



# A Sustainable Development Managerial Analysis of the Integration Among Healthcare, Safety, Ergonomics, and Environment



Geraldo Assis Cardoso , Annibal Scavarda , Ve Adamu ,  
Miranda Harizaj , and Miguel Afonso Sellitto 

**Abstract** In the contemporary scenario presents a high prevalence of accidents and occupational diseases with impacts on health and safety in the work environment. This study, through a narrative review of the literature, proposes an integrated health, safety, ergonomics and environment management policy. This integrated management allows for the improvement of workers' health and safety in line with sustainable development policies. An integrated management model allows for more global actions in relation to workers' health, not dividing the risks and therefore not segmenting prevention actions. Organizations need to evolve from a management based on simple compliance with legislation, such as occupational health and safety and prevention of environmental accidents, to sustainable management, with proactive positioning and actions in relation to eco-efficient product projects.

**Keywords** Ergonomics · Management · Sustainability · Safety · Worker's health

---

G. A. Cardoso (✉) · A. Scavarda · M. Harizaj  
Federal University of the State of Rio de Janeiro, Rio de Janeiro, RJ, Brazil

Polytechnic University of Tirana, Tirana, Albania

Universidade do Vale do Rio dos Sinos, Porto Alegre, RS, Brazil  
e-mail: [geraldo.cardoso@foa.org.br](mailto:geraldo.cardoso@foa.org.br)

V. Adamu · M. A. Sellitto  
Polytechnic University of Tirana, Tirana, Albania

Universidade do Vale do Rio dos Sinos, Porto Alegre, RS, Brazil  
Euclid University, Sukuta, Gambia

## 1 Introduction

Occupational Health is a branch of Public Health and its primary object of study is the relationship between work and health and the objective of promoting and protecting workers' health, through the development of actions to monitor the risks present in the environments and in working conditions and injuries resulting from exposure to them [1].

Historically, the most important record in the analysis of the relationship between work and health dates back to the release of the book *De Morbis Artificum Diatriba*, in 1700, by the Italian physician Bernardino Ramazzini, who based his work on the study of 54 professions known at his time, listing their exercises with the consequent diseases, proposing adequate treatment and prevention for these disorders [1, 2]. His lessons remained the basic text of preventive medicine for nearly two centuries [1–3]. In addition to these contributions, he expanded the view of the working environment to the factory's surroundings, reporting the deleterious effects on the health of the population that inhabits the environments close to the factories, as well as describing the environmental conflicts that occurred at the time, similar to those that occur currently [4].

About 200 years after the publication of Ramazzini's work, the industrial revolution emerged with the increase in serial production, making increasingly evident the fragility of the worker in the face of machines and modern means of production, alarmingly increasing the number of invalid workers and deaths from work accidents. In this scenario, occupational medicine emerges with the vision of placing the right man in the right place, whose main characteristic was the placement of the doctor inside the factories to attend to the sick worker, keeping this workforce productive. During this period, the first laws for the protection of workers also appeared, in England, in 1802 and later in other European countries in the following years, until arriving in Brazil, through Legislative Decree no. 3724, of January 15, 1919 [1].

Over the years, it was realized the need to go beyond the to go beyond simple medical care within companies. It was necessary to identify the causal factors for the effective prevention of the health of the workers' community. Then comes the contribution of Engineering through Occupational Hygiene and, later, Ergonomics, whose multidisciplinary analysis includes the participation of physiologists, psychologists, architects, physicians and engineers.

In this scenario, the "Occupational Health" stage begins in the mid-twentieth century. The concept of health was expanded with the creation of the World Health Organization – WHO – in 1946 and Brazil expanded the standards of occupational safety and medicine, instituting the Specialized Services in Safety Engineering and Occupational Medicine – SSSEOM – and the Internal Accident Prevention Commissions – IAPC. In 1978, the Ministry of Labor published the consolidation of occupational safety and medicine standards, through Ordinance n. 3.214. During this period, the worker and the union movement became concerned with working

conditions, actively intervening in the health and safety conditions of the work environments. The era of Worker's Health begins [5].

In Brazil, the Federal Constitution (CF) of 1988 was a fundamental milestone in the evolution of this new concept of worker's health. Health was considered a social right, and workers were guaranteed the reduction of risks inherent to work, through health, hygiene and safety standards. The FC establishes the competence of the Union to take care of the worker's safety and health through the actions developed by the Ministries of Labor and Employment, Social Security and Health [6].

In Brazil, regarding the legislation that regulates and directs the actions of companies, in the field of worker health and in the structuring of Occupational Safety and Medicine services in companies inserted in the formal market, we highlight the Regulatory Standards (NR) of the Ministry of Labor, in which we highlight NR 4 which establishes the competences of the SSSSEOM; NR 7, which underlies the Medical Control and Occupational Health Program – OHMC and NR 17 – Ergonomics, which establishes parameters that allow the adaptation of working conditions to the psychophysiological characteristics of workers, in order to provide maximum comfort and safety for the workers [5, 7].

Importantly, the interrelationships production/work, health and environment, determined by the mode of production and consumption in a given society, are the main references to understand the living conditions, the profile of illness and death of people, the vulnerability of certain social groups and environmental degradation. The knowledge of this reality is fundamental for building change alternatives capable of guaranteeing life and health for the environment and the population, including the working population [8].

The labor legislation as it is structured, according to the researched literature, dichotomizes the actions of the NR and the National Occupational Health Policy itself, causing the Occupational Health services to act in accordance with these standards, but in a dissociated manner, where the Management of the Medical Control Program in Occupational Health occurs without proper integration with the Ergonomics Programs, as well as with environmental policies. Companies, to meet legal requirements, implement different types of programs with different methodologies, with different purposes, but without integration and not always reaching the main objective, which is the health and well-being of workers, as well as the development of a policy of sustainability [3, 5, 9].

This study, through a narrative review of the literature, analyzes the legislation that supports worker health in Brazil and sustainability policies, and proposes an integrated health, safety, ergonomics and environment management policy. This integrated management can allow the improvement of workers' health and safety in line with sustainable development policies.

## **2 Legal Basis for Workers' Health Actions in Brazil**

### ***2.1 Brief History***

The Industrial Revolution that took place in Europe, between the years 1760 and 1850, had a great impact on people's lives and health. Evidencing the fragility of the worker in the unfair fight with the machine, causing a frightening increase in the number of dead, mutilated, sick, orphans and widows. It was during this period that the stage of "Occupational Medicine" emerged, whose main characteristic was the placement of a doctor inside the factories to assist sick workers and keep the workforce productive. The first laws regarding work-related accidents also appeared in England, Germany and other countries in Europe [1, 2]. The creation of the International Labor Organization – ILO – by the Treaty of Versailles increased the production of preventive norms, so much so that, already at its first meeting in 1919, six conventions were adopted, which directly or indirectly aimed at protecting health, as well-being and physical integrity of workers, as they dealt with the limitation of working hours, unemployment, maternity protection, night work for women, minimum age for admission of children and night work for minors [1, 3].

In Brazil, in 1943, Decree-Law no. 5452, created the Consolidation of Labor Laws, CLL, which established standards of safety, hygiene and occupational medicine, in Chap. V. In 1972, Ordinance no. 3237, from the Ministry of Labor, determined the existence of SSSEOM. Law no. 6514, from 1977, empowered the Ministry of Labor to regulate, through Ordinances, the matters of Safety, Hygiene and Occupational Medicine Services in companies, and this year, Ordinance no. 3.214, editing the Basic Regulatory Standards [1, 3].

### ***2.2 Brief The National Occupational Safety and Health Policy***

It is highlight, among these legal instruments, the National Policy on Occupational Safety and Health (2004), which should be developed in an articulated and cooperative manner by the Ministries of Labour, Social Security and Health, with a view to ensuring that work, basis of social organization and fundamental human right, is carried out in conditions that contribute to improving the quality of life, personal and social fulfillment of workers and without prejudice to their health, physical and mental integrity [7].

The purpose of this policy is to promote the improvement of the quality of life and health of workers, through the articulation and integration, in a continuous manner, of Government actions in the field of production relations. It proposes a National Occupational Safety and Health Policy – PNSST, seeking to overcome the fragmentation, disarticulation and overlapping of the actions implemented by the Labor, Social Security, Health and Environment sectors. For the purposes of this Policy, all

men and women who carry out activities to support themselves and/or their dependents, whatever their form of insertion in the labor market, in the formal or informal sector of the economy, are considered workers [7].

### ***2.3 The Regulatory Standards of the Ministry of Labor***

#### **NR 01 – General Provisions and Occupational Risk Management**

This NR 01 was sanctioned by SEPRT Ordinance No. 6.730 of March 9, 2020 and should enter into force in January 2022. General Provisions and Occupational Risk Management” [1, 3, 7, 8].

The purpose of this Standard is to establish the general provisions, field of application, terms and definitions common to the NR relating to occupational health and safety and the guidelines and requirements for the management of occupational risks and prevention measures in Safety and Health at Work – SHW.

This standard states that the organization must implement, by establishment, the management of occupational risks in its activities. Occupational risk management must constitute a Risk Management Program – RMP. At the organization’s discretion, the RMP may be implemented by operating unit, sector or activity. The RMP can be served by management systems, as long as they comply with the requirements set out in this NR and in legal provisions on safety and health at work. The RMP must contemplate or be integrated with plans, programs and other documents provided for in the occupational health and safety legislation [1, 3, 7, 8].

This standard also recommends that the Occupational Risk Inventory must include, at least, the following information: characterization of work processes and environments; characterization of activities; description of hazards and possible injuries or harm to workers’ health, with identification of sources or circumstances, description of risks generated by the hazards, with indication of groups of workers subject to these risks, and description of implemented prevention measures; data from the preliminary analysis or monitoring of exposures to physical, chemical and biological agents and the results of the ergonomics assessment in terms of the risk assessment, including classification for the purpose of preparing the action plan; and criteria adopted for risk assessment and decision making [1, 3, 7, 8].

#### **NR4 – Specialized Services in Safety Engineering and Occupational Medicine**

Regulatory Standard No. 4 aims to indicate the implementation in all companies with employees governed by the CLL of Specialized Services in Safety Engineering and Occupational Medicine, aimed at promoting health and protecting integrity [1, 3, 5]. The implementation of these Services varies according to the number of employees the company has and the degree of health risk [1, 3, 5].

The degree of risk of companies is based on the National Classification of Economic Activities, and ranges from 1 to 4.

The SSSEOM service must be composed of a team composed of Occupational Physician, Occupational Safety Engineer, Occupational Safety Technician, Occupational Nurse and Occupational Nursing Assistant.

The professionals of this service are responsible for applying knowledge to the environment and components; determine when necessary the use of Personal Protective Equipment; collaborate, when requested, in the projects and implementation of new physical and technological facilities in the company; be responsible for the guidance and collection of what is presented in the NR's; maintain a relationship with IAPC by supporting, training and serving it; promote awareness, education and guidance activities for workers to prevent accidents and occupational diseases; analyze and record in a specific document, all accidents that occurred, with or without victims and all cases of occupational disease; monthly register updated data on accidents at work, occupational diseases and unhealthy conditions and send a map with annual assessment of the data referred to the Department of Safety and Occupational Medicine; keep the records at the Specialized Services headquarters or in some accessible place, ensuring the understanding of the content, for a period longer than 5 years; the work must be preventive, and emergency action is not prohibited when necessary, and the control of catastrophes, firefighting or any other type of accident must also be their responsibility [1, 3, 5].

All SSSEOM must be registered with the Ministry of Labor, and must include the name of the components, registration number, number of degree of risk and number of employees, specification of shifts and working hours [1, 3, 5].

### **NR 7 – Occupational Health Medical Control Program**

The object is to establish mandatory preparation and implementation, by all employees and institutions that admit workers as employees, the OHMC, aims to promote and preserve the health of all its workers [1, 3, 5]. The OHMC is an integral part of the company as a whole in the area of worker health, so it should have the character of prevention, tracking and early diagnosis of work-related health problems, in addition to the existence of cases of occupational diseases or irreversible damage to the health of the workers [1, 3, 5].

According to item 7.2.4 of this NR, the OHMC must be planned and implemented based on the risks to the health of workers, especially those identified in the assessments provided for in the other NR's [1, 3, 5]. For the execution of the OHMC, a coordinator must first be indicated among the physicians of the SSSEOM of the company, and in cases where the company is not obliged to maintain occupational physician, according to NR 4, the employer must appoint an occupational physician, a non-company employee, to coordinate the OHMC [1, 3, 5].

According to item 7.3.1.1.3 of the NR 4, by determination of the DRT (Regional Labor Office), based on the conclusive technical opinion of the competent regional authority in matters of occupational safety and health, or as a result of collective bargaining, the companies they may be required to appoint a coordinating physician, when their conditions represent a potential serious risk to workers.

The OHMC must include, among others, the performance of mandatory medical exams, such as: admission, periodic, return to work, change of function and

dismissal. These exams include: clinical evaluation (occupational anamnesis and physical and mental exam) and complementary exams [1, 3, 5].

According to item 7.4.4 of the NR 4, for each medical examination performed, the physician will issue the Occupational Health Certificate (OHC) in two copies. The OHC must include: the worker's full name, identity, function, specific occupational hazards that exist according to technical instructions issued by the SSST (Secretary of Safety and Health at Work), indications of the medical procedures that the worker was submitted, name of the coordinating physician and the respective Regional Council of Medicine (RCM), definition of "CAPABLE or UNABLE" of exercising a specific function that the employee will perform, name of the physician in charge of the examination [1, 3, 5].

In item 7.4.5 of this NR, the data obtained in the medical exams including clinical evaluation and complementary exams, the conclusions and the measures applied must be registered in an individual clinical record, which will be under the responsibility of the coordinating physician of the OHC. After the employee leaves the company, their clinical records must be kept for 20 years and if there is a change of doctor, the notes and medical records must be forwarded to their successor.

The OHMC must comply with a plan in which the health actions that will be carried out during the year are foreseen, and these actions must be the object of an annual report. After the annual report has been assembled, it must be presented to the IAPC, if the company has it, and this report can be kept in the form of a computerized file, provided it is kept easily accessible by the agent of the labor inspection [1, 3, 5].

In this standard it is observed that ergonomic hazards and occupational accidents are not mentioned in it, but can be characterized and registered, in a preventive manner, at the discretion of the coordinating physician of the OHMC. According to NR 7, OHMC must have a preventive character, so the inclusion of ergonomic risks could be a great tool for the prevention of musculoskeletal diseases [1, 3, 7].

### **NR9 – Environmental Risk Prevention Program – PPRA**

NR9 is the regulatory standard responsible for the Environmental Risk Prevention Program, also known as PPRA. NR9 determines the mandatory protection necessary to ensure the physical and mental health of workers in unhealthy environments. For the purpose of this NR, environmental risks are considered to be physical, chemical and biological agents existing in work environments that, due to their nature, concentration or intensity and exposure time, are capable of causing damage to the worker's health. It also establishes the important stages of the Risk and Accident Prevention Program, which are: Anticipation and recognition of risks. Evaluation and control priorities and goals. Implementation of control measures and evaluation of their effectiveness.

### **NR 17 – Ergonomics**

The seventeenth regulatory norm came to establish criteria in order that the adaptations of working and psychophysiological conditions can provide maximum comfort, safety and performance, has its legal existence ensured at the level of legislation through articles 198 to 199 of the CLL. With this set of criteria comes ergonomics.

According to item 17.1, “this NR aims to establish parameters that allow the adaptation of working conditions to the psychophysiological characteristics of workers, in order to provide maximum comfort, safety and efficient performance” in order to allow managers to quantitative data control [1, 3, 9].

This standard refers to working conditions where aspects related to lifting, transporting and unloading materials, furniture, equipment and environmental conditions of the workplace are reported, and the organization of work itself.

To assess the adaptation of working conditions to the psychophysiological characteristics of workers, it is up to the employer to carry out an ergonomic analysis of the work, which should address, at least, the working conditions, as established in this NR [1, 3, 5, 9].

## ***2.4 The Federal Constitution***

The execution of actions aimed at workers’ health is the responsibility of the Brazilian Unified Health System – BUHS, prescribed in the Federal Constitution of 1988 and regulated by the Organic Health Law – LOS. Article 6 of this law gives the national management of the System the responsibility to coordinate the worker’s health policy. According to paragraph 3 of article 6 of the LOS, worker health is defined as “a set of activities that are intended, through the actions of epidemiological surveillance and health surveillance, to promote and protect worker health, as well as aiming at the recovery and rehabilitation of workers subjected to risks and injuries arising from working conditions” [1, 6, 10].

In addition to the Federal Constitution and the LOS, other federal instruments and regulations guide the development of actions in this field, within the scope of the Health sector, among which the Ordinance/MS no. 3.120/1998 and Ordinance/MS no. 3908/1998, which deal, respectively, with the definition of basic procedures for the surveillance of workers’ health and the provision of services in this area. The operationalization of activities must take place at the national, state and municipal levels, to which different responsibilities and roles are assigned [11–13].

## ***2.5 National Occupational Health Policy***

Integrated with the National Occupational Safety and Health Policy, the National Occupational Health Policy, instituted in August 2012, aims to define the principles, guidelines and strategies to be observed in the three spheres of management of the BUHS – federal, state and municipal, for the development of comprehensive care actions to Occupational Health, with an emphasis on surveillance, aimed at promoting and protecting the health of workers and reducing morbidity and mortality resulting from development models and production processes. It is aligned with the set of health policies within the BUHS, considering the transversality of workers’



health actions and work as one of the determinants of the health-disease process. Among its objectives, we can highlight: strengthening Occupational Health Surveillance and integration with the other components of Health Surveillance; promote health and healthy work environments and processes; ensure comprehensive care to the worker's health; expand the understanding that Worker's Health TS must be conceived as a transversal action, and the health-work relationship must be identified at all points and instances of the care network; incorporate the category of work as a determinant of the health-disease process of individuals and the community and joint planning actions between surveillances, with the election of common priorities for integrated action, based on the analysis of the health situation of workers and the population in general and in the mapping of productive activities with potential environmental impact in the territory; promoting health and healthy work environments and processes, which presupposes, among other actions, the strengthening and articulation of health surveillance actions, identifying environmental risk factors, with interventions both in work environments and processes, as well as in the surroundings, in view of the quality of life of workers and the surrounding population [14].

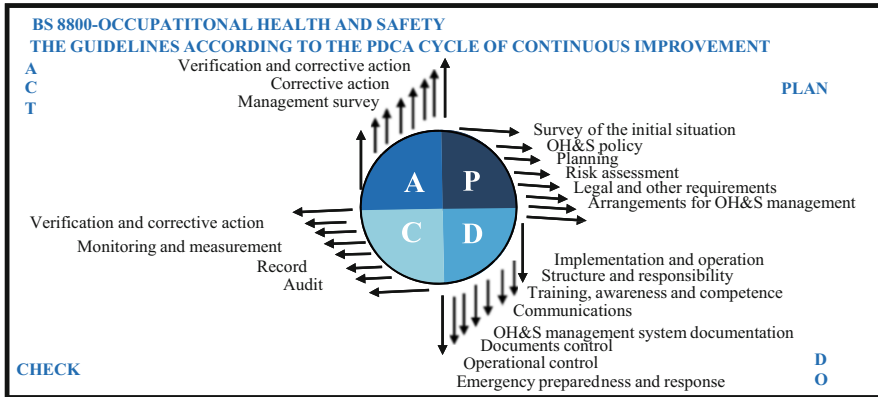
### **3 Worker's Health in the International Plan**

At the international level, since the 70s, documents from the WHO – World Health Organization, such as the Alma Ata Declaration and the proposal of the Health for All Strategy, have emphasized the need to protect and promote health and safety at work, through the prevention and control of risk factors present in work environments. More recently, the topic has received special attention in the focus of health promotion and the construction of healthy environments by the Pan American Health Organization [1, 7, 15].

The International Labor Organization (ILO), in Convention/ILO no. 155/1981, adopted in 1981 and ratified by Brazil in 1992, establishes that the signatory country must institute and implement a national policy on safety and the environment of work. Brazil, as a member of the ILO, has already ratified several conventions related to safety, health and the environment at work. In fact, the ILO has been promoting the international standardization of Labor Law, in order to provide a harmonious evolution of the norms of worker protection and achieve the universalization of social justice and decent work for all [3].

#### ***3.1 British Standard Standard – BS 8800***

The British standard BS 8800 was considered a first attempt to implement a safety, health and environment management system. It is widespread and implemented in several countries. Its objective is to continuously improve the conditions of the



**Fig. 1** PDCA applied to Occupational Health and Safety management (BS 8800). (Source: Adapted from Quelhas et al. [22])

working environment. It is important to emphasize that the principles of this standard are in line with the guidelines of the ISO 9000 series (Quality System) and ISO 14000 series (Environmental Management) standards. The BS 8800 standard can be used as a guide that allows organizations to implement occupational health and safety management, enabling the protection of their employees, who may have their health and safety status affected by the activities carried out by the organization [12, 21, 22].

The standard is structured into four chapters, which describe the following topics: guidance on the development of occupational health and safety management systems and the links with other management systems standards; references to publications, which may be consulted in addition. This standard was developed based on the PDCA cycle (Plan, Do, Check, and Act). This cycle of continuous improvement in management and the way in which it is integrated into the global system, guarantees the continuous improvement and maintenance of the organizations' routine, taking into account all stages of implementation, as shown in Fig. 1 [12, 21, 22].

The PDCA cycle brings the guidelines that companies must follow, based on the ISO 14000 standard for their organization. The contents presented in the standard are considered, by several authors, essential for an effective management system [12, 21, 22].

### **3.2 Occupational Health and Safety Assessment Series – OHSAS 18001**

The OHSAS Standards for Occupational Health and Safety Management – SHW, aim to provide organizations with elements of an effective SHW management system, which can be integrated with other management requirements and help

them achieve their SHW goals and economical. Developed from the experiences of the BSS 8800, by a selection of the main trade bodies, international standards and certification bodies. The OHSAS 18001 standard was developed based on the PDCA cycle [11, 12].

This standard specifies requirements for an SHW management system to enable an organization to develop and implement a policy and objectives that take into account legal requirements and information on SHW risks. It also allows an organization to control its risks of accidents and occupational diseases and improve its SHW performance.

The objectives of this standard must be communicated to all employees, so that they become aware of their individual obligations in relation to SHW; Employee involvement and commitment are vital to successful SHW management.

It is necessary to make employees aware of the effects of SHW management on the quality of their own work environment. It is recommended that they are encouraged to actively contribute to SHW management.

Employees (at any level, including Administration levels) will hardly be able to contribute efficiently to the management of SHW, unless they understand their responsibilities and are competent to perform the required tasks. This requires the organization to clearly communicate its SHW policies to employees; in order to provide them with a framework with which to measure their own SHW performance [11, 12].

## **4 Ergonomics and Worker Safety and Health**

### ***4.1 Concept and Areas of Expertise***

According to Iida [13] ergonomics is the study of adapting work to man, where work has a broad meaning, covering not only work performed with machines and equipment, used to transport materials, but also every situation in which men are related to a productive activity, thus involving not only the physical environment, but also the organizational one. With a long view, ergonomics encompasses planning and design activities, which take place before the work is performed, and control and evaluation taking place during and after the work. All these aspects are necessary for the work to achieve its desired goals. ABERGO (Brazilian Ergonomics Association) defines ergonomics as:

Ergonomics is understood as the study of people's interactions with technology, organization and the environment, aiming at interventions and projects that aim to improve safety, comfort, well-being and effectiveness in an integrated and non-disassociated way of human activities [14].

Internationally, the International Ergonomics Association (IEA) approved a definition in 2000, conceptualizing ergonomics and recognizing its specializations: "Ergonomics (or Human Factors) is the scientific discipline, which studies the interactions

**Table 1** Ergonomics goals

Goals	Favorable working conditions
Worker's health	It is maintained when the demands of work and the environment do not exceed their energy and cognitive limitations, in order to avoid situations of stress, risk of accidents at work and occupational diseases
Safety	Safety is achieved with the projects of the workstation, environment and work organization, which are within the worker's capabilities and limitations, in order to reduce errors, accidents, stress and fatigue
Satisfaction	It is the result of meeting the needs and expectations of the worker. Satisfied workers tend to adopt safer behaviors and are more productive
Efficiency	Consequence of good planning and organization of work, which provides health, safety and satisfaction to the worker

between human beings and other elements of the system, and the profession that applies theories, principles, data and methods, to projects aimed at improving human well-being and performance global systems" [15].

Within the discipline, according to the IEA, there are three main areas of specialization that represent competences in specific human characteristics, among them, physical ergonomics which is related to posture at work, handling of materials, repetitive movements, disorders work-related musculoskeletal disorders, job design, safety and health; [15].

The main objective of ergonomics is always the well-being, health, comfort and consequent increase in worker productivity, providing favorable working conditions [13]. The Table 1 defines each of these points aimed at by ergonomics and its benefits for worker health and safety.

The role of ergonomics in industries has great contributions such as increasing efficiency, reliability and quality of operations, however these gains can be obtained through three ways: the improvement of the human-machine-environment interaction, the organization of the work process and the improvement of working conditions [9].

Ergonomics is a strong field of action that is focused on organizational aspects of work, with the aim of reducing fatigue, repetitive work and the lack of worker motivation due to little participation in the decisions of their work. Another important point is the analysis of environmental working conditions, such as temperature, noise, vibrations and gases [9, 13, 14].

The systematic performance of ergonomics in factories and industries aims to identify more serious anti-ergonomic situations, where some factors stand out, such as occupational diseases, accidents, high number of errors at work, employee turnover and absenteeism. The causes of these problems are varied, such as workers' inadequacy of the work instruments, failure in the work organization process, environmental discrepancies, among others that lead to these situations [9, 13, 14].

#### ***4.2 The Ergonomics Integrated into the Occupational Health Medical Control Program – PCMSO***

The proposed implementation of the ergonomics program integrated with OHMC is based on NR 4, 7 and 17 of the Ministry of Labor and Employment and on the references of Iida and Grandjean on ergonomic bases [13, 16].

According to the guidelines of OHSAS 18001, the SHW services of organizations must work in an integrated management, aiming at the continuous improvement of health and safety and with the active participation of employees [12]. Oliveira [3] proposes the inclusion of ergonomic risks in OHMC, thus increasing their preventive dimension.

Within this context, we report the experience of a large steel company in the State of Rio de Janeiro, Brazil, where the ergonomics service is linked to occupational medicine, whose OHMC management is articulated with the ergonomics management ergonomics come from occupational medical examinations, direct request from the work areas, situations identified by the ergonomics committees and related work accidents. After identifying a possible situation that requires an ergonomic assessment, an epidemiological study of the diseases detected in periodic examinations and medical dismissals due to musculoskeletal disorders is carried out. These collected data are discussed in a team, together with the occupational physician responsible for the area, the OHMC coordinator, the ergonomics coordinator and the ergonomics consultant to verify if the data collected from the epidemiological survey are valid. After these studies, ergonomic evaluations are initiated by the ergonomics team, together with the ergonomics committees of the areas involved.

With the assessment completed, a meeting is held with the ergonomics team, the ergonomics coordinator and the OHMC to reach a consensus on what was raised and thus propose the improvements that will be relevant to better adapt the work position. Once these conclusions have been reached, a subsequent meeting should be scheduled with the area's management and supervision to clarify the facts verified, demonstrate the ergonomic solutions that were proposed and discuss the feasibility of their implementation.

### **5 Environmental Health and Worker's Health**

In Brazil, the National Environmental Policy, Law 6938, of August 31, 1981 [17], aims to: reconcile economic and social development with the preservation of environmental quality and ecological balance; establishment of criteria and standards of environmental quality and norms related to the use and management of environmental resources; the development of national research and technologies aimed at the rational use of environmental resources; the dissemination of environmental management technologies, the dissemination of environmental data and information, and the formation of public awareness of the need to preserve

environmental quality and ecological balance; the preservation and restoration of environmental resources with a view to their rational use and permanent availability, contributing to the maintenance of the ecological balance conducive to life; the imposition, on the polluter and predator, of the obligation to recover and/or indemnify the damage caused and, on the user, the contribution for the use of environmental resources for economic purposes. As principles we can highlight: maintenance of ecological balance; rationalization, planning and inspection of the use of environmental resources; protection of ecosystems; control of potentially polluting activities; between others.

According to the literature, Brazil, in recent years, has evolved towards a movement towards the environmental issue and its relationship with health. A gradual, theoretical and practical approach between the fields of Environmental Health and Workers' Health, in an integrative and transdisciplinary perspective. The relationships between environment and health are widely recognized, where human health is highly dependent on society's ability to manage the interaction between the physical, biological and human activities [17, 18].

The Basic Health Care, of the Brazilian public health system, BUHS, is an advanced theme towards the integration of worker and worker health in the health system, as well as workers' users of basic health units. In 2011, Decree no. 7508, which regulates the Organic Health Law No. 8080/90, highlights the importance of Health Surveillance, and its fields of action are the promotion of population health, surveillance, protection, prevention and control of diseases and health problems, which should be organized from the articulation of the Epidemiological, Sanitary, Environmental and Occupational Health Surveillance [4].

According to Dias [4], health surveillance actions in BUHS Primary Health Care, related to productive activities, still remain unsystematic and discontinuous, but according to the author, "it is possible to recognize the growing understanding that the construction of health takes place beyond the spaces and practices of health units and services, covering everyday life". This empowerment of people's daily lives allows knowledge of production processes and the dynamics of life in cities and the countryside, which is reflected in interventions on the determinants and conditioning factors of health, including aspects of worker health and the environment.

On the path to the integration of worker's health with the environment, the 3rd National Conference on Worker's Health of 2005, includes in its agenda the thematic axis 2: How to incorporate the health of workers in health policies sustainable development in the country? Among the deliberations related to this axis, we highlight: To oblige multinationals to obey, at least, the same standard of protection for workers and the environment that is given in the country of origin; Obliging companies to provide a list of the substances they use and their risks; Elaboration of a government policy, ensuring that technological advances take into account the need to preserve health; Obligation of information, by the employee, to the worker, their families and the community, regarding the risks to which they are subject due to indirect and environmental contamination resulting from the company's activity; That deforestation, installation of dams and agro-industries be controlled and endorsed by the community and local entities; Articulation with a technology import

policy that ensures the mandatory adoption of safety criteria according to the most rigorous and efficient principles recognized by the international community; Guarantee that all public works contracts include in their clauses the obligation of companies to maintain the safety of work environments [19].

## **6 The Integrated Management of Health, Safety and Ergonomics and the Challenge of Integration with Environmental Health**

In Brazil, the concept of Occupational Health as a practice related to sustainable development has been growing since the beginning of the twenty-first century, through the implementation of this field as a health policy. In the same direction, throughout this period, health legislation, and also that of workers' health, has been proposing and articulating some actions that aim to promote changes in the practices of health organizations, aiming at the quality of life of workers in territories impacted by large projects and works that are essential for the country's growth [20].

In this sense, the concept of workers' health is related to a public health policy aimed at promoting and protecting the health of workers, which has been built over the last few years. In this way, we can state that worker health actions can be understood as a set of actions aimed at the realization of sustainable development considering the socio-environmental conditions related to work [20].

In Brazil, health and safety management is well established in formal market companies, where we have workers governed by the Consolidation of Labor Laws – CLL, based on Regulatory Standard number 4, which advocates the management of SSSEOM, which is part of the Standard Regulatory number 7, which advocates the Medical Control Program in Occupational Health – OHMC [3].

Ergonomic actions, NR 17, are commonly developed outside these two standards. The new NR 1, which is not yet in force, calls for an integrated management, through the Risk Management Program – RMP [8].

According to this standard, organizations must develop actions in occupational health of workers integrated with other prevention measures in Occupational Health and Safety – SHW, according to the risks generated by the work. The control of employee health must be a planned, systematic and continuous preventive process, in accordance with the classification of occupational risks and in accordance with the other Regulatory Standards. The RMP must contain some documents that are fundamental for an integrated management, such as: risk inventory and action plan. The documents that make up the RMP must be prepared under the responsibility of the organization, in compliance with the provisions of other Regulatory Standards. They must always be available to interested workers or their representatives and to the Labor Inspectorate.

Data from hazard identification and occupational risk assessments must be consolidated into an occupational risk inventory that must include, at least, the

following information: characterization of work processes and environments, as well as the activities performed; description of hazards and possible injuries or harm to workers' health, with identification of sources or circumstances and description of implemented prevention measures; data from the preliminary analysis or monitoring of exposures to physical, chemical and biological agents and the results of the ergonomic assessment pursuant to NR-17 [8].

According to Vitoreli [21], there is a growing need for organizations to meet market requirements for international certifications and this has led to the increasingly frequent adoption of different health, safety, ergonomics and environment management systems, where each one covers some minimum requirements for meeting a given objective. Among these certifications we highlight: ISO 9001, ISO 14001 and OHSAS 18001. According to this author, "with the increase in the adoption of different management systems by organizations, difficulties arise related to the parallel management of these systems".

Thus, integration is seen as a way to generate greater efficiency in several aspects, alleviating these difficulties. Standardized management systems are those based on norms, of a national or international character, elaborated due to the need of organizations to meet legal and market demands. Vitoreli also states that "due to the difficulties of parallel management of these systems, their integration into a single Integrated Management System has been seen as a way to generate several benefits". The literature points to some benefits, such as cost reduction and management improvement [21].

According to Quelhas [22], "increasingly, the concerns of the government, businessmen and unions in improving safety, health and the conditions of the work environment are highlighted". This author also highlights "many organizations in Brazil still have a restricted view in relation to safety, occupational medicine and occupational health. The treatment of these issues is restricted to the collection of statistical data, reactive actions to work accidents and responses to labor claims". Literature points out that occupational health and safety begins as a management system through international standards such as SHWAS 18001, respecting national standards and legislation and evolving with the integration of these management systems [22].

## **7 The Integrated Management Systems: Occupational Health Safety, Ergonomics and Environment**

According to Vitoreli [21], an Integrated Management System can be defined as "a set of interrelated processes that divide a set of human, financial, material resources, in addition to infrastructure and information, in order to achieve a set of objectives related to the satisfaction of stakeholders". When thinking about health, safety, ergonomics and the work environment, this management system can be structured in a set of initiatives, based on policies, programs, procedures and processes that



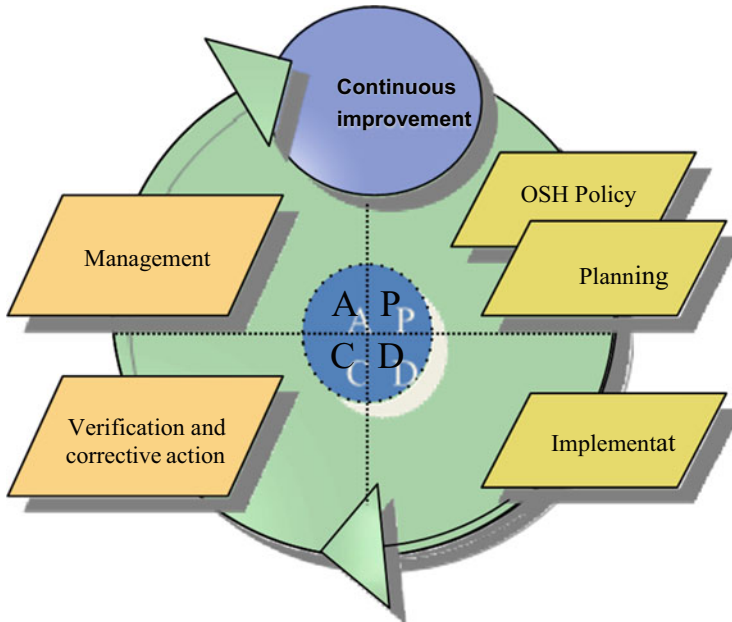
integrate the organization's activity in order to optimize compliance with legal requirements in line with the organization's philosophy and culture, conducting its activities within the principles of ethics and social responsibility [21].

A safety and well-being management system in occupational environments must go beyond a simple risk management tool. It must be considered an operational challenge for organizations, structured in a system for evaluating and controlling the risks arising from their activities, aiming at a continuous improvement in performance and in the constant development of best practices. Another important objective of an integrated management system is the sharing of procedures, processes and practices adopted by an organization, so that it can implement its strategic planning, policies and guidelines, aiming to achieve its goals, goals and the development of health programs, safety, environment and ergonomics. These integrated management systems also aim at meeting regulatory and legal requirements, contributing to the continuous improvement of the organizations' sustainable, ethical and responsible performance [21, 27].

According to the researched literature, the OHSAS 18001 standard presents fundamental requirements for the management of occupational health and safety in the organization, filling a gap due to the lack of an international occupational health and safety standard. It was developed based on the PDCA cycle, and its requirements can be related to each of the stages of this cycle [21, 22, 26]. Another issue raised in the researched literature is the difficulties of parallel management of management systems in health and safety, including the integration of the management of some international quality standards such as ISO 9001 and 14,001. The integration in a single Management System has seen as a way to ensure several benefits for organizations, such as cost reduction and optimization in the management process. The management system of the OHSAS standard does not include the inclusion of ergonomic risks, so we think that it still leaves a gap. Based on this issue, we propose an integrated management model with the inclusion of ergonomic risks, as shown in Fig. 1 [21].

According to Fig. 2, within the stages of an Integrated Management Cycle, based on the PDCA cycle, in the Plan stage, the planning requirements must include the development, by the organizations, of an occupational health and safety policy, with identification of the hazards and risk assessment of the work environment, including ergonomic risks and also a planning of improvements through objectives and goals of safety and health that must be settled by the organizations. Within the "do" stage of the cycle, related requirements include the implementation and implementation of the controls and preventive measures that were identified in the first phase of the cycle.

Also within this stage, it is essential to carry out training for employees so that activities are carried out in accordance with health and safety policies and also so that they are aware of the importance of the safety and health management system within the company. In the "verify" stage of the PDCA cycle, organizations can assess and monitor the performance of their Occupational Health and Safety Management System – SGSSO. In the last stage of the cycle, "acting correctively", organizations



**Fig. 2** Management model in safety, worker health, ergonomics and the environment

must, through a critical analysis of management, generate actions to improve the performance of their integrated health and safety management system [21, 22].

The Chart 1 shows the stages of the Integrated Safety, Occupational Health, Ergonomics and Environment Management Cycle based on PDCA.

## 8 Results and Discussion

Environmental Health and Occupational Health are fundamental fields of Public Health in the social determination of the health-disease process. They seek to transform the reality of production-consumption-environment and health relations, in order to make them favorable to life with quality and social justice. The social responsibility of an organization consists of the decision to participate more directly in community actions in the region in which it operates and to reduce possible environmental damage resulting from the type of activity it carries out.

During the development of this study, we can highlight that in Brazil, health and safety management is more established, still consolidating, in companies in the formal market, where they walk in an attempt to comply with the Regulatory Standards – NR, especially in the NR 4 standards, which advocates the management of SSSEOM, which is part of NR 7, which advocates the Medical Control Program

**Chart 1** Stages of the integrated safety, occupational health, ergonomics and environment management cycle

P – Plain	D – Do	C – Check	A – Corrective Act
Legal requirements	Implementation of the controls and preventive measures identified in the first step	Monitor established controls and the performance of the Occupational Health and Safety Management System (SGSSO), ergonomics and the environment	Management review
Federal Constitution	Employee Training	Records	Actions to improve SGSSO, ergonomics and the environment
Regulatory Standards – NR1, NR4, NR7, NR9 and NR17	Management System Documentation	Audits	
Environmental legislation	Documents control		
Occupational health and safety policy	Operational control		
Identification of hazards and risk assessment of the work environment (including ergonomic risks)	Emergency Preparedness and Response		
Improvement planning			

in Occupational Health – OHMC. Ergonomic actions, NR 17, are commonly developed outside these two standards [3].

Sustainable Management must be articulated with Organizational Social Responsibility and must be recognized as a continuous and ethical commitment of organizations, aligned with economic development. It must promote the improvement of the quality of life of workers, their families and the local community. Sustainable management, integrated with the management of health, safety and ergonomics in companies, is still under construction and needs more inspection with regard to environmental damage [23–25].

The current trend of sustainable management is to go beyond the control actions of pollutants or waste generated in the production process. Prevention should be prioritized in the structural phase, with an emphasis on prior project analysis. An action that would start before the construction and operation of factories, examining the standards of environmental protection, together with safety and health at work, aiming to establish the necessary modifications in the production process, avoiding the generation of contaminants and defining effective management programs of risks.

The Brazilian environmental legislation recommends that a large part of the projects be submitted to the environmental licensing procedures, requiring the presentation of technical documentation containing a series of requirements, such as the description of the production process, operational techniques, (raw materials and products used in the production process, possible contaminants generated, control measures and the foreseen environmental impacts in this production process.

An evaluation of the effectiveness of this policy is necessary, aiming at the integration of health, safety and environmental actions and optimization of results in line with the vast legislation. On this path we can see that the working population has been empowered by this issue, with regard to health, safety and sustainability, see the discussion and reports of the 3rd Occupational Health Conference, which need to be included in the priority of the discussion agenda of country authority [19, 23].

According to the researched literature, we understand that Brazilian companies should evolve to an integrated management model, based on the guidelines of international standards, BSS and OHSAS 18001, where the OSH services of organizations must work in an integrated management, aiming at continuous improvement health and safety, ergonomics and environment, as well as the adaptation to the new NR 01 [21, 22, 26, 27].

## 9 Final Considerations

Initially, we found throughout this work that, historically, worker health has evolved over several centuries. Starting from Ramazzini, passing through the industrial revolution, where the first laws to protect workers in Europe appeared, starting the period of occupational medicine there, which evolved over the years to occupational health with dissemination of health and safety standards at work by the International Labor Organization. Despite the relative normative progress, work-related illnesses and accidents continued to severely affect the working class, especially due to the rapid process of industrialization. The concept of occupational medicine only evolved into worker health when workers started to demand better health and safety conditions. From this evolution, workers assume the role of actors, of subjects capable of thinking and thinking themselves, producing their own experience.

Workers, individually and collectively in organizations, are considered subjects and participants in health actions, which include: the study of working conditions, identification of technical intervention mechanisms for their improvement and adequacy, and control of the health services provided. Even with this normative evolution in Brazil, worker health actions are still dissociated, especially with regard to the Regulatory Norms of the Ministry of Labor and environmental protection laws. Based on this context, the companies' occupational health services need to work in articulation with occupational hygiene and safety, constituting their SSSEOM, which in turn need to promote joint actions with the ergonomics services and likewise integrate with the principles of an environmental management. A

proposal to include ergonomic risks in the OHMC can increase its preventive dimension, following the determinations of NR 1.

The study also emphasize that companies must follow the guidelines of international standards, such as OHSAS 18001, where the SHW services of organizations must work in an integrated management, where the inclusion of ergonomic risks has been proposed, in this management system (Fig. 2), aiming at the continuous improvement of health and safety and with the active participation of employees, who must know this company's health and safety policy. An integrated management model allows for more global actions in relation to workers' health, not dividing the risks and therefore not segmenting prevention actions. Organizations need to evolve from a management based on simple compliance with legislation, such as occupational health and safety and prevention of environmental accidents, to a sustainable management with proactive positioning and actions in relation to eco-efficient product projects.

## References

1. Saúde do trabalhador e da trabalhadora no Brasil: uma abordagem holística e integrada / Organizado por Tatiliana Bacelar Kashiwabara et al. – Diamantina: UFVJM, 249 (2021).
2. Ramazzini B.: *De Morbis Artificum Diatriba* (Tratado sobre as Doenças dos Trabalhadores), Módena, 1700. Tradução Raimundo Estrela. São Paulo: Fundacentro (2000).
3. Oliveira, S.G.D.: Estrutura Normativa da Segurança e Saúde do Trabalhador no Brasil, *Rev. Trib. Reg. Trab. 3ª Reg.*, Belo Horizonte 45 (75), 107–130 (2007).
4. Dias, E. C., Silva, T. L., & Almeida, M. H.: Desafios para a construção cotidiana da Vigilância em Saúde Ambiental e em Saúde do Trabalhador na Atenção Primária à Saúde. *Cad Saúde Colet*, 20 (1), 15–24 (2012).
5. Araújo, G.M.: Normas regulamentadoras comentadas. Rio de Janeiro. 6ª Ed. GVC, NR17 (2007).
6. Brasil, Constituição da República Federativa do Brasil. Promulgada em 5 de outubro de (1988).
7. Arcuri, A. S. A.: A Política Nacional de Segurança e Saúde do Trabalhador. *INTERFACEHS*, 2 (4) (2007).
8. Brasil. Ministério do Trabalho. Norma Regulamentadora n.º 01 – disposições gerais e gerenciamento de riscos ocupacionais. Portaria SEPRT n.º 6.730, de 09 de março de (2020).
9. Mesquita, D. F.: Ergonomia na era do Teletrabalho: Impactos para a Saúde e Segurança do Trabalho (2020).
10. Brasil. Lei Federal n.º 8.080, de 19 de setembro de 1990. Dispõe sobre as condições para a promoção, proteção e recuperação da saúde, a organização e o funcionamento dos serviços correspondentes e dá outras providências (1990).
11. International Organization for Standardization.: iso Concept Database (2010).
12. BSI, a, OHSAS 18001 – : Especificação para Sistemas de Gestão da Segurança e Saúde no Trabalho, Reino Unido (2007).
13. Iida, I., Buarque, L.: Ergonomia: projeto e produção. 3. ed São Paulo: Blucher (2018).
14. ABERGO – Associação Brasileira de Ergonomia (2018).
15. International Ergonomics Association (IEA): Human Factors/ Ergonomics HF/E (2020).
16. Grandjean, E. Manual de ergonomia. Porto Alegre: Artes Médicas (2005).
17. Ministério da Saúde (BR). Subsídios para construção da Política Nacional de Saúde Ambiental. Ministério da Saúde, Conselho Nacional de Saúde. Brasília: Ministério da Saúde, 56 (2007).

18. Rigotto, R. M.: Saúde Ambiental & Saúde dos Trabalhadores: uma aproximação promissora entre o Verde e o Vermelho. *Revista Brasileira de Epidemiologia*, 6, 388–404 (2003).
19. Brasil. Ministério da Saúde. 3.<sup>a</sup> Conferência Nacional de Saúde do Trabalhador: 3.<sup>a</sup> CNST: “trabalhar, sim! adoecer, não!”: coletânea de textos / Ministério da Saúde, Ministério do Trabalho e Emprego, Ministério da Previdência e Assistência Social. – Brasília: Ministério da Saúde, 214 (2005).
20. Silva, J. M. D., Santos, M. O. S. D., Augusto, L. G. D. S., & Gurgel, I. G. D.: Desenvolvimento sustentável e saúde do trabalhador nos estudos de impacto ambiental de refinarias no Brasil. *Saúde e Sociedade*, 22, 687–700 (2013).
21. Vitoreli, G. A., & Carpinetti, L. C. R.: Análise da integração dos sistemas de gestão normalizados ISO 9001 e OHSAS 18001: estudo de casos múltiplos. *Gestão & Produção*, 20, 204–217 (2013).
22. Quelhas, O., Alves, M., & Filardo, P.: As práticas da gestão da segurança em obras de pequeno porte: integração com os conceitos de sustentabilidade. *Revista Produção Online*, 4(2), (2004).
23. Augusto, L. G. S. A construção do campo da saúde do trabalhador e da saúde ambiental. In: AUGUSTO, L. G. S. (Org.). *Saúde do trabalhador no desenvolvimento humano local: ensaios em Pernambuco*. Recife: Editora Universitária UFPE, 17–47 (2009).
24. Organização Mundial da Saúde. *Atención Primaria de Salud: Informe de la Conferencia Internacional sobre Atención Primaria de Salud*. Ginebra: Organización Mundial de la Salud, 91 (1978).
25. WHO – World Health Organization. *Health impact assessment as part of strategic environmental assessment*. Geneva (2001).
26. da Silva, E. H. D. R., Daniel, B. H., & de Oliveira, D. B.: Os sistemas de gestão em segurança e saúde no trabalho em auxílio à prevenção de acidentes e doenças ocupacionais. *Revista de Gestão em Sistemas de Saúde*, 1(2), 157–172, (2012).
27. Ruella, N. C., & sa-petrobras, p. b. (2004). *Processo de implementação de sistemas de gestão integrada com base nas ISO 9001, ISO 14001, OHSAS 18001, BS 8800, SA 8000 e OIT SGSST 2001*. In *II Congreso latinoamericano de calidad en la industria del petroleo y gas*, (2004).