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Bibliometric study on Ergonomics and Sustainability

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ABSTRACT

Reflections on ergonomics in the context of the sustainability of organizations are an important strategy for the improvement of safe working environments. In the literature, the discussion that encompasses the relationship between ergonomics and business sustainability is a topic little explored. The objective of the present research is to map and explore the scientific production in the field of ergonomics and sustainability in the period from 2010 to 2020, in order to show the temporal evolution of research and the existing articulation between the themes. The research method is exploratory. To carry out the research, the bibliometric technique was chosen. To this end, articles were searched in the SciELO and Scopus databases, and theses and dissertations in the Digital Library of Theses and Dissertations (BDTD) of CAPES on the theme of ergonomics and sustainability. The bibliometric research allows to identify limits, contributions and potentialities that highlight the need for the production of research and new knowledge that associate the theme of ergonomics with sustainability. The development of an ergonomics program associated with the principles of sustainability seems to be a way to manage occupational risks with preventive measures in occupational safety and health.

KEYWORDS: Ergonomics. Sustainability. Safety at work.

1 INTRODUCTION

Reflections on ergonomics in the context of the sustainability of organizations have been an important strategy for the improvement of safe work environments. In Brazil, Ordinance No. 6,730, of March 9, 2020 - Regulatory Standard No. 1 (NR-1) deals with General Provisions and Management of Occupational Risks. The objective is to present guidelines and requirements for the management of occupational risks with prevention measures in Occupational Health and Safety – OSH (BRASIL, 2020).

This instrument obliges organizations to comply with the legal provisions related to health and safety at work. In this context, it is up to the employer "to inform workers of the occupational risks existing in the workplace, and the preventive measures adopted by the company to eliminate or reduce such risks [...]" (BRAZIL, 2020, p. 2-3).

Trindade (2017, p. 68) reports that "ergonomics has been defined as the integrated search and not dissociated from the quality of life at work and the improvement of the effectiveness of production processes". The author warns that the maturity of ergonomic management should be built considering the relationship between ergonomics and sustainability for the promotion of dignity at work.

In the business environment, the adoption of management criteria and indicators from the point of view of ergonomics for the sustainability of the business can favor the power to act in situations of occupational risks for the preservation of the workers' health.

Although Hart and Milstein (2004, p. 66) say that "the creation of a more sustainable world will require companies to sacrifice profits and shareholder value", Trindade (2017) points out new paths for strategic business management and reports that it is possible to calculate the return on investments based on the systematization of ergonomics in activities of the organization, the results of which can be observed not only in terms of the reduction of injuries and diseases, but also in relation to the costs of the business by reducing absenteeism, improving product quality and business performance.

In the literature it is observed that the discussion that involves the relationship between ergonomics and business sustainability is a topic little explored. In this context, bibliometric research allows the identification of limits, contributions and potentialities that highlight the need for research and new knowledge related the theme of this article.

2 OBJECTIVE

To map and explore the national and international scientific production in the field of ergonomics and sustainability in the period from 2010 to 2020, in order to show the evolution over the years of the research and the existing articulation between the themes.

3 METHODOLOGY

The research method is exploratory. Severino (2017) points out that the exploratory method makes it possible to survey and identify specific information from a delimited field of work. Gil (2017) and Prodanov (2013) reinforce that this method can be applied to generate additional information on topics to be investigated, allowing greater proximity to the subject, even if they are little explored in the scientific literature.

To carry out the research, the bibliometric technique was chosen, as it makes possible to situate the state and evolution of certain fields of study (GUTIÉRREZ-SALCEDO et al., 2018). The application of bibliometrics is useful to improve documentation and scientific information, with the quantitative analysis of sets of academic works (OSAREH, 1996).

As criteria for this mapping of the ergonomics and sustainability field, the following parameters were adopted: i) language present in the work published on the subject; ii) area that most published on the subject; iii) the main author on the subject.

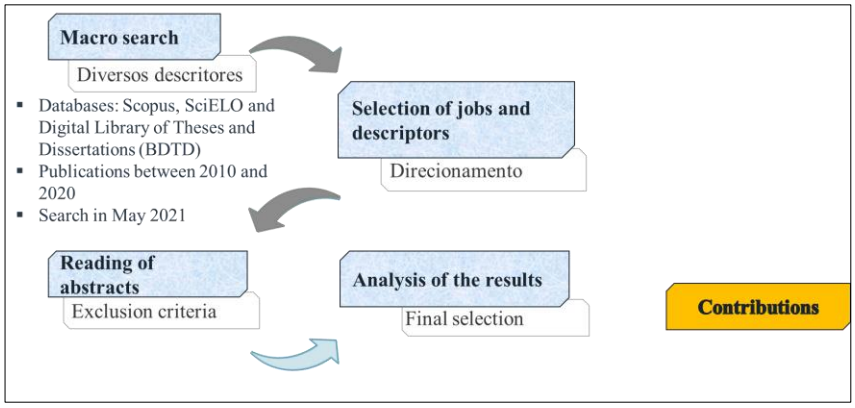
For the search, articles published in Portuguese and English in the SciELO and Scopus databases and in the Digital Library of Theses and Dissertations (BDTD) of CAPES were considered. The mapping information of articles, theses and dissertations were selected and tabulated using the Excel® program (version 10). With the careful analysis of the results, it was possible to show the state of the art of the publications related to the ergonomics and sustainability theme.

4 RESULTS

The mapping of the production of the ergonomics and sustainability theme was based on the definition of the descriptors that represent the research theme in the scientific literature and other publications in the area of study.

The main steps until the definition of the selected contributions are represented in Figure 1. As a criterion of choice, results that were not available in full, those that were repeated and those that were not in Portuguese or English were excluded. For the selection of theses and dissertations, the reading of the abstracts allowed the exclusion of publications not related to the objectives proposed in this research.

Figure 1 - Stages of the development of bibliometric research.



Source: Elaborated by the authors.

Queries to the Scopus, SciELO, and Digital Library of Theses and Dissertations (BDTD) databases took place between May 8 and 15, 2021, for mapping the publications of articles, theses and dissertations published between the period from 2010 to 2020 on ergonomics and sustainability. As the intention is to understand how the two terms are portrayed together, the use of the Boolean operator AND was chosen.

The selection of descriptors on ergonomics and sustainability was organized in three stages:

a) specific descriptors related to the research of each theme.

b) *Boolean* search "Ergonomic AND Sustainability", in Portuguese and English.

c) *Boolean* search with the combination of general and specific descriptors alternately (e.g., descriptors "specific to ergonomics AND sustainability" and "specific to sustainability AND ergonomics") in the Portuguese language and their respective translation into the English language.

The selected descriptors that meet the research criteria, as well as the set of studies published by keywords are shown in Table 1. It is observed that of the total of 570 publications, 66 were found in the BDTD, being 42 dissertations and 24 theses, in addition to 504 articles, of which 498 were located in the Scopus database.

Table 1 - Selected descriptors (in Portuguese and English) and total number of publications found.

Keywords	SciELO Articles	SCOPUS Articles	BDTD Dissertations	BDTD Theses	Total per keyword
Ergonomics AND sustainability	3	408	8	4	**423**
Ergonomia E sustentabilidade	3	0	28	12	**43**
Ergonomic management	0	28	2	0	**30**
Gestão da ergonomia	0	0	3	3	**6**
Green ergonomics	0	21	0	0	**21**
Ergonomia verde	0	0	0	0	**0**
Ergonomics maturity	0	13	0	0	**13**
Maturidade ergonômica	0	0	0	0	**0**
Ergonomic risk AND sustainability	0	12	0	0	**12**
Risco ergonômico E sustentabilidade	0	0	0	2	**2**
Decent work AND ergonomics	0	9	0	1	**10**
Trabalho decente E ergonomia	0	0	0	1	**1**
Green ergonomics AND sustainability	0	6	1	1	**8**
Ergonomia verde E sustentabilidade	0	0	0	0	**0**
Sustainable business AND ergonomics	0	1	0	0	**1**
Negócios sustentáveis E ergonomia	0	0	0	0	**0**
Total per data base	**6**	**498**	**42**	**24**	**570**

Source: Elaborated by the authors.

It is important to note that in the databases consulted, no studies were found in the Portuguese language for the terms "green ergonomics", "ergonomic maturity", and for the combinations "sustainable business AND ergonomics" and "green ergonomics AND sustainability".

It was found that for the keyword "green ergonomics", the publications found contemplate two types of subjects: "circular ergonomics" which refers to circularity aiming at minimizing ergonomic risks with greater positive impact in the scope of environmental issues and "green ergonomics" which is related to the strategy for business sustainability.

In order to better describe and understand the trends and general characteristics of the publications, quantitative analyses were performed.

Initially, publications were searched with the combined terms "ergonomics AND sustainability" under the lens of sustainability and ergonomics (Table 2). Only for the articles, the same comparisons of the publications found in the English language were performed.

Table 2 - Proportion of publications with related themes from the perspective of each subject.

Areas (or themes?)	General keywords	Data base	Proportional relation
Sustentabilidade/ *Sustainability*	Ergonomia E sustentabilidade	Scopus e SciELO	0,11 %
	Ergonomics AND sustainability	Scopus e SciELO	0,63 %
	Ergonomia E sustentabilidade	BDTD	0,2 %
Ergonomia/ *Ergonomics*	Ergonomia E sustentabilidade	Scopus e SciELO	0,21 %
	Ergonomics AND sustainability	Scopus e SciELO	1,32 %
	Ergonomia E sustentabilidade	BDTD	3,54 %

Source: Elaborated by the authors.

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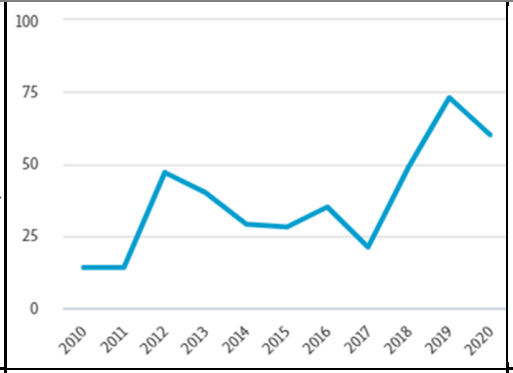
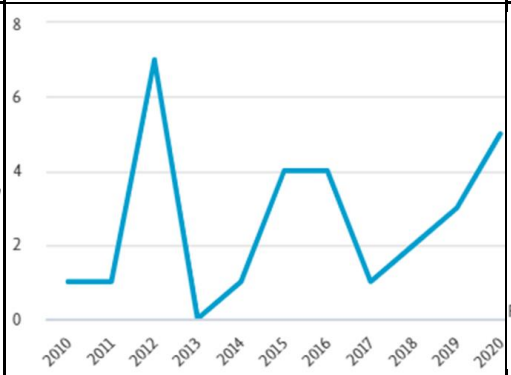
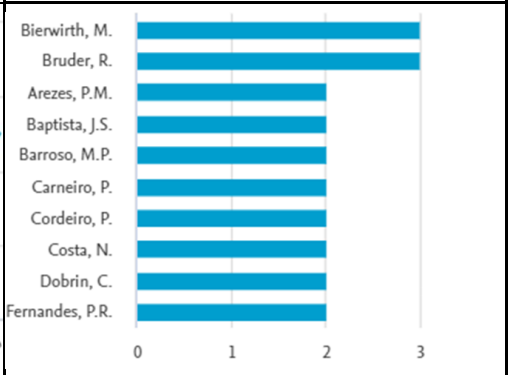
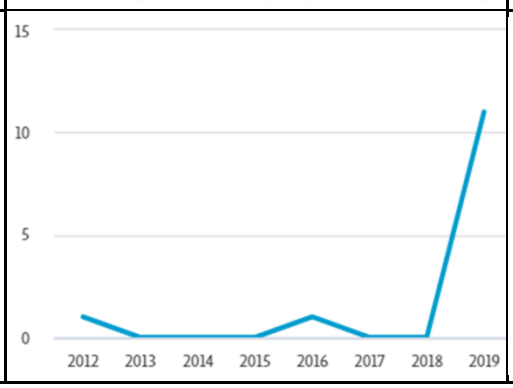
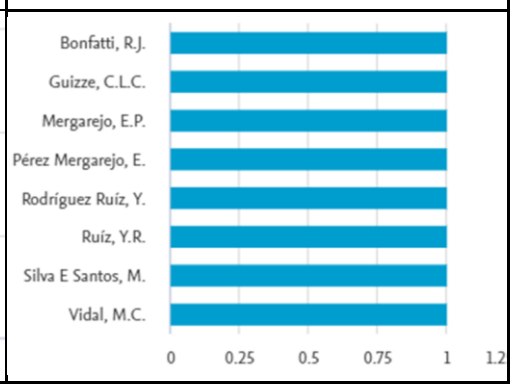
It is observed in Table 2 that it is rare to find published studies with the combined terms “ergonomics AND sustainability”, considering the existing publications in the areas of ergonomics or sustainability, individually. Mainly from the perspective of sustainability, in the three databases consulted, the results of the combination "ergonomics AND sustainability" occurred in a maximum of 0.63% of publications in English in the Scopus and SciELO databases. However, the combination of the two terms appears in 1.5% of articles in English and in 3.5% of Brazilian theses and dissertations in the field of ergonomics.

The bibliometric analysis allows to identify the temporal trend of the publications by year, author, nationality, as well as the areas of concentration and the universities of the researchers.

The search results of the keywords "Ergonomics AND Sustainability"; "Ergonomics Management"; "Ergonomics Maturity" searched in the SCOPUS database, by year and author are evidenced in Chart 1. It is observed that the mapping presented a greater number of publications of scientific articles.

Chart 1 - Articles published in Scopus from 2010 to 2020.

Descriptors	Publications by year	Publications by author
Ergonomics AND sustainability		
Ergonomic management		
Ergonomic maturity		

Source: Elaborated by the authors with data extracted from the SCOPUS database (2021).

For the combination "Ergonomics AND Sustainability" the total number of publications registered in the year pf 2019 is three times higher compared to the previous year, which reveals a result well above the overall average, this behavior was also recorded in the year of 2020.

The most representative Brazilian authors in terms of the number of publications on the topic of ergonomics associated with sustainability are Bolis and Brunoro. The countries with the highest number of publications in the period analyzed are: Italy, Brazil and the United States. It is worth mentioning that only Brazil does not have an annual congress of international reference. These congresses explain the predominance of publications of articles from conferences. The areas of study, engineering and computer science are the ones that appear most prominently in terms of number of publications.

The results reveal that the descriptor "Ergonomic Management" is the one that presents the largest number of Brazilian publications in the analyzed period. There is a stability in the total number of publications per year. Most of the publications originated in congresses, with a predominance of engineering and computer science as the main areas of concentration.

Regarding the descriptor "Ergonomic Maturity", 2019 presented a peak of publications, mainly from studies in Brazil and Colombia.

After the selection of the 66 publications in the BDTD, all abstracts of theses and dissertations were read and the exclusion criteria explained were applied, resulting in 14 theses or dissertations, as described in Chart 2.

Chart 2 - BDTD selection after exclusion criteria.

Authors (year)	**Title**	**Descriptors**
Andrade (2011)	Feeling of (in)justice in justice: (de)structuring factors of QWL from the perspective of the servants of an organ of the judiciary	Ergonomics And Sustainability
Brunoro (2013)	Work and sustainability: contributions of the ergonomics of the activity and the psychodynamics of work	Decent work And ergonomics
Mateus Junior (2013)	Ergonomics management model integrated with lean production practices – ERGOPRO: the case of a corrugated cardboard packaging company	Ergonomics management
Bezerra (2014)	Development of a system of performance indicators for civil construction projects, using the macro ergonomic approach	Ergonomics And Sustainability
Gonçalves (2014)	Ergonomic action and operations strategies: proposal for integration in practice	Ergonomic management
Paz (2014)	Occupational health surveillance: factors associated with accidents, musculoskeletal changes and occupational diseases	Ergonomic risk AND sustainability
Bolis (2015)	The work for sustainability: aligning the strategy with the operation through sustainable tasks	Ergonomics And Sustainability
Mattos (2015)	Evaluation of an ergonomic management model based on lean production practices: focus on the absenteeism rate in a corrugated cardboard packaging company from Santa Catarina	Ergonomics management
Oliveira (2017)	Ergonomics and training: limits to train and transform work into a self-managed coal miner	Ergonomics And Sustainability
Trindade (2017)	Management guidelines in ergonomics: standardization and practice in companies	Ergonomics Management
Goulart (2018)	Contributions of ergonomics to data-driven decision-making in people management	Ergonomics And Sustainability
Santos (2019)	Socio-environmental health conditions of shellfish gatherers from Mem de Sá Island, Itaporanga D'Ajuda-SE	Ergonomic risk and sustainability
Sousa (2019)	Enterprise modeling of the collaboration process between companies for the implementation of solutions related to Industries 4.0	Ergonomics and sustainability

Vieira (2020)	Proposition of ergonomic risk management model in a mining company	Ergonomics management

Source: Elaborated by the authors.

It is observed by the titles of the works that the combinations of descriptors of the research can result in applications in various segments, such as: industrial, environmental, civil construction, and legal, related to health at work, circular economy, management, and human resources. The scope of applications in the world of work is verified, especially in labor-intensive sectors.

Table 3 presents the annual distribution of theses and dissertations published from 2010 to 2020.

Table 3 - Evolution of BDTD publications from 2010 to 2020.

Descriptors	Type of research	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total by type and descriptors
Ergonomics and Sustainability	Dissertation		1			1				1			**3**
	Thesis					1			1		1		**3**
Ergonomic management	Dissertation						1					1	**2**
	Thesis				1	1			1				**3**
Ergonomic Risk and Sustainability	Thesis					1					1		**2**
Decent Work and Ergonomics	Thesis				1								**1**
General total by year		**0**	**1**	**0**	**2**	**4**	**1**	**0**	**2**	**1**	**2**	**1**	**14**

Source: Elaborated by the authors.

Regarding theses and dissertations, the publications are by different authors. The most representative universities in terms of the number of publications on the subject are: University of São Paulo (three theses); Federal University of Santa Catarina (two dissertations and one thesis); and the Federal University of São Carlos (two theses) (Chart 3).

Chart 3 - BDTD selection by type, university and program.

Authors (year)	Type of reaearch	University	Program
Andrade (2011)	Dissertation	University of Brasilia	Psychology
Brunoro (2013)	Thesis	University of São Paulo	Production Engineering
Mateus Junior (2013)	Thesis	Federal University of Santa Catarina	Production Engineering
Bezerra (2014)	Dissertation	Federal University of Rio Grande do Norte	Production Engineering
Gonçalves (2014)	Thesis	Federal University of São Carlos	Production Engineering
Paz (2014)	Thesis	Federal University of Rio Grande do Sul	Nursing
Bolis (2015)	Thesis	University of São Paulo	Production Engineering
Mattos (2015)	Dissertation	Federal University of Santa Catarina	Production Engineering
Oliveira (2017)	Thesis	Fluminense Federal University	Production Engineering
Trindade (2017)	Thesis	Federal University of São Carlos	Production Engineering
Goulart (2018)	Dissertation	Federal University of Santa Catarina	Production Engineering
Santos (2019)	Thesis	Federal University of Sergipe	Development and Environment

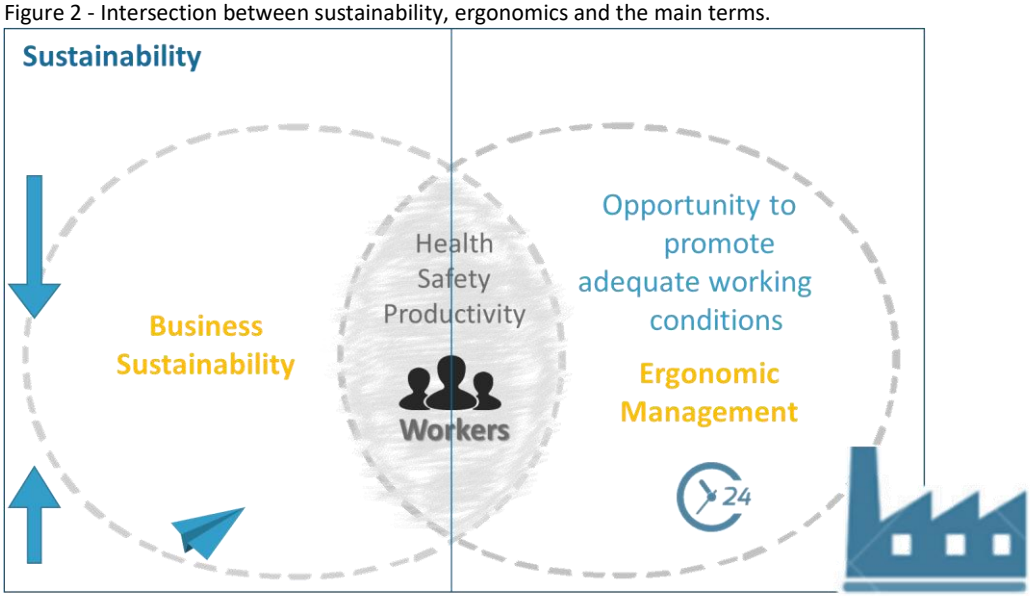
Sousa (2019)	Thesis	University of São Paulo	Production Engineering
Vieira (2020)	Dissertation	Federal University of Maranhão	Energy and Environment

Source: Elaborated by the authors.

We did not find available publications developed in private universities, nor publications originated from Graduate Programs in the area of Sustainability. When analyzing the distribution of publications according to the Graduate Programs, a concentration of studies in the area of Production Engineering is observed.

Figure 2 presents the intersection between the theme of sustainability and ergonomics, identifying workers as the central element, especially when the terms health and safety are associated with productivity.

Figure 2 - Intersection between sustainability, ergonomics and the main terms.



Source: Elaborated by the authors.

4.1 Ergonomics and Sustainability

Companies that follow the principles of sustainability, according to Székely and Knirsch (2005), can gain competitive advantage and proactively manage performance, generating value for stakeholders. Elkington (2012) recommends that organizations structure their activities on the tripod of sustainability, formed by the economic, social and environmental dimensions.

Barbieri *et al*. (2010) discuss the relevance and speed of voluntary adherence of companies from various sectors to the movement for sustainability. This adherence resulted in the development of organizations committed to the theme, considering the impacts of the organization's activities on the degradation of the ecosystem.

The impacts of the changes that have occurred in the environment business, such as, for example, the updates of the Regulatory Standards have a direct impact on the strategic definitions related especially to workers (ANDRADE, 2011).

Andrade (2011) recalls the origins of the word ergonomics through two radicals of Greek origin "*ergon*" and "*nomos*" that can be translated as rules of work.

Both for Wisner (2004), as for Iida and Buarque (2016), Ergonomics as a discipline aims at health at work and seeks to understand and adapt the elements of a system for human beings. Bezerra (2014, p. 18) emphasizes that ergonomics "uses several methods and instruments that allow clarifying and demonstrating the real situation of the organization regarding efficient performance, health, safety and comfort."

The International Ergonomics Association (IEA) officially defined the term ergonomics in 2000, a definition recognized in 2012 by the Brazilian Association of Ergonomics (ABERGO).

> Ergonomics (or Human Factors) is a scientific discipline concerned with understanding the interactions between humans and other elements or systems, and applying theories, principles, data and methods to projects in order to optimize human well-being and the overall system performance. Ergonomists contribute to the planning, design and evaluation of tasks, jobs, products, environments and systems in order to make them compatible with people's needs, abilities and limitations (IEA, 2000; ABERGO, 2012, s/p).

Gonçalves (2014) comments that the definition of ergonomics has undergone changes due to the novelties that have emerged aiming at greater comfort of workers and better performance of companies, whether they are specific to the jobs or general referring to organizational aspects.

Historically, the Science of Ergonomics has the year 1949 as an important date, according to Iida and Buarque (2016), when in England researchers and scientists made it official as an interdisciplinary novelty. Mattos (2015) states that the success in the simultaneous action between professionals from engineering, psychology and other areas of health in the remodeling of the cabins of English fighter aircraft boosted the multidisciplinarity of ergonomics for the industry in the post-war period. However, its expansion only occurred after the founding of the Research Ergonomics Society in the early 1950s, which Mattos (2015, p.77) describes as "an international organization for professionals who use knowledge and skills about the human being to design and build with comfort, efficiency, productivity and safety".

Daniellou (2004) and Iida and Buarque (2016) agree that, with the multidisciplinary knowledge of ergonomics, work situations are transformed into activities with greater well-being and satisfaction, reducing the risks to diseases and consequently result in better performance of the process.

According to Montmollin (1990) and Trindade (2017), the theoretical currents of ergonomics are complementary, even though some points of divergence remain. The authors clarify that the Anglo-Saxon current advocates the improvement of working conditions through methods and technologies, while the French-speaking current is dedicated to the study of human work with the aim of improving it through the understanding of Ergonomic Work Analysis (AET).

In the ergonomic evaluation, according to Attwood, Deeb and Danz-Reece (2004), elements related to workers, organizations, facilities, equipment and environments should be analyzed. The main characteristics of the jobs analyzed by Iida and Buarque (2016) are summarized in Chart 4.

Chart 4 - Main characteristics of the workplace.

Part of the workstation	**Analysis of the characteristics**
Worker's posture	Sitting, standing, or both? Is the table of adequate height? Is the chair suitable? Does it allow adjustments? Is there enough room for movement? Are there forced and stressful postures?
Instruments and controls	Are the controls easy to reach? Are they placed in sequential or importance order? Do they allow good grip and natural body movements? Are the emergency controls well located? Are they identified by signs or symbols?
Visual and sound devices	Are the dials easy to see? Are they readable? Is there proper use of letters, symbol, and colors? Are the sounds and alarms audible?
Task requirement	Are the postures suitable for material handling? Are the required movements the most appropriate? Are there repetitive cycles shorter than 90 seconds? Are the loads and weights within limits?
Environment	Is the lighting adequate? Are there sparkles and glare? Are the noises within limits? Are there heat sources or gaseous pollutants? Is the ventilation adequate?

Source: Iida and Buarque (2016, p. 298).

Bezerra (2014) also classifies Ergonomics as: cognitive, physical and organizational and presents Ergonomics as part of Work Engineering.

Only in 1990, according to Gonçalves (2014), ergonomics was incorporated into its broad conception in the business environment, with the purpose of seeking solutions that meet the social objectives related to the health of workers and economic, aiming to maximize productivity and quality in the processes. This point is highlighted in this research.

For Mafra (2006, p. 78) "Ergonomics, allied to the quality movement, stands as a basis for the proposal of continuous improvement of production processes", and the elements that characterize the recent processes of productive restructuring are flexibility in management, technological investment and changes in the legal structure (FERREIRA, 2008). In Brazil, ergonomics is present in the Regulatory Standards of the Ministry of Labor and Employment, making it an obligation for companies to ensure the health of their employees.

It is important to question how prepared employees, companies and society are to deal with this apparent contradiction in the simultaneous search for safety, health and productivity at work (ANDRADE, 2011).

It should also be remembered that ergonomics studies work "in order to characterize the working conditions, their result and the activity itself" (GONÇALVES, 2014, p. 30). According to Gonçalves (2014) and Zink (2014), work is intrinsically related to the social and economic dimensions of sustainability in companies, as well as ergonomics. It plays a crucial role in Quality of Life at Work (QWL) and impacts the organization of work by integrating employee performance, health and legal issues, resulting in an improvement in both organizational performance and employee well-being.

5 CONCLUSIONS

The research carried out met the proposed objective of mapping scientific production in the field of ergonomics and sustainability. bibliometric research carried out shows that, although there is a gap in published studies on the relationship between ergonomics and sustainability, a significant increase in scientific interest in this approach is noticeable in recent years.

Among the contributions of ergonomics to corporate sustainability, gains in terms of better organizational performance stand out, based on adequate health and safety conditions in the work environment. The development of an ergonomics program associated with the principles of sustainability seems to be a way to manage occupational risks with preventive measures in safety and health at work.

REFERENCES

ABERGO. ASSOCIAÇÃO BRASILEIRA DE ERGONOMIA. 2012. **O que é a ergonomia.** Available in: <https://www.abergo.org.br/sobre>. Acesso em: 14 out. 2021.

ANDRADE, P. P. **Sentimento de (in)justiça na justiça:** Fatores (des)estruturantes de QVT sob a ótica dos servidores de um órgão do Poder Judiciário. 2011. 151f. Dissertação (Mestrado em Psicologia) - Universidade de Brasília, Brasília, 2011.

ATTWOOD, D. A.; DEEB, J. M.; DANZ-REECE, M. E. **Ergonomic solutions for the process industries.** Nova York: Elsevier, 2004.

BARBIERI, J. C. *et al.* Inovação e sustentabilidade: Novos modelos e proposições. **Revista de administração de empresas RAE/FGV**, v.50, n.2, p.146-154, abr./jun. 2010.

BEZERRA, I. X. B. **Desenvolvimento de um sistema de indicadores de desempenho para empreendimentos em construção civil, utilizando a abordagem macroergonômica.** 2014. 189 f. Dissertação (Mestrado em Engenharia de Produção) - Universidade Federal do Rio Grande do Norte, Natal, 2014.

BOLIS, I. **O trabalho para a sustentabilidade:** Alinhando a estratégia com a operação através de tarefas sustentáveis. 2015. Tese (Doutorado em Engenharia de Produção) - Escola Politécnica da Universidade de São Paulo, São Paulo, 2015.

BRASIL. **PORTARIA Nº 6.730, DE 9 DE MARÇO DE 2020**. Aprova a nova redação da Norma Regulamentadora nº 01 - Disposições Gerais e Gerenciamento de Riscos Ocupacionais, Brasília, DF. Available in: <https://protecaomais.com.br/wp-content/uploads/2020/03/PORTARIA-N%C2%BA-6.730-DE-9-DE-MAR%C3%87O-DE-2020-DOU-Imprensa-Nacional.pdf>. Accessed in: 10 dez. 2022.

BRUNORO, C. M. **Trabalho e sustentabilidade:** Contribuições da ergonomia da atividade e da psicodinâmica do trabalho. 2013. 203f. Tese (Doutorado em Engenharia de Produção) - Escola Politécnica da Universidade de São Paulo, São Paulo, 2013.

DANIELLOU, F. **A ergonomia em busca de seus princípios:** Debates epistemológicos. São Paulo: Edgar Blucher, 2004.

ELKINGTON, J. **Sustentabilidade, canibais com garfo e faca**. São Paulo: M.Books, 2012.

FERREIRA, M. C. A ergonomia da atividade se interessa pela qualidade de vida no trabalho? Reflexões empíricas e teóricas. **Cad. psicol. soc. trab**., São Paulo, v. 11, n. 1, p. 83-99, 2008.

GIL, A. C. **Como elaborar projetos de pesquisa**. 6 ed. São Paulo: Atlas, 2017.

GONÇALVES, J. M. **Ação ergonômica e estratégias de operações:** Proposta de integração na prática. 2014. 238f. Tese (Doutorado em Engenharia de Produção) - Universidade Federal de São Carlos, São Carlos, 2014.

GOULART, M. C. **Contribuições da ergonomia para o processo decisório orientado por dados em gestão de pessoas.** 2018. 215 p. Dissertação (Mestrado em Engenharia de Produção) - Universidade Federal de Santa Catarina, Florianópolis, 2018.

GUTIÉRREZ-SALCEDO, M., MARTÍNEZ, M. Á., MORAL-MUNOZ, J. A., HERRERA- VIEDMA, E., & COBO, M. J. Some bibliometric procedures for analyzing and evaluating research fields. ***Applied Intelligence***, v. *48, n.* 5, 1275-1287, 2018. DOI: https://doi.org/10.1007/s10489-017-1105-y

HART, S. L.; MILSTEIN, M. B. Criando valor sustentável. **RAE Executivo**, v. 3, n. 2, p. 65-79, 2004.

IIDA, I.; BUARQUE, L. **Ergonomia:** Projeto e produção. São Paulo: Blucher, 2016.

MAFRA, J. R. D. Metodologia de custeio para a ergonomia. **Rev. contab. financ**., São Paulo, v. 17, n. 42, p. 77-91, 2006.

MATEUS JUNIOR, J. R. **Modelo de gestão da ergonomia integrado as práticas da produção enxuta - ERGOPRO:** O caso de uma empresa de embalagem de papelão ondulado. 2013. 171 f. Tese (Doutorado em Engenharia de Produção) - Universidade Federal de Santa Catarina, Florianópolis, 2013.

MATTOS, D. L. **Avaliação de um modelo de gestão de ergonomia baseado em práticas da produção enxuta:** Enfoque no índice de absenteísmo em uma empresa de embalagens de papelão ondulado catarinense. 2015. 195 p. Dissertação (Mestrado em Engenharia de Produção), Universidade Federal de Santa Catarina, Florianópolis, 2015.

MONTMOLLIN, M. **A Ergonomia.** Lisboa: Instituto Piaget, 1990.

OLIVEIRA, V. A. N. **Ergonomia e formação:** Limites para formar e transformar o trabalho numa mineradora de carvão autogestionária. 2017. 333 f. Tese (Doutorado em Engenharia de Produção) - Universidade Federal Fluminense, Niterói, 2017.

OSAREH, F. Bibliometrics, citation analysis and co-citation analysis: A review of literature I. ***Libri***, v. *46, n.* 3, 149-158, 1996. DOI: https://doi.org/10.1515/libr.1996.46.3.149

PAZ, A. A. **Vigilância na saúde do trabalhador:** Fatores associados aos acidentes, alterações musculoesqueléticas e doenças do trabalho. 2014. 223 f. Tese (Doutorado em Enfermagem) - Universidade Federal do Rio Grande do Sul, Natal, 2014.

PRODANOV, C. C.; FREITAS, E. C. **Metodologia do trabalho científico:** Métodos e técnicas da pesquisa e do trabalho acadêmico, 2 ed. Novo Hamburgo, Associação Pró-Ensino Superior em Novo Hamburgo, 2013.

SANTOS, L. X. C. **Condicionantes socioambientais de saúde de marisqueiras da Ilha de Mem de Sá, Itaporanga D'Ajuda-SE.** 2019. 167 f. Tese (Doutorado em Desenvolvimento e Meio Ambiente) - Universidade Federal de Sergipe, São Cristóvão, 2019.

SEVERINO, A. J. **Metodologia do trabalho científico.** São Paulo: Cortez, 2017.

SOUZA, T. B. **Modelagem de empresas (enterprise modeling) do processo de colaboração entre empresas para a implantação de soluções relacionadas às Indústrias 4.0.** 2019. 193 p. Tese (Doutorado em Engenharia de Produção) - Escola Politécnica da Universidade de São Paulo, São Paulo, 2019.

SZÉKELY, F.; KNIRSCH, M. Responsible leadership and corporate social responsibility: metrics for sustainable performance. **European Management Journal**, v. 23, p. 628-647, 2005.

TRINDADE, M. A. L. **Diretrizes de gestão em ergonomia**: A normalização e a prática nas empresas. 2017. 213f. Tese (Doutorado em Engenharia de Produção) - Universidade Federal de Santa Catarina, São Carlos, 2017.

VIEIRA, Y. dos S. P. **Proposição de modelo de gestão dos riscos ergonômicos em uma empresa de mineração.** 2020. 144 p. Dissertação (Programa de Pós-Graduação em Energia e Ambiente) - Universidade Federal do Maranhão, São Luís, 2020.

WISNER, A. Questões epistemológicas em ergonomia e em análise do trabalho. In: DANIELLOU, F. (Org.) **A ergonomia em busca de seus princípios**: debates epistemológicos. São Paulo: Edgard Blucher, 2004.

ZINK, K. J. Designing sustainable work systems: The need for a systems approach. **Applied Ergonomics**, v. 45, p.126-132, 2014.