

# Bibliometric analysis on current ergonomic trends in the international labor context

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## Abstract

The objective of this research is to conduct a literature review on current ergonomic trends in the international labor context. The Prisma method was used and a total of 160 articles from 20 high impact journals selected from the Scimago Journal & Country Rank platform were examined. The most relevant results were: there is a higher concentration of publications in the year 2023 (43.75%); the journals with the highest number of publications on Ergonomics are IEE Transaction on Human Machine systems (16.25%), in which Physical Ergonomics (53.67%) studied existing Ergonomics dimensions followed by Cognitive Ergonomics (36.03%). It is concluded that the emerging trends in Ergonomics reveal the current interest in bringing automation, artificial intelligence and new technologies to all areas of the human life.

**Keywords:** ergonomics; human factor engineering; work environment; ergonomic trends.

# Análisis bibliométrico sobre las tendencias ergonómicas actuales en el contexto laboral internacional

## Resumen

El objetivo de esta investigación es realizar una revisión bibliográfica sobre las tendencias ergonómicas actuales en el contexto laboral internacional. Se utilizó el método Prisma y se examinaron un total de 160 artículos provenientes de 20 revistas de alto impacto seleccionadas de la plataforma Scimago Journal & Country Rank. Los resultados más relevantes fueron: existe una mayor concentración de publicaciones en el año 2023 (43.75%); la revistas con mayor número de publicaciones sobre Ergonomía son IEE Transaction on Human Machine systems (16.25%), en las cuales la Ergonomía Física (53.67%) es la más estudiada entre las 3 dimensiones de la Ergonomía existente seguida de la Ergonomía Cognitiva (36.03%). Se concluye que las tendencias emergentes en la Ergonomía revelan el interés actual de llevar la automatización, la inteligencia artificial y las nuevas tecnologías a todas las áreas de la vida humana.

**Palabras claves:** ergonomía; ingeniería del factor humano; entorno laboral; tendencias ergonómicas.

## 1 Introduction

Human capital is still the main engine that drives companies and organizations around the world, for this reason it is of utmost importance that workers can have good health and all the guarantees that allow them to perform their work with all the necessary safety and comfort, without this being detrimental to their health or their physical or emotional capabilities [1].

Depending on the physical, environmental, organizational and cognitive conditions, a work activity can cause undesirable effects on the safety and health of the workers themselves. Throughout history, work has undergone major transformations in terms of structure, design, organization and technification [2].

Ergonomics is defined by the International Ergonomics Association (IEA) as the "...scientific discipline concerned with understanding the interactions between humans and

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other elements of a system, and the profession that applies theory, principles, data and methods to design to optimize human and general well-being” [3].

Ergonomics presents certain guiding principles that guide its application and understanding. They represent the very basis of ergonomics and range from the adaptation of work to human capabilities to the optimization of efficiency and safety in the workplace. Among these principles are: studying the configuration of the workstation and working conditions, adapting the demands of the task to human capabilities, adapting the environment (light, noise, temperature...) to the needs of man at his workstation, and designing machines, equipment and installations with maximum performance, precision and safety [4].

The development of ergonomics is a subject of reflection for the members of its scientific and professional community at both the international and national level. In fact, the IEA in 2020 declared that its main mission is to promote the development of ergonomics as a discipline and as a profession [5,6].

Although studies concerning ergonomics have been developed for several centuries, it was not considered as a discipline until the late 1940s, when the world began to see the importance that this science attributed to the worker. Different groups were created at this time, such as the Human Factors and Ergonomics Society (HFES) in the United States, the International Ergonomics Association (IEA) in 1961 and in 1963, the French-language Ergonomics Society (ELF) was founded. Currently, more than 50 ergonomics societies from various regions of the world are an integral part of the IEA [7].

Nowadays, industrial companies have taken into account the importance of ergonomics in their work environments, because it influences the normal development of their activities, and this occurs as a result of a bad design of the tools and facilities where production work is performed. The application of ergonomics in the industry raises the performance and improves the quality of the product where the human element is the key factor to increase efficiency and effectiveness in all activities. [8].

Ergonomics simultaneously contributes to the economic health of organizations by improving the well-being, capability and sustainability of workers, maximizing performance and reducing direct and indirect costs arising from productivity losses, quality deficiencies and staff turnover [5].

Another relevant element of ergonomics is its inclusive nature, as it takes into account human variability in the design of systems. For example, some contemporary ergonomics topics include design for people with both physical and mental disabilities, as well as for the elderly population. In this way, ergonomics contributes to improving the health, safety and well-being of people, impacting public health. [7].

Therefore, even though ergonomics has had an apparently recent origin, it is in constant development and evolution to constantly offer more information on strategies and possible alternatives to facilitate and ensure the health and well-being of workers in the work environment, articulating these benefits with the projection of the achievement of organizational objectives, thus becoming a topic that is becoming increasingly relevant [4].

Consequently, the objective of this research is to conduct a literature review on current ergonomic trends in the international labor context.

## 2 Materials and method

In order to perform a bibliometric analysis of current trends in Ergonomics, the PRISMA method was used, following the steps outlined in the bibliographic study of [9]. In order to obtain the most outstanding advances, it was decided to use information from high impact scientific journals. In order to determine the goals of this research, the following question was asked:

What are the current ergonomic trends applied in the international work context?

To proceed with the selection, abstracts and keywords associated with Ergonomics were reviewed. The results and conclusions of the articles were reviewed and those that were most related to the topic and met the inclusion criteria were selected. Information on authorship, year, abstract, results and conclusions was collected from the systematic reviews.

According to [10] the term Human Factor Engineering and therefore Human Engineering are equivalent to the term Ergonomics being the first two definitions more used in North America. Consequently, the search was performed using the descriptor *Ergonomics*, *Human factors* and *human engineering* to broaden the exploration system. To limit the search field, the following inclusion criteria were established:

- It was limited by year of publication in each of the journals chosen to search for updated information from January 2022 to April 2024.
- Quantitative, qualitative or mixed studies.
- English was introduced as the language of the studies.
- Open access research
- Research from high impact journals in the Q1 and Q2 quartiles during 2022 and 2023 belonging to the Scimago Journal & Country Rank platform.
- Publications that were related to the search term related to the question posed.

Therefore, as exclusion criteria, outdated articles were discarded, which were related to ergonomics, but did not contain the information and were not available for reading. The establishment of these criteria made it possible to purify the information. Fig. 1 shows the procedure for the search and selection of articles

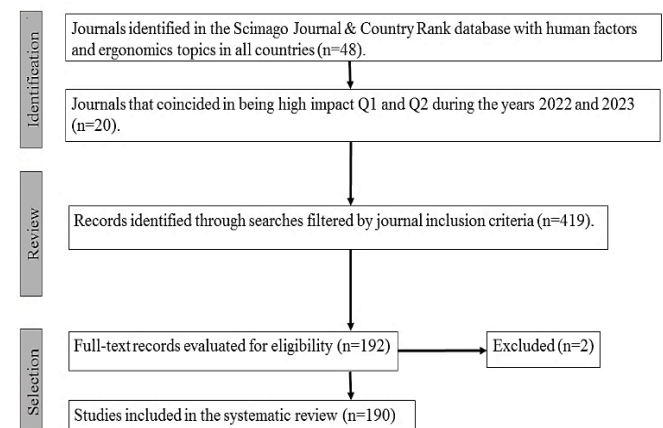


Figure 1. Procedure for the search and selection of articles.  
Source: own elaboration

The articles were then classified according to the dimension of ergonomics classified by the IEA, according to the following criteria:

**Physical Ergonomics:** concerned with the anatomical, anthropometric, physiological and biomechanical characteristics of the worker, as they relate to physical activity. Its most relevant topics include work postures, overexertion, manual material handling, repetitive movements, work-related muscle-tendon injuries (TML), job design, occupational safety and health [11].

**Cognitive Ergonomics:** deals with the study of the worker's mental processes. Factors such as perception, attention, cognition, motor control, storage and memory retrieval, which are affected by mental workload, decision making, skill performance, worker interaction with the computer, stress and training. [12,2].

**Organizational Ergonomics:** is interested in the optimization of socio-technical systems, including their organizational structure, rules and processes. The topics covered include communication, management of collective resources, conception of work, conception of work schedules, teamwork, participatory conception, community ergonomics, cooperative work, new forms of work, organizational culture, virtual organizations, teleworking and quality management [13].

### 3 Results

Fig. 2 shows the quantities published per year in the period 2022-2024. The highest rate of publications in scientific journals related to ergonomic topics during the period of analysis is presented by the year 2023 (42.55%), followed by the year 2022 (30.09%) and in the months elapsed in the year 2024 (27.66%).

Table 1 identifies the journals with the number of publications per year. There are 14 journals with Human Factor and Ergonomics theme belonging to the Scimago Journal & Country Rank base that have published a total of 160 articles in the period 2022-2024. The journals with the highest number of publications on Ergonomics are IEE Transaction on Human Machine systems (16.49%), International Journal of Industrial Ergonomics (15.95%), International Journal of Human Computer Interaction (11.17%) and Theoretical Issues in Ergonomics Science (9,57%).

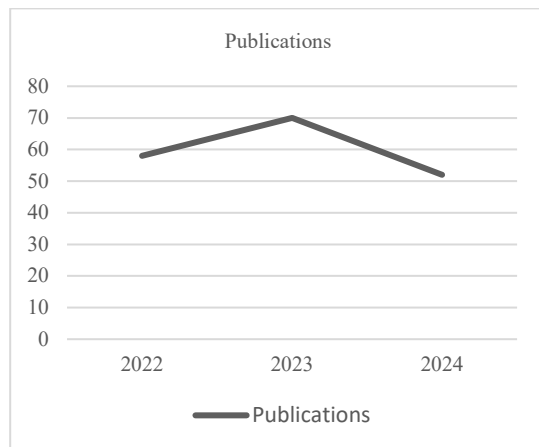


Figure 2. Accounting of publications on Ergonomics between 2022-2024. Source: own elaboration (2024)

Table 1. Number of publications in journals.

#	Journal	2022	2023	2024	%
1	IEE Transaction on Human Machine systems	12	11	8	16.49
2	International Journal of Industrial Ergonomics	6	16	8	15.95
3	International Journal of Human Computer Interaction	2	13	6	11.17
4	Theoretical Issues in Ergonomics Science	8	4	6	9.57
5	Human Factors	0	6	11	9.04
6	Smart and Sustainable Built Environment	8	6	1	7.97
7	APPLIED ERGONOMIC	6	3	4	6.91
8	Ergonomics	5	6	0	5.85
9	Human Factors and Ergonomics In Manufacturing	4	3	2	4.78
10	International Journal of Human Computer Studies	2	3	2	3.72
11	Facilities	2	3	1	3.19
12	Journal of Cognitive Engineering and Decision Making International	0	2	3	2.65
13	Technology in Society	1	3	0	2.12
14	New Technology, Work and Employment	0	1	0	0.53
15	Journal of Physiological Anthropology	1	0	0	0.53
16	JMIR Human Factors	1	0	0	0.53
	Total	58	80	52	100

Source: own elaboration

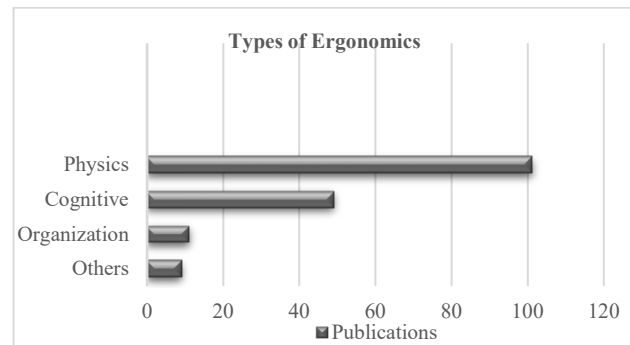


Figure 2. Types of Ergonomics.

Source: own elaboration.

Fig. 2 shows the Ergonomics dimensions used in the research works analyzed, where those studies that covered ergonomics trends in a general way are classified as others. In addition, there were researches projected to more than one dimension of Ergonomics, so they were counted equally for each criterion. Physical Ergonomics (51.53%) is the most studied among the 3 existing Ergonomics dimensions followed by Cognitive Ergonomics (32.65%).

All the data collected and evaluated show a strong tendency to research on Physical Ergonomics issues, being this the main source of future research as foreseen during all the analysis performed.

## 4 Discussion

The development of technologies, robotics and the world's thinking in terms of improving the working conditions of workers contribute to the evolution of Ergonomics. The following will show the current trends that are being generated in the different dimensions of Ergonomics:

**Physical Ergonomics:** Several works focused on the use of technologies for the physical improvement or evaluation of people such as the study by [14] on 3D mapping of the head, face and neck; or that of [15] with the creation of an evidence-based electronic training program (Sit-Stand e -Guide) and the use of assistive devices for older adults or sick people among others.

In addition, there were a considerable number of studies concerning anthropometry for the design of intelligent chairs and desks, handrails for fast and precise reactive grip when people lose their balance, as well as posture assessment in vehicles and airplane seats. Also, as the analysis of musculoskeletal disorders. Of note is the research by [16] where they developed a tool to estimate maximum acceptable manual arm forces for over-the-shoulder work with adjustments for supraspinatus tendon impingement and shoulder fatigue.

One of the areas most addressed was the health sector for research on the use of exoskeletons for stroke rehabilitation and in work areas for the reduction of fatigue and muscular activities in healthy people.

**Cognitive Ergonomics:** The research analyzed addressed on several occasions the use of eye tracking, eyelid marking or visualization of the maximum pupil diameter as techniques to identify mental workload supported in some cases by electroencephalography, as well as discovering usability problems and even harnessing the power of machine learning to recognize various types of emotions related to user interactions in smart applications.

A minority of papers focused on the study of smart glasses in the health area seen from the perspective it provides to patients and medical staff using them. Use of applications to promote mental health in workers and artificial intelligence to reduce the cognitive workloads of UAV operators.

One of the most visualized areas in this research has been the evaluation of the cognitive capacity of drivers in automated vehicles. Job stress due to cognitive load or simply the continued stay in an unhealthy environment was assessed in different jobs reaching conclusions such as the one offered by [17], who understand that all external environmental factors, except political factors, shape mental health management outcomes.

**Organizational ergonomics:** Research focused mainly on the collaboration of humans and robots to reduce the ergonomic burden on workers in the heavy automotive manufacturing industry and in the digital industry. Likewise, it happens with the study presented by [18] in which he comments on the advantages and disadvantages of incorporating supportive conversational agents (CA) in workplaces, as well as assistance for people with

disabilities, which requires personalization and transparency, research commented by [19]

Research on how technology can help create a sustainable aging workforce was conducted, [20] note that digitization of workplaces, digital literacy, innovation, intergenerational collaboration and knowledge management form important elements of the international standard on age-inclusive workforce.

One of the researches in this area was that of [21] where they presented a computational model that combines all the key parameters that musicians evaluate to verify the quality of a musical instrument such as tuning, sound quality and ergonomics to predict the construction details of the instrument. In addition to the research of [22] where they analyze the hardware and software interaction interface of a smart air conditioner in order to improve the intelligence and humanization of the home environment.

Regarding the study and advancement of ergonomics the recent research by [23] comments that the impact of ergonomics and human factors (EHF) has been limited to date and that critical issues need to be resolved, such as increasing the number of appropriately qualified practitioners, resolving the gap between research and practice, and increasing awareness of EHF and its benefits. This article provides the perspectives of 18 ergonomics and human factors (EHF) professionals on the impact of EHF, current challenges and critical future directions, and changes that are needed to ensure that EHF remains relevant in the future. As such, it provides important guidance on future EHF research and practice.

[23] clarified that frequently discussed future directions include advanced emerging technologies such as artificial intelligence, developing new EHF methods, and improving the quality and scope of education and training. Most felt that there will be a need for EHF in 75 years; however, many noted that our methods will need to adapt to meet new needs.

There is a bibliographic study on Ergonomics by [24] that focused on the types of Ergonomics based on scientific publications located in the Web of Science during the years 2019 and 2022. With a sample of 69 articles it was evidenced that there is a higher concentration of publications in the journals *Applied Ergonomics* (29%) and *Ergonomics* (25%) and; where with 55% the most studied Ergonomics is physics.

The study by [24] although it does not have the same number of articles analyzed as the research presented, supports the results of the same where, combining both investigations, it can be said that during the last 5 years (2019 to mid-2024) physical ergonomics has positioned itself as the main interest of ergonomists and researchers who study safety and health at work. Therefore, it can be predicted that by the year 2025 there will also be a large number of studies on Physical Ergonomics, and from the results obtained in this research it could also be thought that studies on Cognitive Ergonomics will acquire the same fate.

## 5 Conclusions

From the research conducted, it can be concluded that the emerging trends in Ergonomics reveal the current interest in bringing automation, artificial intelligence and new technologies to all areas of human life. Through the bibliographic review of articles published from 2022 to 2024, it was evidenced the current interest in researching especially Physical Ergonomics, being the subject of 51.53% of the publications analyzed in this research with new visions on risk detection and protection measures involving such technological advances. In addition, there is a potential for growth in the number of researches on the area of Ergonomics, given that in 2024, 52 publications were analyzed, representing 89.66% of those reviewed in the whole year 2022.

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