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TOWARDS A CONCEPTUALIZATION OF ERGONOMIC MATURITY IN ENTERPRISES: A LITERATURE REVIEW

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Purpose: The aim of this article is to conceptualize the notion of enterprise ergonomic maturity and to identify its key dimensions.
Design/methodology/approach: This article is based on a systematic literature review covering ergonomics management and organizational maturity. The analysis was qualitative and conceptual in nature. Drawing on the selected publications, the study identifies, organizes, and synthesizes the key areas that contribute to an organization's ergonomic maturity.
Findings: The results indicate that ergonomic maturity is a multidimensional construct encompassing such areas as leadership, organizational culture, employee participation, ergonomic design, risk assessment, organizational learning, and a systems approach.
Research limitations/implications: The article is conceptual in nature, which means that the dimensions of ergonomic maturity proposed here have not yet been empirically validated. Future research should focus on examining individual dimensions of ergonomic maturity and assessing their relevance in companies pursuing Industry 5.0 implementation, particularly from the perspective of human-centered production systems.
Practical implications: The proposed concept may serve as a starting point for the development of diagnostic and auditing tools supporting the assessment of the level of ergonomic development within an enterprise. It may also assist managers in integrating ergonomic requirements into work design, production organization, and the improvement of management systems.
Social implications: The development of ergonomic maturity in enterprises may contribute to improving employees' quality of life, enhancing safety, and reducing physical and cognitive strain in the work environment. This is particularly important in the context of digital transformation and the growing use of artificial intelligence, which increase the need to design production systems that are more human-centered, socially responsible, and oriented toward long-term human well-being.
Originality/value: The value of this article lies in organizing the fragmented body of literature and proposing a coherent approach to enterprise ergonomic maturity and its key dimensions discussed in previous studies.
Keywords: ergonomic maturity, enterprise ergonomics, Industry 5.0, human-centered orientation.
Category of the paper: Literature review.

1. Introduction

In contemporary enterprises, ergonomics is no longer perceived solely in terms of workstation design, the reduction of awkward postures, or compliance with minimum physiological requirements. Instead, it is increasingly approached from a systemic perspective consistent with macroergonomics, emphasizing the design and improvement of processes across the organization as a whole (Hendrick, Kleiner, 2002). From this viewpoint, ergonomics is closely linked to the human factor (HF) and constitutes an important foundation for building organizations that address human needs in a deliberate and responsible manner (Butlewski, 2026). Organizations that incorporate ergonomics into management practice may achieve benefits that extend far beyond the prevention of work-related musculoskeletal disorders (WRMSDs). Previous studies indicate that ergonomics may enhance productivity (Elvis Campos Naval et al., 2025), support the development of competitive advantage (Dul, Neumann, 2007), foster innovation and organizational success (Islam et al., 2025), improve employee well-being and efficiency (Butlewski, 2020; Sisodia, Zaini, 2025), and strengthen workplace safety (Stoidner et al., 2023). Furthermore, the systematic integration of ergonomics into organizational practice may generate operational, organizational, and strategic benefits while also supporting broader objectives, including sustainable development (Butlewski, Broda, 2025).

Nevertheless, in managerial practice ergonomics remains too often confined to occupational health and safety activities and is rarely embedded in the broader logic of organizational development and management systems. This gap points to the need for conceptual frameworks that allow organizations to assess their current level of advancement, identify improvement priorities, and benchmark their practices. In this regard, maturity models appear to offer a promising approach to evaluating the development of ergonomics within enterprises.

Accordingly, the aim of this article is to conceptualize enterprise ergonomic maturity and to identify its principal dimensions on the basis of a literature review. The article assumes that ergonomics should not be treated merely as a set of operational activities or workstation-level interventions, but rather as a component of a broader organizational management system. Against this background, the study addresses the question of how enterprise ergonomic maturity may be defined and structured, particularly in terms of its dimensions, criteria, and maturity levels.

2. Materials and methods

This study employed a systematic literature review conducted in accordance with PRISMA guidelines. The search was carried out in the Scopus and Web of Science Core Collection databases using a two-block search strategy. The first block comprised terms related to ergonomics and human factors, including the systems approach, macroergonomics, and the concept of human-centered organizations. The second block comprised terms associated with maturity models, assessment frameworks, organizational diagnosis, organizational development, and excellence models, given their frequent co-occurrence and conceptual proximity in the literature. Search queries were developed using OR and AND operators and were limited to titles, abstracts, and keywords. Wildcards were applied to capture different terminological variants. Overall, the search strategy combined concepts from the field of ergonomics and human factors with terms referring to maturity models, organizational capabilities, excellence, and assessment frameworks. The review included publications in which Human Factors/Ergonomics (HF/E) represented a substantial element of organizational assessment or was explicitly connected with management practices, particularly in relation to work system design, process management, and integrated management systems. Studies in which ergonomics appeared only incidentally or played a marginal role were excluded. The quantitative results of the review are presented in Table 1.

Table 1.
Quantitative results of the individual stages of the systematic literature review

Reduction levels	Scopus	Web of Science
Number of records identified	193	158
Number of records after removing duplicates	239	
Number of records analyzed (title and abstract)	239	
Number of full-text articles assessed for eligibility	33 (including 3 in Spanish)	
Number of detailed records assessed in the full version (found)	30	
Number of studies included in the review and operationalization of the presented concepts	13	

Source: own elaboration.

3. The concept of enterprise ergonomic maturity

Enterprise ergonomic maturity can be conceptualized as a multidimensional characteristic reflecting the extent to which ergonomics is recognized, accepted, institutionalized, and embedded in the organization's overall management logic (Ruíz, Mergarejo, 2019). It should not be understood merely as the implementation of isolated ergonomic solutions or as a series of ad hoc responses to occupational health and safety problems. Rather, it denotes a level of organizational development at which ergonomics becomes an enduring component

of strategic thinking, work design, operational management, and organizational culture. From this standpoint, ergonomic maturity begins with the recognition of ergonomics as a meaningful managerial and organizational principle. In organizations characterized by such an orientation, ergonomics is incorporated into management processes, work system design, and continuous improvement efforts. Its essence lies in the organization's ability to systematically address the interrelationships among people, tasks, technologies, the work environment, and organizational structures, thereby treating ergonomics as a property of the enterprise as a socio-technical system. The literature suggests that organizations with higher levels of ergonomic maturity not only understand the problem-solving potential of ergonomics (Ruíz, Mergarejo, 2019), but also acknowledge the need for its systematic application, develop relevant competencies, establish responsibility structures, allocate resources, conduct ergonomic risk assessments, and monitor the effects of ergonomic interventions (Chinda et al., 2021; Edmonds, 2019; Rodríguez et al., 2022; Vidal et al., 2012). Importantly, they also use the outcomes of these activities to support further organizational improvement. In this sense, ergonomic maturity emerges when ergonomics becomes both a durable organizational capability (Reiman et al., 2021) and a component of organizational culture (Chinda, 2021), supporting employee well-being as well as organizational effectiveness. This understanding may be further reinforced by the human-centric ergonomic axiom, according to which ergonomics is grounded in the simultaneous pursuit of human fit, optimal system performance, and employee well-being (Butlewski, 2018). Enterprise ergonomic maturity may therefore be defined as the degree of organizational advancement in the institutionalization, integration, evaluation, and continuous improvement of Human Factors/Ergonomics (HF/E) within management systems, organizational structures, operational practices, and organizational culture. Consequently, an ergonomic maturity model reflects the extent to which ergonomics is implemented in a planned, systematic, and monitored manner, with due consideration given to strategy, resources, competencies, responsibilities, indicators, risk assessment, and employee participation (Chinda et al., 2021; Edmonds, 2019; Rodríguez et al., 2022; Vidal et al., 2012).

4. Dimensions of enterprise ergonomic maturity

An analysis of the identified publications indicates that enterprise ergonomic maturity can be considered across dimensions operating at the conceptual, structural, strategic, cultural, process, competency, technological, and outcome levels (Neves et al., 2023; Ródriguez Ruiz et al., 2012). Accordingly, ergonomic maturity should be understood as a complex organizational characteristic that needs to be developed across multiple organizational functions and domains.

Some authors therefore refer to dimensions typical of general organizational maturity models, such as leadership, management commitment, strategic alignment, resource allocation, competencies, process orientation, monitoring, and continuous improvement (Páez et al., 2018; Santos-Neto, Costa, 2019). In this sense, enterprise ergonomic maturity may be interpreted as a specific manifestation of broader organizational maturity. At the same time, however, the literature indicates that the assessment criteria should also reflect the substantive specificity of ergonomics as a field of practice and knowledge.

In macroergonomic approaches, maturity is assessed with reference to whether ergonomics is culturally accepted within the organization, whether competent ergonomic practitioners are available, and whether the organization has appropriate oversight and feedback mechanisms in place (Páez et al., 2018; Rodríguez et al., 2022). Ergonomic maturity models also include criteria related to risk identification capabilities, design and implementation competencies, responsibility for the implementation of solutions, and motivational mechanisms supporting their long-term sustainability (Ruíz, Mergarejo, 2019). A similar interpretation can be found in studies on macroergonomic organizational factors, in which maturity development is associated with building consistency between the organizational system, employee competencies, and working conditions (Realyvásquez Vargas et al., 2016). A dimension that is particularly specific to ergonomics is employee participation (Pérez et al., 2021), including the incorporation of employee experience and the collaborative prioritization of changes, both of which are characteristic of participatory and user-centered approaches. Employee experience is treated as an important condition for accurate diagnosis and effective intervention (Kogi, 2006).

Another group of criteria relates to monitoring, indicators, and supervision, which play a particularly important role in ergonomic maturity models. In classical maturity models, monitoring is usually intended to control processes, measure outcomes, and support improvement. In the context of ergonomics, however, it takes on a more specialized form, encompassing information systems as well as ergonomic indicators related to workloads and adverse events (Chinda et al., 2021). In ergonomic maturity models, the surveillance dimension is treated as one of the core pillars of assessment, which suggests that an ergonomically mature organization should not only implement solutions, but also possess the capability to observe, document, and evaluate their effects (Rodríguez et al., 2022). Health surveillance systems and contemporary ergonomic risk assessment methods further strengthen this organizational capability, indicating that the development of monitoring tools substantially advances this dimension of maturity (Butlewski et al., 2025; Mollabagher et al., 2026; Scataglini et al., 2025). The identified and organized dimensions are presented in Table 2.

Table 2.
Dimensions of enterprise ergonomic maturity and their characteristics

Dimension of ergonomic maturity	A characteristics and subcomponents of a dimension
Ergonomic culture	It encompasses the level of acceptance of ergonomics within an organization, the willingness to recognize its importance to the functioning of the enterprise, the development of cooperation and teamwork, and the building of attitudes that encourage employee participation in identifying and resolving ergonomic problems. Ergonomics is viewed as a way of thinking about work, productivity, and well-being.(Ródriguez Ruiz et al., 2012; Ruíz, Mergarejo, 2019)
Strategic and management integration	It addresses the degree to which ergonomics is linked to a company's strategy, management system, policies, management decisions, and development planning. It encompasses criteria such as strategic alignment , formalization of ergonomics management, management commitment, incorporating ergonomics into organizational and design decisions, and anchoring it firmly in company structures and procedures.(Earthy et al., 1999; Poghosyan et al., 2020; Ródriguez Ruiz et al., 2012; Vidal et al., 2012)
Resources and organizational support	It encompasses the availability of resources necessary to conduct ergonomic activities, including human, financial, technical, information, and infrastructure resources. This dimension reflects whether the organization creates realistic conditions for implementing ergonomics, providing tools, time, expert and program support, and organizational resources enabling the continuous and planned development of ergonomic activities.(Rodríguez et al., 2022; Ruíz, Mergarejo, 2019)
Competencies and contractors	It refers to the level of knowledge, skills, experience, and training of those responsible for implementing ergonomics. It encompasses specialist competencies, role assignments, responsibilities, professional development, training, access to advice, and the ability to collaborate among various participants in the ergonomic design and improvement process. The organization has people capable of implementing ergonomic design in practice.(Edmonds, Gray, 2019; Poghosyan et al., 2020; Ródriguez Ruiz et al., 2012)
Responsibility and leadership	This dimension encompasses the existence of clearly defined roles and responsibilities in the area of ergonomics. This includes both the formal designation of individuals responsible for ergonomics and its dimensions, as well as effective support from management, which gives ergonomics activities organizational importance, ensures their continuity, and strengthens a culture of responsibility for people and the work system.(Pérez et al., 2021; Ruíz, Mergarejo, 2019)
Participation and cooperation	It indicates the degree of involvement of employees and users of work systems in identifying problems, co-creating solutions, and assessing their effectiveness. This dimension emphasizes both participation mechanisms and practices of interdisciplinary and interorganizational collaboration. Ergonomic maturity assumes that users are not merely recipients of changes but co-participants in their design and implementation.(Rodríguez et al., 2022; Suarez Noto, Narino Lescay, 2018)
Ergonomic design and human-centered design	It encompasses an organization's ability to consider human characteristics, needs, and limitations in the design of jobs, tools, procedures, technologies, and entire work systems. The criteria for this dimension relate to the practical application of human-centered design principles, consideration of users, tailoring solutions to people , and integrating efficiency requirements with safety and well-being requirements.(Edmonds, Gray, 2019; Suarez Noto, Narino Lescay, 2018)
Ergonomic risk assessment	It concerns an organization's ability to identify ergonomic hazards, analyze their sources, assess workloads and risks, and incorporate the results of these analyses into improvement actions. This dimension includes recognizing problems related to posture, physical workload, work organization, fatigue, procedures, and human-technology interaction.(Pérez et al., 2021; Ródriguez Ruiz et al., 2012; Rodríguez et al., 2022)
Indicators, monitoring and information systems	This includes the use of ergonomic metrics, data collection, the development of decision-support information systems, and monitoring the results of ergonomic activities. An ergonomically mature organization has the ability to implement interventions, track them, document them, and utilize the information in management and reporting processes.(Edmonds, 2019; Rodríguez Ruíz, Pérez Mergarejo, 2016; Rodríguez et al., 2022)

Process and regularity of ergonomics application	This dimension refers to whether ergonomics is used occasionally or is programmatic, regular, and systematic. It encompasses planning activities, sequential implementation, reviewing, maintaining results, and developing procedures to ensure the sustainability of the ergonomic approach. Maturity increases when ergonomics ceases to be a reaction to incidents and becomes part of the cyclical management of the organization.(Chinda et al., 2021; Rodríguez Ruíz, Pérez Mergarejo, 2016)
Organizational learning and continuous improvement	It encompasses an organization's ability to learn from assessments, interventions, incidents, project experiences, and best practices, and then use these lessons to improve work systems. In this dimension, ergonomics becomes part of organizational learning, and maturity assessments are used to determine priorities, action plans, and development directions.(Edmonds, 2019; Rodríguez et al., 2022; Vidal et al., 2012)
Macroergonomic and systemic perspective	It means approaching ergonomics at the level of the entire sociotechnical system, taking into account the interconnections between people, technology, tasks, the environment, and the organization. This dimension indicates that ergonomic maturity is not limited to workstations but encompasses the holistic design and improvement of organizational systems in a way that supports both human well-being and system performance.(Pacholski, Szczuka, 2018; Reiman et al., 2021; Rodríguez et al., 2022)

Source: own elaboration based on the literature review.

The identified categories of ergonomic maturity provide a conceptual foundation for further research on the shaping of ergonomic maturity in organizations and for the development of models of progression toward maturity.

5. Summary

The analysis undertaken in this article enabled the concept of enterprise ergonomic maturity to be organized on the basis of the existing literature and its principal dimensions to be identified, including leadership, organizational culture, employee participation, ergonomic design, risk assessment, monitoring, organizational learning, and a systems perspective. Nevertheless, the proposed framework remains conceptual and therefore requires empirical verification. Future research should focus on examining the individual dimensions of ergonomic maturity and evaluating their adequacy in specific organizational settings. This is particularly relevant in enterprises implementing the assumptions of Industry 5.0, where the importance of human-centered work system design, human–technology integration, and the development of production environments combining efficiency with employee well-being continues to increase. There is also a clear need for empirical studies addressing the benefits achieved by organizations that seek to develop ergonomic orientation or, more broadly, human-centricity (Butlewski, 2026). Such studies may help establish a more realistic framework for the implementation of these approaches and provide evidence of their effectiveness in organizational practice (Hamel, Zanini, 2020).

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