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EFFECTS OF IMPLEMENTING ERGONOMIC INNOVATIONS – EMPIRICAL RESEARCH IN ORGANIZATIONS

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Purpose: The purpose of this article is to present the results of research on the most commonly implemented types of ergonomic innovations in organizations and their impact on employees and organizational functioning. It also highlights key benefits and barriers associated with their implementation.
Design/methodology/approach: The study was based on an analysis of surveys conducted among 357 organizations. The questionnaire included questions about the types of ergonomic innovations implemented, their impact on organizational activities, the most common results achieved, and the implementation barriers encountered. Data were collected using the CAWI technique. Respondents were managers and specialists with knowledge and experience in implementing ergonomic solutions in their organizations.
Findings: The research results indicate that the implementation of ergonomic innovations contributes to increased employee productivity and improved comfort and safety at work. Organizations that effectively implement such solutions also report increased employee engagement and improved task quality. The main barriers to introducing ergonomic innovations include limited financial resources and lack of time for implementation.
Research limitations/implications: The main limitations of the study concern the relatively small number of organizations surveyed, which may affect the weaker ability to generalize the results. Additionally, the analysis is based on subjective assessments by respondents, which may lead to some measurement errors.
Practical implications: The research results provide practical guidelines for managers and ergonomics specialists, emphasizing the importance of implementing ergonomic innovations. Their implementation promotes improved comfort and quality of work, increases employee safety, and contributes to increased productivity and better organizational outcomes.
Originality/value: The article adds new value to the literature on ergonomic innovations by combining theoretical perspective with empirical analysis of their implementation effects. The obtained results can inspire further research and support practical actions to more effectively implement ergonomic innovations in organizations.
Keywords: ergonomic, ergonomic innovations, types of ergonomic innovations, benefits of implementing ergonomic innovations, barriers of the implementation of ergonomic innovations.
Category of the paper: Research paper.

1. Introduction

Modern organizations operate in a dynamic environment where ergonomic innovations play a crucial role in shaping working conditions, process efficiency, and employee well-being (Hovanec et al., 2024). Ergonomic innovations are used in every sector of the economy (Shorrock, Williams, 2016). On one hand, their search and application are highly risky and unpredictable, but on the other hand, they offer an opportunity for businesses to maintain or even strengthen their market position. The growing interest in ergonomic innovations in organizations stems from the belief in their positive impact on efficiency and quality of work life (Duplakova et al., 2022; Dewicka-Olszewska, 2023). Ergonomic innovations are applied in design processes, diagnostic research, and managerial actions in enterprises (Górska, 2021; Czernecka, 2022). Implementing modern ergonomic solutions, which include both technologies and work organization methods, contributes to increased work comfort, reduced physical and mental strain, and improved overall business productivity (Grossi, 2017; Drăghici et al., 2017; Sosa et al., 2018; Loup-Escande, Loup, 2021). The specificity and innovation of ergonomics lie in synthesizing knowledge from various fields and using methods to assess human needs and expectations to create safe, useful, and comfortable environments, products, and services. This is also a way to improve physical, cognitive, sensory, and emotional experiences (Wilson, Sharples, 2015).

In this article, attention is focused on analyzing the effects resulting from the implementation of ergonomic innovations in organizations. Both the motivations for implementing ergonomic innovations, the types of benefits achieved, and potential challenges or difficulties associated with implementing ergonomic solutions in organizations are presented. Identified research gaps based on a literature review allowed for defining the research goal and problems. The paper presents the results of empirical research on identifying ergonomic innovations implemented in organizations operating in various sectors of the economy.

The article consists of four sections, an introduction, and a conclusion. Section 1 is theoretical and includes a literature review on types of ergonomic innovations in organizations and benefits and barriers to implementing ergonomic innovations. Additionally, this section presents the problem undertaken. The next section of the article is empirical and contains research methodology, research results, and their limitations. Section three includes conclusions and practical recommendations, while section four presents directions for future research. The article provides valuable information for decision-makers shaping work ergonomics policy.

2. Theoretical background

2.1. Types of ergonomic innovations in organizations

Ergonomic innovations refer to novel solutions related to the economy and human interaction with objects. They can be defined as the process of introducing "new solutions" into production and use by combining anthropocentric, social, biotic, and technical elements, leading to changes in the parameters of objects and products in terms of size, quality, modernity, and efficiency (Harris, 2016; Dewicka-Olszewska, 2021). Ergonomic innovations can be treated as the implementation of new solutions within the industrial process and new solutions in the areas of technology, economics, and human interaction with products (Hoff, Öberg, 2014). Ergonomic innovations are new or improved methods, technologies, tools, or workplace designs that, by considering human capabilities and limitations, lead to improved working conditions, employee well-being, and productivity, while minimizing the risk of injuries and health problems (Marková, Lestyáska Škurková, 2023). Therefore, ergonomic innovations in businesses involve adapting technology, technology, and the work environment to human psychophysical capabilities, using anthropocentric, social, biotic, and technical knowledge. Their task is to adapt the parameters of objects or products in terms of safety, quality, modernity, and efficiency (Dewicka-Olszewska, 2023).

The goal of ergonomic innovations is to meet the requirements of local and international communities, which expect formalization, expansion, and adherence to standards for the safety of products and services produced and offered under conditions of high safety and hygiene at work, along with respect for the natural environment (Faludi, 2022).

Based on the analysis of literary sources, the following types of ergonomic innovations can be distinguished:

1. Product (technological) innovations. These involve designing ergonomic tools and devices, using new intelligent materials, integrating intelligent technologies, and incorporating digital solutions into ergonomic products, which improves their functionality and adaptation to user needs (Ferenčiková, 2014; Lawrence, 2021; Spreafico, Sutrisno, 2023; Gempur Santoso, 2023; Dewicka-Olszewska, 2023; Hovanec et al., 2023; Michel, 2023).
2. Process (organizational/non-technological) innovations. These concern optimizing (designing) workstations according to ergonomic principles, implementing ergonomic principles in processes, creating procedures and instructions that consider ergonomic aspects, conducting ergonomics training for employees, and developing systems for monitoring working conditions (Alhadeff et al., 2012; Alexander, Paul, 2014; Claeys et al., 2022; Dewicka-Olszewska, 2023).

3. Marketing innovations. These involve conducting effective promotions of products and services that improve ergonomics. They are crucial for increasing awareness and demand for these products, and informational campaigns can educate consumers about the benefits of ergonomics (Alexander, Paul, 2014; Chodźko, Szymczyk, 2023).
4. Innovations in business models. These involve offering advisory services and personalizing solutions (Wierzbiński, 2017; Dewicka-Olszewska, 2023).

Ergonomic innovations utilize scientific achievements in ergonomics to improve and organize work, as well as methodologies for creating new and correcting existing technical-organizational solutions. Practical examples include innovative solutions in work processes, work organization, work methods, work tools, physical work environment, enhancing work qualifications, and managerial procedures (Górska, 2021; Dewicka-Olszewska, 2023).

It is important that ergonomic innovations facilitate work and reduce the burden on employees. The synergy between technological and non-technological innovations is crucial, for example, introducing advanced work tools should be combined with appropriate training and workstation optimization (Desbarats, 2005; Hovanec et al., 2023; Bortolini et al., 2023; Mehta et al., 2024).

2.2. Benefits and barriers of implementing ergonomic innovations in organizations

The motivations for implementing ergonomic innovations in organizations are various factors of economic, social, and regulatory nature (Alexander, Paul, 2014; Dewicka-Olszewska, 2021; Spreafico, Sutrisno, 2023; Murani, 2024). Implementing ergonomic solutions has significant importance for both the organization and its employees. Research results indicate that the benefits achieved from ergonomics include the following aspects:

1. Increased efficiency and productivity. Ergonomic workstations contribute to increased productivity because employees working in comfortable conditions are more focused and engaged (Kushwaha, Kane, 2016; Hovanec et al., 2023; Mehta et al., 2024).
2. Improved workplace safety, reduced accidents and occupational diseases. The implementation of ergonomic solutions reduces the number of accidents and injuries related to working conditions, contributing to improved employee health and reduced absenteeism (Quiroz-Flores et al., 2023; Amit, 2024; Korkmaz, Unver, 2024).
3. Increased employee well-being. Ergonomic solutions reduce the number of medical leave days and medical care costs (Wilson, Sharples, 2015; Marková, Lestyáska Škurková, 2023).
4. Boosted morale and employee satisfaction. Investing in ergonomic solutions shows employees that the organization cares about their comfort and health, which strengthens their engagement and loyalty to the company (Mazzoni et al., 2019; Heidarimoghadam et al., 2020).

5. Achieving long-term economic benefits. Investments in ergonomics allow for reducing labor costs, such as absenteeism and medical care costs, while improving productivity. Organizations can also gain prestige and attractiveness as employers. Well-designed work environments also contribute to better company performance (Mishra et al., 2021; Duplakova et al., 2022; Hovanec et al., 2023; Quiroz-Flores et al., 2023; Mehta et al., 2024).
6. Improved work quality. Ergonomic workstations reduce errors and improve the quality of tasks performed (Thun et al., 2011; Hasanain, 2024).

Ergonomic innovations also bring intangible business benefits, such as improving the well-being of employees and users (increased motivation), interest in work and tasks, adaptation to work and tolerance of mental stress, and reducing interpersonal conflicts. Additionally, innovative ergonomic solutions include mechanization and automation of work, which improve work posture, better organize work time, and streamline information reception and transmission (Dewicka-Olszewska, 2023).

Despite numerous benefits, many organizations face difficulties in implementing ergonomic innovations. The main barriers include:

1. Lack of management support. Insufficient engagement from management can result in a lack of resources for implementing ergonomic innovations (Yazdani, Wells, 2018; Neves et al., 2023).
2. Limited financial resources. The costs of purchasing new equipment, modifying existing workstations, and training employees often pose a barrier (Karsh et al., 2013; Cyran, 2016).
3. Employee resistance. Lack of awareness of the benefits of ergonomic solutions and fear of change can hinder implementation (Rothmore et al., 2015; Mooren-van der Meer "et al., 2024).
4. Deficiencies in research and development infrastructure. Limited technical facilities can delay the implementation of innovations (Riel, Imada, 2010).
5. Insufficient knowledge of ergonomics. Both employees and managers may not be aware of available solutions and their advantages, resulting in a one-sided, narrow view of developing and implementing ergonomic innovations (Karsh et al., 2013; Yazdani, Welles, 2018).
6. Lack or insufficient training. Inadequate preparation of employees to apply ergonomic practices can hinder the implementation of changes (Karsh et al., 2013; Mooren-van der Meer et al., 2024).
7. Communication problems. Lack of information about implemented ergonomic solutions can lead to misunderstandings and lack of employee engagement (Driessen et al., 2010; Kumar, Kashyap, 2023).
8. Bureaucracy. The process of obtaining funds for implementing ergonomic innovations can be complicated and time-consuming (Koma et al., 2019).

9. Complexity of implementations. They require cooperation between many departments, which can be difficult to achieve (Mooren-van der Meer et al., 2024).
10. Complex legal regulations. Regulations can hinder rapid implementation, and there is also a problem with standardizing the norms used in a specific organization (Glimskär, Lundberg, 2013).
11. Prioritizing other needs. Organizations often focus on production and productivity, marginalizing ergonomics (Mooren-van der Meer et al., 2024).

Ergonomic innovations are an important element of organizational development. They require a holistic approach, considering technical, organizational, marketing, and business aspects. Despite the barriers, investing in ergonomics leads to increased productivity, improved work quality, and gaining a competitive advantage.

2.3. Legal regulations in the field of ergonomics

The modern work environment increasingly appreciates the importance of ergonomics, which plays a crucial role in improving employee safety, health, and productivity. Ergonomic innovations are supported by legal regulations worldwide. In the European Union, for example, directives concerning machinery and work with display screen equipment specify minimum safety and health requirements (Guide to Application…, 2024). In Poland, the Regulation of the Minister of Labor and Social Policy imposes an obligation on employers to ensure ergonomic working conditions, including at workstations with screen monitors (The Journal of Laws of the Republic of Poland 2023, item 2367). At the international level, ISO standards, such as ISO 9241, provide guidelines for ergonomic design of workstations, interfaces, and work systems (*ISO 9241-20:2021*(E)).

The most important, selected initiatives undertaken recently in the EU in the field of occupational safety and health include (EU Strategic Framework…, 2025; Eurofound, 2024a):

- Treaty on the Functioning of the European Union (TFEU) (art.: 91, 114, 115, 151, 153 and 352).
- EU Strategic Framework on Health and Safety at Work 2021-2027.
- Update of Council Regulation (EC) 1994/2062 establishing the European Agency for Safety and Health at Work (EU-OSHA) and its tasks (Regulation (EU) 2019/126 of the European Parliament and of the Council of January 16, 2019).

In 2025, according to information published by EU-OSHA, safety regulations will undergo changes to reflect global trends, including technological innovations (the development of automation, robotics, and intelligent technologies), remote and hybrid work models (Moreno, 2025). It is also worth noting that aspects related to the use of artificial intelligence, particularly during the implementation of ergonomic innovations, lack unified legal regulations despite ongoing efforts. This is due to the complexity of systems (Ziakkas, Henneberry, 2024) and the dynamic development of technology (ERA Industrial..., 2024).

2.4. Context of the problem addressed

Ergonomic innovations, due to their diversity, require conducting extensive research, methodological analyses, and workshops. The need for these arises both before implementing new solutions such as machines, systems, or technologies and in situations where the number of injuries and occupational diseases increases, negatively affecting working conditions (Dewicka-Olszewska, 2023). The results of ergonomic research and analysis allow companies to meet legal requirements, adhere to safety and hygiene standards, and effectively improve employee comfort and health. An analysis of the literature on ergonomic innovations has identified several key research gaps:

1. Insufficient scope of research on evaluating the effectiveness of implementing ergonomic Innovations.
2. Lack of evidence showing the impact of ergonomic innovations on productivity, health, and working conditions.
3. Lack of detailed analyses on the economic aspects of implementing ergonomic innovations.
4. Lack of in-depth research on adapting ergonomics to new technologies.
5. Few studies showcasing the practical use of different methods at the stage of implementing ergonomic innovations.
6. Lack of research integrating different approaches to create a coherent model for implementing ergonomic innovations.
7. Limited scope of research on the impact of ergonomic innovations on safety culture.
8. Concentration of research mainly on standard solutions, overlooking the diversity of needs of different user groups, including people with disabilities.

Identifying these gaps indicates the need for further research in the area of ergonomic innovations, which can contribute to better adapting the work environment to employee needs and increasing organizational efficiency (Kim, 2015). An important aspect that should be studied and compared is the ability to identify types of implemented ergonomic innovations and the effects achieved by organizations after their implementation.

3. Empirical studies

3.1. Methodology

The adopted research methodology is consistent with the approaches presented in the literature and used in management science research (Matejun, 2021). This methodology allows for achieving the set goal, was chosen appropriately for the topic, and includes several stages. The first stage was a review of Polish and foreign literature in four publicly available databases:

EBSCO, Scopus, Web of Science, and Emerald. The analysis covered two main research areas: types of ergonomic innovations and benefits and barriers associated with their implementation. The literature review allowed for identifying research gaps in the area of ergonomic innovations. In the next stage, the research objective was defined (Stańczyk-Hugiet, 2021).

The main objective was to identify current challenges related to the implementation of ergonomic innovations in organizations, determine their types, and identify the benefits and barriers during their implementation. The practical objective of the study was to develop conclusions and recommendations that management staff in organizations can use to more effectively and quickly implement ergonomic innovations that improve employee productivity and safety.

To conduct the research, four research hypotheses were formulated:

H1: The ergonomic innovations implemented in organizations most often focus on improving the workstation and work organization.

H2: The primary goals set by organizations implementing ergonomic innovations are to increase work productivity and improve work safety.

H3: The most commonly achieved benefits of implementing ergonomic innovations in organizations are improved work comfort and improved work quality.

H4: Financial and time constraints on implementing changes are the main barriers to implementing ergonomic innovations in organizations.

In the study, a diagnostic survey method was used, allowing for the collection of information about the phenomenon under investigation, analysis of respondents' views and beliefs, and assessment of their state of knowledge (Dźwigoł, 2015; Czakon, 2021). A questionnaire was used to collect data (Matejun, 2021). The developed questionnaire consisted of a metadata section and detailed questions, serving to conduct quantitative research (Czakon, 2021). The study was conducted from October 2024 to January 2025 using the CAWI method. The research sample was selected purposefully, and the questionnaire was addressed to management and specialists who have knowledge about the ergonomic innovations implemented in their organizations. The questions were closed-ended. The type and size of the organization were not significant – the study included manufacturing, service, and trade organizations operating in Poland. Based on the collected data, an analysis of the results was performed (Baran, 2021), and conclusions were formulated in relation to the research hypotheses (Flick, 2020). The obtained results also enabled the proposal of recommendations for organization managers and the indication of directions for future empirical research in this area (Lenart-Gansiniec, 2021).

3.2. Research results

The overall goal of the empirical research conducted in organizations operating in Poland was to identify the types of ergonomic innovations being implemented and the benefits and barriers encountered during the implementation of ergonomic innovations. The presented results constitute a part of broader research conducted using a questionnaire survey. The study involved 357 organizations. Table 1 contains data on the characteristics of the surveyed organizations.

Among the surveyed organizations, the largest percentage consisted of: organizations with over 20 years of experience in the market (28.3%), employing up to 49 employees (41.5%); having good financial condition (41.7%); providing services (54.1%); conducting sales on the domestic market (33.6%); operating based on domestic capital (40.3%), and functioning in industries such as food (30.7%), IT and telecommunications (13.2%), construction (8.4%), clothing (7.8%), and machinery (6.7%).

Table 1.
Characteristics of the surveyed organizations (% share)

1. Experience on the market			
under 5 years (28.9)	6-10 years (20.7)	11-20 years (22.1)	over 20 years (28.3)
2. Number of employees			
10-49 (41.5)	50-249 (30.8)	250-499 (10.1)	over 500 (17.6)
3. Financial condition			
very good (14.0)	good (41.7)	average (33.6)	weak (10.7)
4. Scope of core activities			
component production (9.5)	manufacturing of products (24.9)	services (54.1)	commerce (23.5)
5. Sales markets			
regional (20.8)	national (33.6)	international (29.7)	global (12.9)
6. Foreign capital share			
0% (40.3)	1-50% (37.8)	51-75% (15.7)	over 75% (6.2)

Source: own study based on research results.

Types of ergonomic innovations implemented in the surveyed organizations

Most respondents considered ergonomic innovations to be the process of introducing new solutions using the collaboration of humanities and technical and organizational sciences to adapt the work environment to the needs and expectations of workers, thereby improving their safety and hygiene at work, which increases their productivity and enhances organizational efficiency. Respondents were asked to indicate the areas where ergonomic innovations were implemented over the past three years in their organizations. Figure 1 shows the share of the most frequently mentioned types of ergonomic innovations implemented in the surveyed organizations.

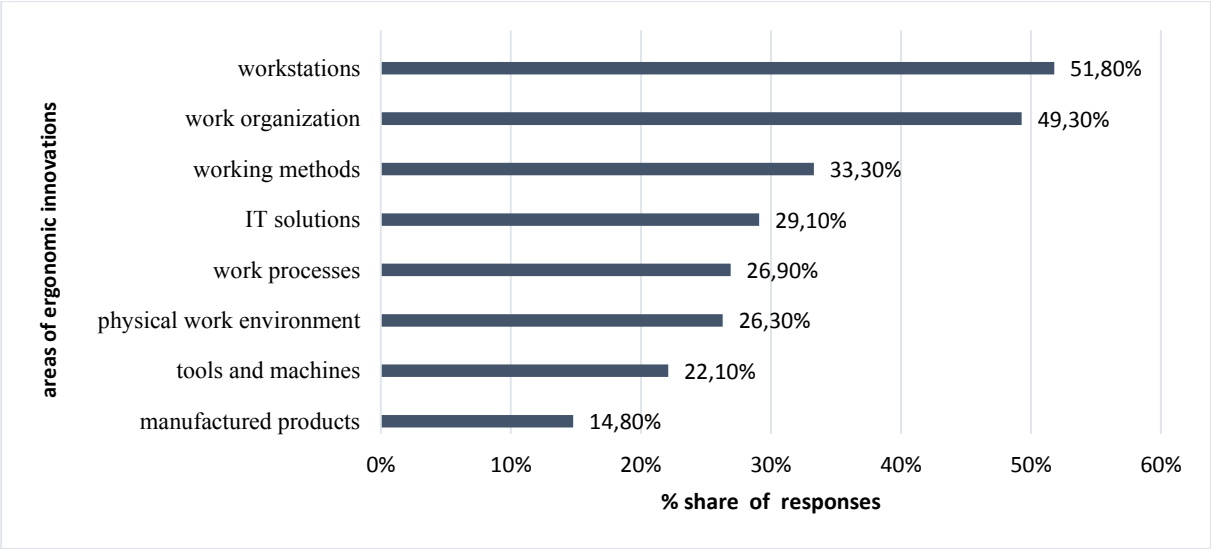

Figure 1. Share of the most frequently mentioned types of ergonomic innovations implemented in the surveyed organizations.

Source: Own elaboration based on survey research results.

The greatest emphasis in the surveyed organizations is placed on implementing ergonomic innovations at workstations (51.80%) and work organization (49.30%), as well as work methods (33.30%), which may result from their direct impact on improving employee comfort and productivity. The surveyed organizations most often invest in improving working conditions by changing the organization of processes and adapting workstations to meet employee needs. In contrast, less attention in the surveyed organizations was devoted to implementing ergonomic innovations in manufactured products (14.8%) and tools and machines used (22.1%), suggesting that innovations in these areas may be less of a priority or more difficult to implement.

Objectives and benefits of implementing ergonomic innovations

In the next question, respondents were asked to assess the objectives impacted by the ergonomic innovations implemented in their organizations. They were able to use a scale from 1 to 5 (1 - completely insignificant impact; 2 - slightly significant impact; 3 - average impact; 4 - significant impact; 5 - extremely significant impact). Among several proposed objectives (5 out of 11), respondents indicated that the ergonomic innovations implemented in their organizations had the greatest impact on: increasing productivity (3.96), achieving better results from business activities (3.92), improving workplace safety (3.86), better meeting consumer needs (3.57), adapting to legal standards (3.54), and enhancing the company's image (3.51).

In the following question, respondents were asked to evaluate the benefits that ergonomic innovations brought to their organizations over the past three years. Table 2 presents the results of responses provided by respondents from the surveyed organizations.

Table 2.
Types of benefits achieved in surveyed organizations

Benefits	1	2	3	4	5	Average
work efficiency	37	19	88	149	74	3.66
product/service quality	19	31	128	128	62	3.61
quality of work	24	22	80	169	74	3.79
frequency of accidents at work	19	30	151	112	59	3.57
severity of work accidents	25	21	155	101	68	3.57
number of workplace accidents	21	28	150	100	70	3.58
potentially accidental events	21	31	134	19	59	2.40
sickness absence	22	29	175	99	38	3.34
labor costs	22	45	135	124	38	3.37
employee turnover	25	44	146	112	36	3.30
direct supervision	24	44	154	101	39	3.29
costs of repairs of machines and equipment	24	49	145	109	39	3.33
caring for equipment and tools	25	27	142	128	43	3.45
work comfortable	19	27	66	168	86	3.85
employee satisfaction level	22	27	81	162	73	3.73
customer satisfaction level	21	27	121	125	71	3.62
organizational image	16	25	100	145	77	3.73
work safety	18	23	117	142	65	3.66
self-control	26	25	146	125	40	3.40

Scale used: 1 - significant deterioration; 2 - deterioration; 3 - almost the same benefits; 4 - improvement; 5 - significant improvement.

Source: Own elaboration based on survey research results.

From the data in Table 2, it appears that the surveyed organizations achieved the greatest benefits in terms of improving work comfort (3.85), improving work quality (3.79), and increasing employee satisfaction (3.73), suggesting that ergonomic actions focus primarily on improving employment conditions. The implemented innovations also had a positive impact on enhancing the organization's image (3.73) and improving safety, which is reflected in the reduction of accidents and improvement in the overall safety level within organizations. Economic and organizational benefits, such as a decrease in absenteeism, labor costs, or employee turnover, are visible but not as strongly noticeable, which may indicate that their effects are more long-term. However, the least noticeable benefit concerns the elimination of potentially hazardous situations (2.40), which may suggest that organizations focus on specific accidents rather than preventive actions reducing risks.

Barriers to implementing of ergonomic innovations

In the next question, respondents were asked to select the 5 most important barriers from 10 proposed options that hinder the implementation of ergonomic innovations in their organizations. Figure 2 shows the percentage share of the most significant obstacles indicated by the respondents.

Figure 2. Largest share of barriers to implementing ergonomic innovations.

Source: Own elaboration based on survey research results.

From the data presented in Figure 2, it appears that respondents considered the following as key barriers to implementing ergonomic innovations in the surveyed organizations: (1) limited financial resources (65.00%); (2) lack of time to implement changes (39.20%); (3) insufficient employee education (32.80%); (4) short-term thinking (32.50%); (5) spatial and organizational constraints (30.50%); (6) costly technological solutions (30.00%); (7) lack of tools and resources (29.40%) supporting ergonomic innovations; (8) lack of management support and engagement (27.20%); (9) employee resistance to change (25.50%).

Identifying these potential barriers allows for continuous monitoring and management of the risk associated with implementing ergonomic innovations, which can prevent unforeseen problems.

3.3. Research limitations

This study encounters limitations associated with the quantitative research paradigm. The study was limited to a selected period (time frame), which did not allow for determining the dynamics of changes in implementing ergonomic innovations and achieving effects by the surveyed organizations. Empirical research conducted using a questionnaire survey has certain limitations, including:

1. Subjectivity of responses. Respondents evaluated the effects of implemented innovations based on their own assessments, which may lead to distortion of the results.
2. Limited knowledge of respondents. Specialists and management of the surveyed organizations may not have had full knowledge about the effects of ergonomic innovations, which could affect the quality of the collected data.
3. Small scale of empirical research. This may have influenced the representativeness of the results and limited the possibilities for generalization.

4. Lack of in-depth understanding. There was no possibility of gaining a deep understanding of the causes and mechanisms behind the effects of ergonomic innovations over time.
5. Potential misinterpretation of questions: Respondents may have misinterpreted questions, leading to incorrect answers and incorrect conclusions.
6. Providing only cross-sectional data. The study provides data at a specific point in time, while the effects of ergonomic innovations may only become apparent after a longer period.

Future research should be conducted on a larger sample and should be more contextually diverse (in different countries, in different sectors), which can contribute to a deeper analysis of the problem. Additionally, conducting research in different countries will allow for comparisons, drawing conclusions, and increasing the possibilities for generalization. Using mixed research methods, which combine quantitative survey data with qualitative interviews or case studies, may allow for a better understanding of the impact of various ergonomic innovations on organizational outcomes.

4. Conclusions and recommendations

Organizations implement ergonomic innovations to improve working conditions, increase work productivity, and reduce the risk of injuries (Gašová et al., 2017). These innovations include actions aimed at humanizing the living and working environment to make it user-friendly for the psycho-physical needs of users, providing them with numerous benefits (Butlewski et al., 2015). The ergonomic innovations implemented in the surveyed organizations relate to technical solutions (adapting workstations and methods to meet employee needs) and organizational solutions (aimed at improving quality of life and safety at work).

The analyzed results from the conducted research unequivocally confirm the four adopted hypotheses:

- Ergonomic innovations in the surveyed organizations most often focus on improving workstations (51.80%) and work organization (49.30%) (H1).
- The primary goals set by the surveyed organizations implementing ergonomic innovations are to increase work productivity (3.96) and improve work safety (3.86) (H2).
- The most commonly achieved benefits of implementing ergonomic innovations in organizations are improved work comfort (3.85) and improved work quality (3.79) (H3).
- The main barriers to implementing ergonomic innovations in organizations are financial constraints (65%) and time constraints (39.2%) for implementing changes (H4).

Contemporary ergonomic innovations also encompass forms of work, including the use of remote work (Kamala et al., 2024), the utilization of digitalization, and automation based on artificial intelligence (Marková, Lestyáska Škurková, 2023). To optimize human-machine-environment interaction, it is crucial to leverage the synergy between technological progress and workplace ergonomic needs, particularly digitalization (Laudante, 2017) and artificial intelligence (Prijanka, Subashini, 2024). Digitalization can improve work ergonomics in production facilities, minimizing risks and increasing efficiency (Duplakova et al., 2022), although it can also lead to "digital Taylorism," limiting autonomy and increasing employee control (Lager et al., 2021), as well as increasing cognitive load and deepening dependence on modern technology, which may contribute to problems in case of failures or lack of access to this technology (Mehta et al., 2024; Milea, Cioca, 2024).

From the analysis of literature and empirical research, it appears that to meet challenges and effectively implement ergonomic innovations in organizations, several best practices should be employed. Below are the most important ones:

1. Increasing management engagement. Enhancing the involvement of management staff (Dewicka-Olszewska, 2023).
2. Employee participation. Encouraging employee involvement in creating and implementing pro-ergonomic projects (Cervai, Polo, 2018; Rostami et al., 2021; Czernecka, 2022; Zhang, Lin, 2023).
3. Expanding work on implementing ergonomic innovations in products and tools. Increasing efforts to implement ergonomic innovations in manufactured products and tools used (Bortolini et al., 2023; Proia et al., 2025).
4. Introducing flexible workspaces and ergonomics training. Providing flexible workspaces, offering ergonomics training for employees, and promoting a safety culture (Quiroz-Flores et al., 2023; Korkmaz, Unver, 2024).
5. Universal design. Incorporating diverse user needs into design (Tosi, Pistolesi, 2018; Vujica Herzog et al., 2019; Mehta et al., 2024).
6. Designing workstations with lean manufacturing and ergonomics principles. Integrating lean manufacturing and ergonomics principles in workstation design (Herwanto, Suziant, 2023).
7. Better recognition of organizational capabilities. Often, there are differences between designed and implemented solutions (Jacobo-Galicia et al., 2021; Motamedimoghadam et al., 2024).
8. Leveraging advanced technologies. Used of automatization, Robotic Process Automation (Ziemianin, 2023), AI (Marková, Lestyáska Škurková, 2023; Bortolini et al., 2023; Hovanec et al., 2024), digitalization (Duplakova et al., 2022).
9. Developing and applying diverse criteria for evaluating ergonomic innovation effects. establishing varied criteria for assessing the effects of ergonomic innovation implementation (Gualtieri et al., 2020; Dewicka-Olszewska, 2023).

10. Integrating ergonomic innovations with other processes. Integrating ergonomic innovations with other organizational processes (Moreira da Silva, 2015; Hovanec et al., 2023).
11. Limiting the impact of existing financial and time barriers. Obtaining different funding sources for implementing ergonomic innovations (Dewicka-Olszewska, 2023) e.g., EU funds (Horizon Europe), application of prioritization strategies for ergonomic projects, phased implementation of ergonomic innovations, division of complex innovative projects into subprojects, cooperation with specialized institutions, involving employees in the process of designing and implementing ergonomic innovations (Zhang, Lin, 2023), use of remote work (Kamala et al., 2024), partnership with technology suppliers (Hoque et al., 2022).

Understanding and effectively managing these challenges is crucial for companies to ensure workplace efficiency and employee well-being across different cultures and locations. New technologies have opened up new opportunities for managing ergonomic challenges, offering innovative, efficient, and consistent solutions. They help companies provide a safe and comfortable work environment for all employees, regardless of their geographical location.

5. Directions for future research

In the future, research on ergonomic innovations in organizations should focus on several key areas to effectively address the changing needs of employees and workplace challenges. Below are the main areas that deserve detailed investigation:

1. Technology and intelligent solutions. The increasing use of technologies such as implementing artificial intelligence (AI), smart workwear, and wearable robotics requires research on their impact on employee health and productivity. Studies should include the effectiveness of these solutions in reducing injuries and improving work comfort (Colim et al., 2020; Alpala et al., 2022; Leśniewicz, 2024; Proia et al., 2025).
2. Personalization of workstations. Understanding how the diversity of employee needs affects the design of ergonomic workstations. Research should focus on developing solutions tailored to individual requirements, which can increase comfort and efficiency (Mayer et al., 2021; Priyanka, Subashini, 2024; Eurofound, 2024b; Firescu, 2025).
3. Ergonomics in remote work context: The growing popularity of remote work poses new ergonomic challenges. Research should address the design of ergonomic home workspaces and the impact of such solutions on employees' mental and physical health (Alsafran, 2024).

4. Impact of work environment on mental health. Investigating the relationship between ergonomics and employees' mental health. Research may focus on the impact of ergonomic solutions, such as lighting or acoustics, on well-being and productivity (Dewicka-Olszewska, 2023).
5. Economic aspects of ergonomic innovations. Analyzing the economic benefits resulting from the implementation of ergonomic innovations, including savings from fewer injuries and increased productivity. Research should also evaluate the long-term effects of investing in ergonomics for organizations (Gupta, 2024).
6. Sustainable development and ergonomics. Researching how sustainable development principles can be integrated with ergonomic innovations to create more environmentally friendly workplaces. This approach may include using eco-friendly materials and designing spaces that promote energy efficiency (Hasanain, 2024).
7. Utilizing diverse methods for analyzing and evaluating implemented ergonomic innovations. Using various methods to analyze and evaluate ergonomic innovations in different organizations (Magally, Wilfredo, 2022; Czernecka, 2022).

These research directions can contribute to further analysis and study of various areas where ergonomic innovations will be developed and implemented in organizations, improving working conditions, health, and well-being of employees, as well as enhancing organizational productivity and efficiency.

6. Summary

The purpose of this study was to identify the types of ergonomic innovations implemented in organizations and the benefits and barriers encountered during their implementation. It was conducted based on an analysis of the results of survey research carried out among 357 organizations. The empirical data indicate that various types of ergonomic innovations are implemented in the surveyed organizations, particularly in the areas of workstations and work organization. The ergonomic innovations introduced in organizations primarily contribute to increasing work productivity, achieving better results from business activities, and improving workplace safety and hygiene. In terms of benefits achieved, respondents most often pointed to improved work comfort and quality. Financial and time constraints were identified as the most significant barriers to implementing innovations.

Identified research gaps and empirical research enabled the identification of directions for further research and the provision of recommendations in key areas related to implementing ergonomic innovations, allowing organizations to achieve better outcomes (Carayon, 2019; Dul, Neumann, 2020). Cultures promoting openness, continuous learning, and employee engagement are better prepared for the effective development and implementation of ergonomic

innovations, which is also confirmed by research conducted in European countries (Eurofound, 2024a). For Poland and other countries, a priority should be to address barriers that hinder innovation and create conditions that stimulate the introduction of ergonomic innovations in enterprises (Growth and competitiveness …, 2025). Meanwhile, for businesses, priority should be given to actions that potentially stimulate the implementation of innovative ergonomic solutions in various areas, including workstation design, work organization, tool design and selection, creation of the physical work environment, enhancement of work qualifications, creation of managerial procedures, and design of manufactured products or services provided (Laudante, 2017). Ergonomic innovations should be one of the key elements of ESG (Environmental, Social, Governance) strategies. Research in this area allows companies to improve working conditions, which is an important aspect of sustainable development.

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