SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2026
ORGANIZATION AND MANAGEMENT SERIES NO. 252

THE IMPACT OF ERGONOMIC ACTIVITIES ON SHAPING SAFETY CULTURE IN MANUFACTURING COMPANIES

Wiktoria CZERNECKA

Poznan University of Technology, Faculty of Engineering Management; wiktoria.czernecka@put.poznan.pl, ORCID: 0000-0003-2060-4488

Purpose: The aim of this article is to examine the perception of taking actions in the field of ergonomics in Polish manufacturing companies in the context of the perceived level of safety culture in the organization.
Design/methodology/approach: As part of this article, research was conducted among 106 employees of Polish occupational health and safety services, who assessed statements regarding the implementation of ergonomics in various aspects of activities aimed at shaping a higher level of safety culture.
Findings: Based on the data obtained in the study, the level of ergonomic activities undertaken in companies was determined in relation to the assessed level of safety culture. Conclusions were drawn about the existence of strong and very strong correlations between the statements assessed by respondents and the assessed level of activities undertaken to shape the safety culture. The research results allowed for conclusions on the shaping of safety culture through ergonomics and appropriate activities in this area, as well as for the development of recommendations regarding their implementation in the company's everyday functioning.
Research limitations/implications: The limitation in the conducted study results from the inability to identify the number of occupational health and safety specialists working in Poland, hence the selection of the research sample was purposeful. Another limitation is that safety culture was considered only from the point of view of occupational health and safety specialists and not all employees of the surveyed organizations.
Practical implications: The research results and practical recommendations presented in the article can be used to implement ergonomic activities in enterprises to obtain additional benefits, e.g., shaping a higher level of safety culture.
Originality/value: The article presents the problem of linking ergonomic activities with the development of safety culture, which allowed for filling the identified, significant research gap in this area.
Keywords: safety culture, ergonomics in OHS, social responsibility.
Category of the paper: Research paper.

1. Introduction

Achieving a high level of safety culture acceptable to the company is currently the goal of most enterprises, especially those that take into account the importance of sustainable organizational development and corporate social responsibility. Ensuring safe working conditions therefore becomes a long-term goal, the achievement of which depends, among others, on ensuring the well-being of employees and the feeling that the organization is making every effort to minimize threats to their health and life (Wijesinghe et al., 2023). One can notice a developing trend of looking at occupational safety not only from the point of view of eliminating physical threats, but also from the point of view of shaping optimal conditions from a psychological point of view (e.g. by implementing the assumptions of the ISO 45003 standard) (Chirico et al., 2023). Taking these aspects into account, there is a potential for combining these areas of shaping safety in taking actions to increase the level of safety culture (Van Nunen et al., 2018). On the other hand, however, Schulman (2020) points out that when shaping a safety culture, companies should also take into account aspects that influence it contextually, e.g. organizational structure or multi-threaded inter-employee relations at various organizational levels. One of the elements that unites broadly understood safety and building employee unity in this area may be ergonomics due to its potential to optimize the human workload in work processes and build employee awareness (and thus motivate to participate in ensuring safety) (Butlewski, Czernecka, 2024; Bisbey et al., 2021). Kaleth, Salesi and Mokarami (2022) point to the relationship between the motivation to conduct work safely and take appropriate actions to respond to threats (also in terms of shaping ergonomics) and Tappura, Jääskeläinen and Pirhonen (2022) emphasize the importance of employee and management involvement in increasing the safety culture level. An attempt to integrate all these characteristics is presenting the concept of Safety Ergonomics (SE), which analyzes the factors of work organization, work environment and technical aspects (machines) that influence humans at work. It notes the importance of safety culture, while pointing to a research gap in the field of practical guidance on how to manage ergonomics in order to increase the level of safety culture (Dong, Wang, 2023).

2. Literature review - safety culture in the context of ergonomic activities

Safety culture (perceived as an element of organizational culture) is the result of individual and group values, perceptions, attitudes, competences and behavioral patterns. It is also related to the style and quality of safety management in the organization. A (high) safety culture is characterized by the perception of high value of safety, communication based on mutual trust

and trust in the adequacy and effectiveness of preventive measures (Deepak, Gangadhar, 2023; Glendon, Stanton, 2000). Safety culture may be characterized by a systemic approach (by taking into account human, organizational and material factors in the process of achieving and maintaining the desired level of safety culture). On the other hand, however, in some cases it is perceived as a phenomenon achieved by the appropriate behavior of organization members or a return to the perceived state of safety after its loss, e.g. after an accident, inappropriate behavior or a gap in security systems (Fig. 1).

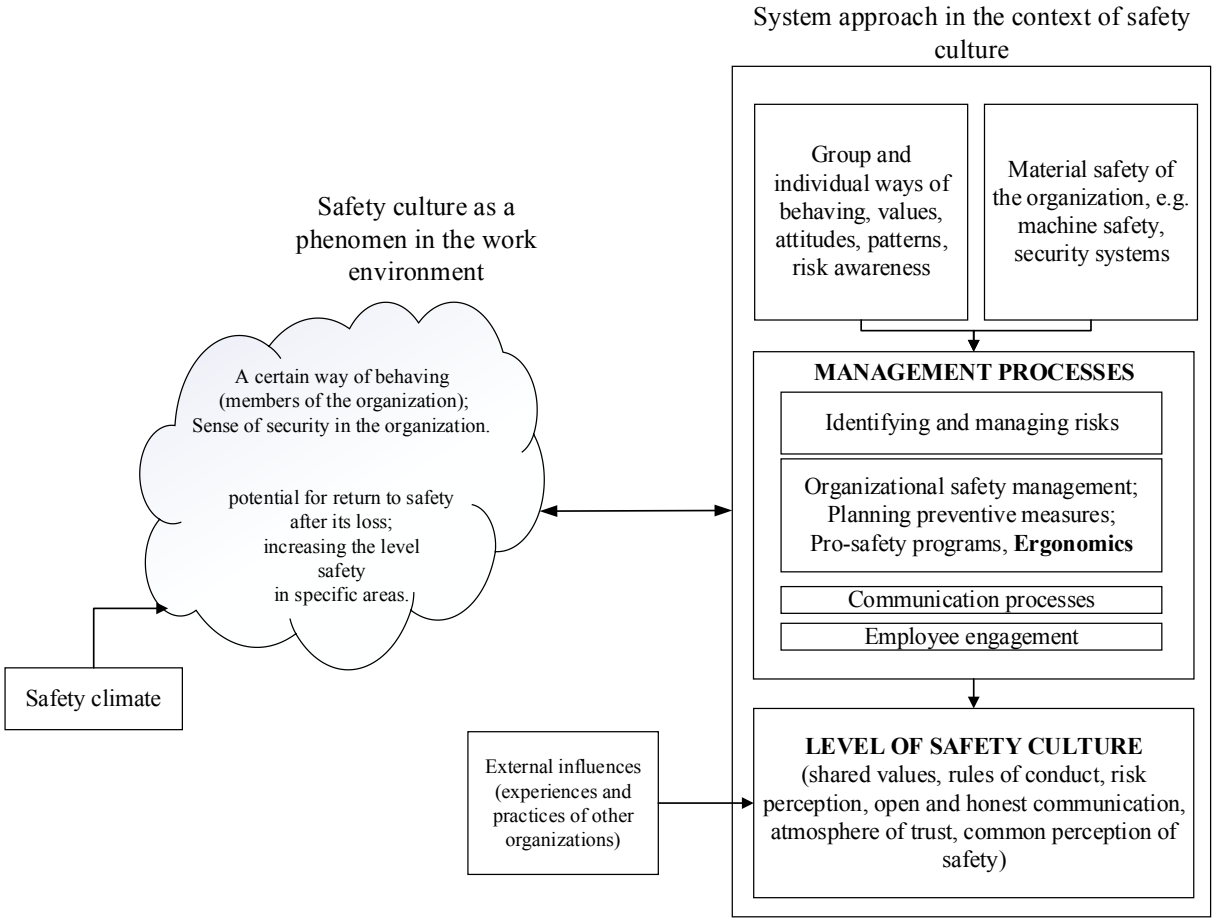

Figure 1. A multi-criteria look at the dimensions of safety culture in an organization.
Source: own elaboration based on: Wolniak, Olkiewicz, 2019; Amirah et al., 2024.

Undoubtedly, one of the factors that should be taken into account in safety management is ergonomics. When considering ergonomic activities, they should be looked at more broadly than just through the prism of shaping the workplace. It is important to take into account the interaction in the human-machine-environment system (Dul, Neumann, 2009). In addition to achieving the optimal functioning of this system, the scope of ergonomic implementation also includes shaping employees' attitudes (e.g. in the context of requiring specific behavior during work), increasing their risk awareness, as well as issues related to ensuring broadly understood safety (Zink, 2014; Robertson et al., 2015). More and more often, additional benefits are noticed from the implementation of ergonomic activities, which include shaping a (high) level of safety culture (Bentley, Tappin, 2010; Gabryelewicz et al., 2015). Hasanain (2024) even points out

that ergonomic design of work, products, interpersonal interactions and services may become the basis for the company to achieve the desired level of safety culture and sustainable development, which is also confirmed in other scientific studies and reports (IAEA, 2024).

Measuring safety culture is used to examine the level of safety in an enterprise and to determine the direction of changes in this area. Mainly qualitative features are assessed (also in the aspect of ergonomics - work organization and work environment factors), which are difficult to determine due to the lack of their clear identification and description. Research most often uses direct and indirect observations, interviews, questionnaires and surveys (which are quick to conduct and allow for learning the opinions of the main recipients of pro-safety activities), whose respondents are employees of a given enterprise. Table 1 presents selected tools for measuring safety culture.

Table 1.
Examples of tools for measuring safety culture, taking into account the context of ergonomics

no.	Method of safety culture assessment	Scope of taking into account ergonomics in the safety culture research tool
1.	Score Your Safety Culture Checklist	Assessment of safety culture using 20 statements relating to, among others: compliance with legal regulations in the field of safety, awareness of threats, financial outlays related to safety. Referring to taking actions to prevent employee injuries and auditing workplaces in terms of safety and ergonomics (Score Your Safety Culture, 2024).
2.	Hearts&Minds, Understanding Your Culture online survey	Multiple checklists used to assess the level of safety culture in the organization - it is possible to assess many aspects with the participation of a large number of respondents. Possibility to assess threats to employees also in terms of material (ergonomic) factors of the work environment (Understanding Your Culture, 2024).
3.	Safety Climate Assessment Toolkit and User Guide	A tool consisting of possible questions aimed at assessing the safety climate in an enterprise. It is assessed in the following categories: commitment of top management, communication, safety prioritization, safety procedures and rules, support for safety-related activities, employee involvement, self-awareness of the importance of safety, risk awareness, work environment (where ergonomic aspects of work are taken into account) (Safety Climate Measurement, 2024).
4.	Safety Health of Maintenance Engineering (SHoMe) Tool	Safety culture assessment tool consisting of three surveys. Creates opportunities to assess safety in the aviation industry, respondents are maintenance workers (industry measurement tool). It allows to take into account organizational factors in relation to safety (including ergonomic ones) (SHoMe Tool, 2024).
5.	Nordic Occupational Safety Climate Questionnaire (NOSACQ-50)	A tool for examining the safety climate, consisting of 50 questions. Initiated in the Nordic countries, but availability in 23 languages makes it possible to assess the level of safety climate also in enterprises from other countries. Ergonomics is included in the section on prioritizing safety (NOSACQ-50, 2024).

Source: own elaboration.

Measuring the level of safety culture can provide companies with a basis for taking actions to increase its level. However, even without a structured approach to this measurement, it is possible to implement such activities (e.g. in the area of ergonomics), based on e.g. data obtained from employees or identified current safety problems.

3. Materials and method of research

In order to complement the identified research area and gap, surveys were carried out among employees of occupational health and safety services performing professional duties in Polish manufacturing enterprises. The study consisted of assessing ergonomic activities undertaken in the company in terms of shaping the safety culture through their implementation. The study involved employees of occupational health and safety services (in the positions of: technician, specialist, inspector, coordinator, occupational health and safety manager) operating in manufacturing enterprises of various sizes (due to employment status - up to 10 employees, 10-49 employees, 50-249 employees, over 249 employees). The criterion of work experience in the occupational health and safety service was not adopted, but in the survey the employees taking part in the study indicated their work experience in full years. The respondents were selected deliberately (one employee represented one company). 106 correctly completed surveys were obtained, the return rate was 26.7%. In the first part of the study, respondents assessed statements regarding activities undertaken in the organization in the context of safety culture. The following rating scale was adopted: 1. I disagree; 2. I tend to disagree; 3. I have no opinion; 4. I tend to agree; 5. I agree (Ponto, 2015). The assessed statements are presented in Table 2.

Table 2.
Statements assessed in the survey research

no.	Statement
1	Ergonomics is an important factor in shaping the safety culture in the company where I work.
2	We monitor and strive to continuously improve employee satisfaction with working conditions in terms of ergonomics.
3	We establish and monitor the implementation of ergonomic goals in projects implemented in the company.
4	We have developed and adhere to an ergonomic policy in the company.
5	We familiarize all employees with the ergonomic goals adopted in the company.
6	We provide employees with the opportunity to report ergonomic problems to the unit designated for this purpose.
7	We encourage employees to report ergonomic problems by providing them with reliable information about this possibility.
8	We provide communication channels for ergonomic problems that are easily accessible to employees (e.g. a dedicated system or e-mail).
9	We solve problems reported by employees on an ongoing basis through ergonomic implementations.
10	We periodically audit workplaces for ergonomics.
11	We propose solutions to ergonomic problems noticed in periodic reviews of workstations, indicating the date of implementation and the person responsible.
12	We classify workplaces according to ergonomic risk determined by selected assessment methods in order to plan corrective actions.
13	The hierarchy of changes undertaken at workplaces results from the value of ergonomic risk.
14	We engage employees in the issues of ergonomics and occupational safety, e.g. by participating in ergonomic analyses.
15	We provide employees with the opportunity to participate in ergonomic analyzes (e.g. by designating time for it in their work schedule).
16	We inform all employees about the results of ergonomic activities.

Cont. table 2.

17	We implement the principles of training employees in the use of new ergonomic solutions and follow them.
18	The company's management provides support for activities aimed at improving the safety and ergonomics of workplaces (including organizational and financial).
19	We include ergonomics in the occupational health and safety instructions available to employees.
20	We include the topic of ergonomics in periodic occupational health and safety training for employees and during meetings with superiors.
21	We organize additional training for employees (apart from periodic occupational health and safety) on ergonomics at work stations.
22	We organize information campaigns on occupational safety and ergonomics of workplaces.
23	We take into account the issues of ergonomics in the analysis of the causes of accidents at work and dangerous incidents.
24	We take ergonomic problems into account when assessing occupational risk.
25	In the company, we promote cooperation between all employees of the company in order to ensure safe and ergonomic working conditions, e.g. through dedicated meetings and discussions on proposed solutions.
26	There is a friendly atmosphere in the company and there is openness to employees' ideas regarding improving the safety and ergonomics of work stations.

Source: own elaboration.

In the subsequent parts of the research sheet, respondents were asked questions about various aspects related to the perceived safety culture and work in a given organization. Five questions were asked: (1) How do you evaluate the actions taken to shape the safety culture in the company where you work? (2) How do you assess the management's involvement in occupational health and safety in the company where you work? (3) How do you assess the level of occupational health and safety management in the company where you work? (4) Please indicate the size of the company you work for. (5) How many years of experience do you have working in the occupational health and safety field (total experience in all companies in full years)?

The research sheet was supplemented with the adopted definition of safety culture, indicating its dimensions in the following aspects: employee awareness of the importance of shaping safe working conditions, the vision and goals of the company regarding the development of safety, the value assigned to safety in the organization, the importance of employee participation in activities aimed at shaping safety, training and education in the development of safe working conditions, analysis of the causes of accidents at work and unsafe behavior of employees.

4. Results

The study involved 4 employees of small companies (employing less than 10 people), 15 employees of companies employing from 10 to 49 people, 41 employees of companies employing up to 50 to 249 people and 46 employees of companies employing more than 250 people. The respondents' work experience is presented in Table 3.

Table 3.
The respondents' work experience in OHS department

Seniority (years)	Less then 1	1	2	3	4	5	6	7	8	9	10	More than 10
No. of respondents	9	17	9	16	12	11	7	7	3	1	5	9

Source: own elaboration.

With regard to questions related to the assessment of the level of occupational health and safety management and activities aimed at shaping a safety culture, the results are presented in Figures 2 and 3.

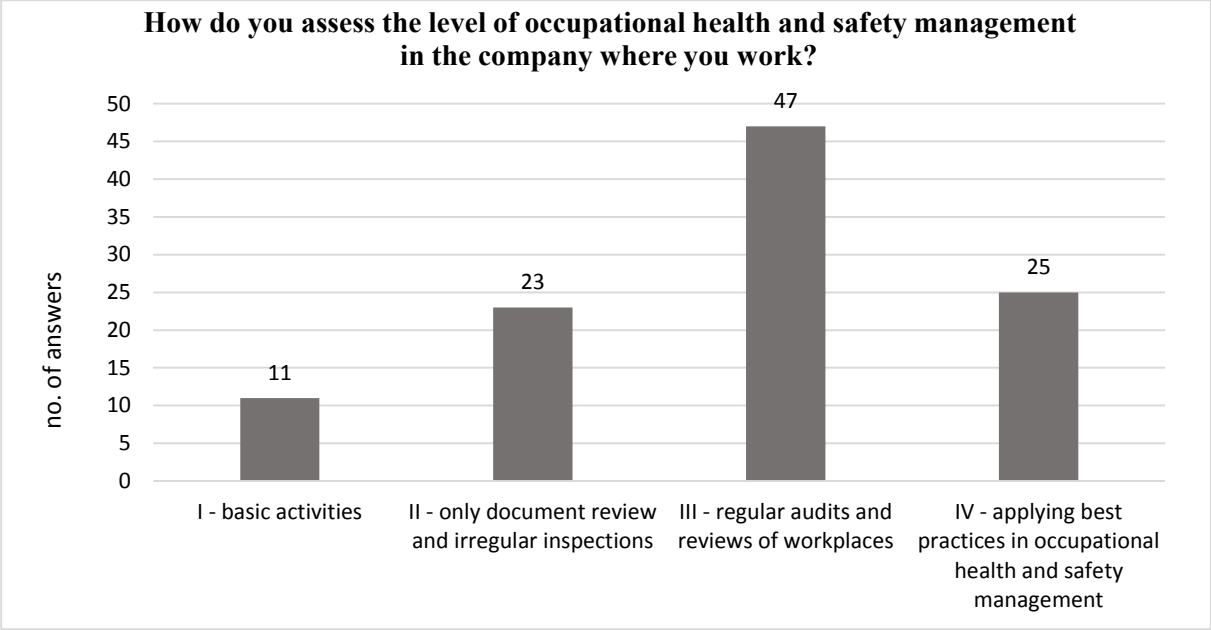

Figure 2. Respondents' assessment of the level of occupational health and safety management in the organization.

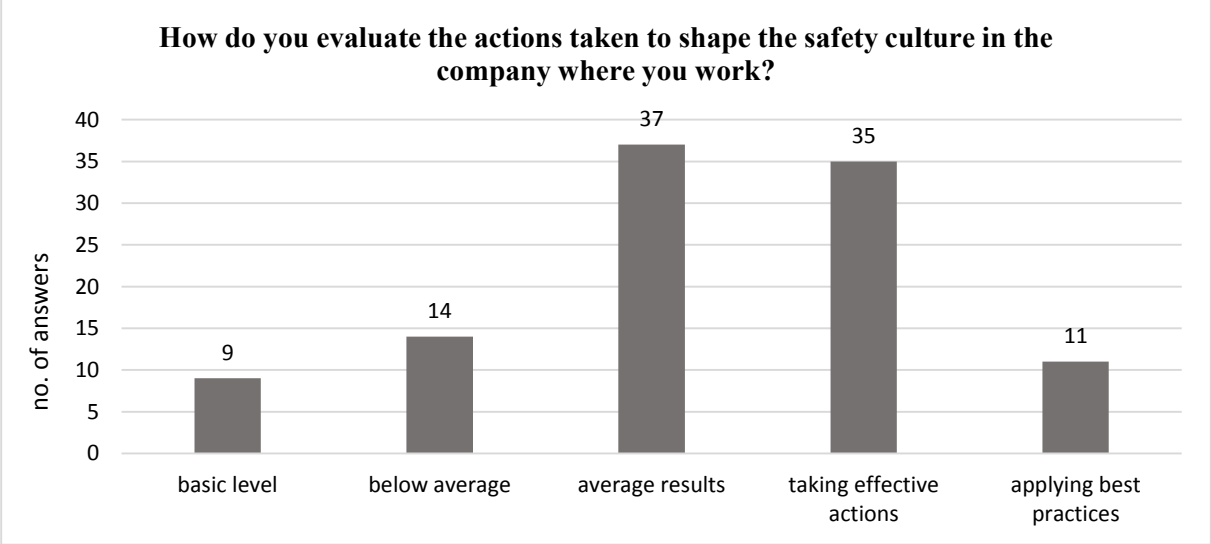

Figure 3. Respondents' assessment of the actions taken to shape safety culture within organization.

As part of the analysis of the data obtained in the survey, descriptive statistics were presented (mean, minimum and maximum value, SD) regarding each statement assessed by the respondents (Table 4).

Table 4.
Descriptive statistics of the carried out surveys and compared data

no. of statement	Mean	Min	Max	SD
1	3,81	1	5	0,98
2	3,76	1	5	1,08
3	3,46	1	5	1,15
4	3,18	1	5	1,21
5	3,50	1	5	1,18
6	3,93	1	5	1,14
7	3,65	1	5	1,18
8	3,58	1	5	1,29
9	3,64	1	5	1,07
10	3,42	1	5	1,19
11	3,41	1	5	1,05
12	3,24	1	5	1,23
13	3,08	1	5	1,17
14	3,49	1	5	1,14
15	3,06	1	5	1,20
16	2,98	1	5	1,27
17	3,54	1	5	1,11
18	3,70	1	5	1,08
19	3,78	1	5	1,18
20	3,87	1	5	1,19
21	2,63	1	5	1,26
22	3,37	1	5	1,31
23	3,70	1	5	1,09
24	4,00	1	5	1,07
25	3,55	1	5	1,07
26	3,78	1	5	1,01

Source: own elaboration.

Due to the purpose of undertaking the research (including examining the correlation between taking actions in the field of ergonomics and the perceived level of safety culture) the data was analyzed using Spearman's rank correlation coefficient (Spearman's rho) to check for the relationships between variables. The section below devoted to the discussion of the obtained research results focuses mainly on the analysis of the correlations that are most important according to the author.

5. Discussion and conclusions

The first statement assessed by the respondents was the importance of ergonomics in shaping the safety culture in the company. Analyzing the obtained research results, it is possible to notice a strong correlation between recognizing this statement and taking specific actions in this area (monitoring and striving to improve employee satisfaction with ergonomic conditions, setting ergonomic goals in projects implemented in the company, developing an ergonomic policy, familiarizing employees with the adopted ergonomic goals, encouraging employees to report ergonomic problems at workplaces, periodic audits of workplaces, proposing ergonomic solutions based on periodic audits of workplaces and taking ergonomic problems into account in the analysis of occupational risk). It can therefore be concluded that the above-mentioned activities will, according to the results obtained, be the most important from the point of view of shaping a safety culture through ergonomics.

An interesting conclusion is also the observation of the connection between setting and monitoring ergonomic goals in projects undertaken in the company and: familiarizing employees with these goals (emphasizing the importance of informing and participating employees in activities aimed at ergonomics), current solving ergonomic problems, auditing workstations, proposing ergonomic solutions based on audit results, classification of workplaces based on the results of ergonomic analyzes and the hierarchy of taking actions based on this classification, involving employees in ergonomic analyses, organizing ergonomics training for employees and organizing inform**ation campaigns on ergonomics.**

In the case of auditing workplaces, the key finding is the connection between this activity and solving ergonomic problems on this basis, in accordance with the classification of workplaces in relation to the ergonomic risk involved. It is also important to involve workplace employees in audits and provide them with the opportunity to take part in ergonomic analyzes (by providing adequate time for this purpose) and to conduct training in the use of new ergonomic solutions. There is also a strong correlation between auditing workplaces and organizing information campaigns on ergonomics (their results are often presented in this way) and using the conclusions from their conduct in the analysis of accidents at work and **occupational risk assessment.**

An important conclusion from the analysis of the research results is also the observation of the relationship between involving employees in ergonomic analyzes with: providing them with time to participate in analyses, informing employees about the results of analyses, organizing information campaigns on ergonomics and promoting cooperation of all employees in ensuring ergonomics and safety (which seems to be justified). In relation to providing employees with the opportunity to participate in ergonomic analyses, strong correlations are noted with the implementation of principles of training employees in the use of new ergonomic solutions and promoting cooperation in the field of ergonomics.

It should also be noted how important is management's involvement in health and safety issues. Respondents linked their involvement with following statements: ergonomics as an important factor in shaping the safety culture, monitoring and striving to improve employee satisfaction with ergonomic conditions and a friendly atmosphere in the organization. It can therefore be concluded that this factor will be important from the point of view not only of the implementation of ergonomic activities, but also of supervising their implementation and meeting the assumed goals, as well as building relationships in the organization based on the cooperation of all employees and openness to their ideas.

There is also a strong correlation between the overall assessment of the level of activities undertaken to shape the safety culture and the commitment of management and the level of occupational health and safety management that the company represents. Management involvement correlates strongly with the level of occupational health and safety management in the organization. An interesting conclusion that can be drawn from the presented correlation analysis is a slight connection between the perception of activities undertaken to shape safety culture through ergonomics and the size of the enterprise and the respondents' work experience. This may indicate that the great importance of ergonomics in an enterprise depends on internal policy and awareness in this area and is noticed by occupational health and safety employees regardless of the time spent in the organization.

General guidelines for actions that can be taken in a manufacturing companies to help shaping the level of safety culture based on the analysis of the obtained research results are presented in Fig. 4.

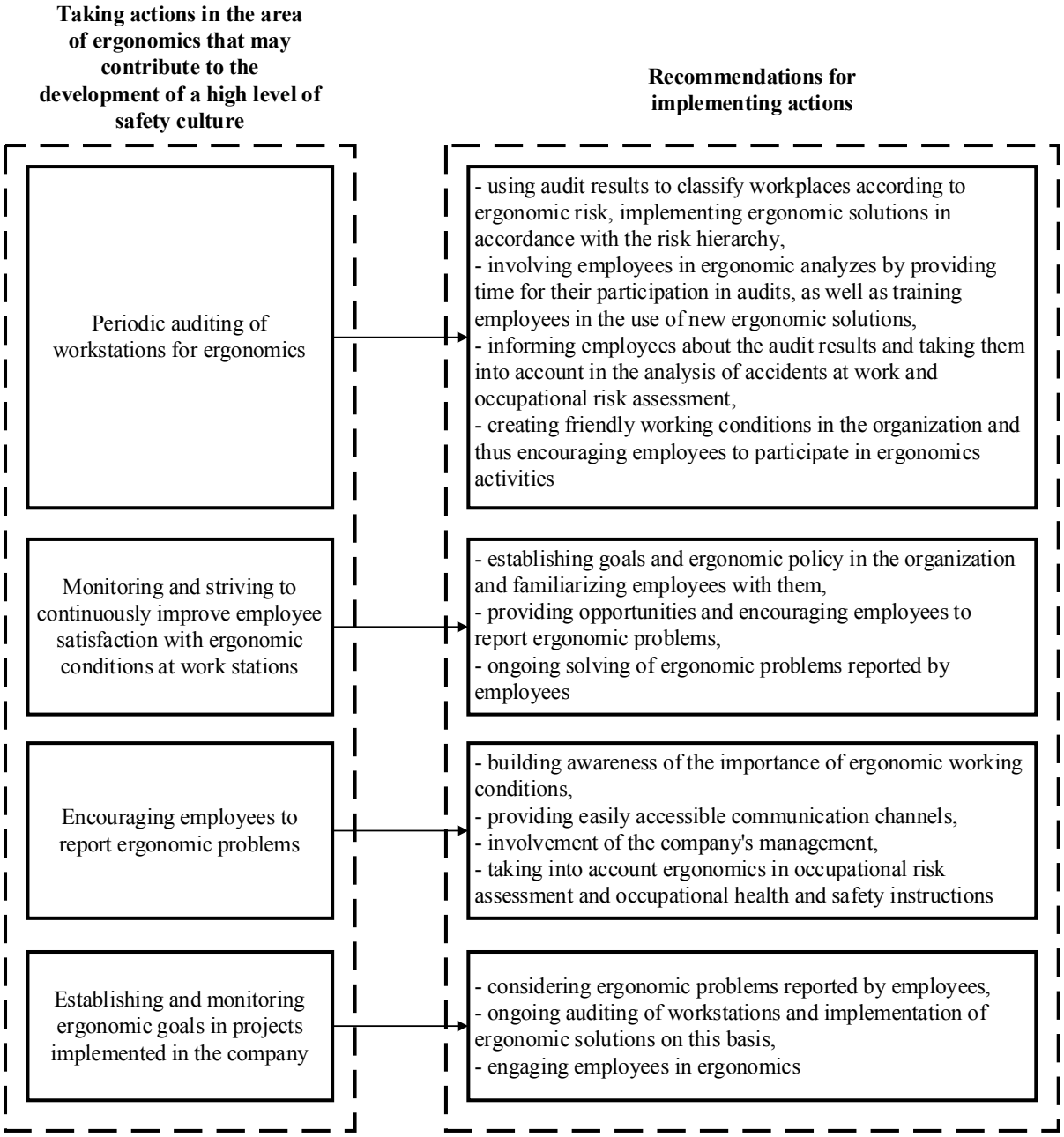

Figure 4. Activities shaping the safety culture in a production company through ergonomics.

Summarizing the research undertaken and the results obtained, it can be concluded that ergonomics can be an important factor supporting the development of a safety culture in an organization. Even if a company does not see the need to formally assess its level using the selected measurement method, it can implement activities that will support its improvement (both in operational terms and taking it into account in long-term planning). However, it can be pointed out that a limitation of the conducted research is that it examined the perception of safety culture only from the perspective of occupational health and safety specialists, not all employees within the organization. This may be the next step in the development of this research.

Funding

This work was supported by Poznan University of Technology, Faculty of Engineering Management, project 0811/SBAD/1101.

References

1. Amirah, N.A., Nik Him, N.F., Rashid, A., Rasheed, R., Zaliha, T.N., Afthanorhan, A. (2024). Fostering a safety culture in manufacturing through safety behavior: A structural equation modelling approach. *Journal of Safety and Sustainability*. DOI: https://doi.org/10.1016/j.jsasus.2024.03.001
2. Bentley, T., Tappin, D. (2010). Incorporating organisational safety culture within ergonomics practice. *Ergonomics*, *53(10),* pp. 1167-1174. DOI: 10.1080/00140139.2010.512981
3. Bisbey, T.M., Kilcullen, M.P., Thomas, E.J., Ottosen, M.J., Tsao, K., Salas, E. (2021). Safety Culture: An Integration of Existing Models and a Framework for Understanding Its Development. *Human Factors*, *63(1),* pp. 88-110. DOI: 10.1177/0018720819868878
4. Butlewski, M., Czernecka, W. (2024). Social Sustainability in Practice: Bridging the Gap from Declarations to Real-World Scenarios on Sustainability Driven by Ergonomics. *Sustainability*, *16(14),* 6019.
5. Chirico, F., Giorgi, G., Magnavita, N. (2023). Addressing all the psychosocial risk factors in the workplace requires a comprehensive and interdisciplinary strategy and specific tools. *Journal of Health and Social Sciences*, *8(3),* pp. 170-174. DOI: 10.19204/2023/DDRS1
6. Deepak, M.D., Gangadhar, M. (2023). Demystifying the Recent Trends and Advances in Safety Culture Research: A Systematic Review. In: Li, R.Y.M. (ed.), *Construction Safety: Economics and Informatics Perspectives*. Singapore: Springer. DOI: https://doi.org/10.1007/978-981-19-3234-2_9
7. Dong, L., Wang, J. (2023). Intelligent Safety Ergonomics: A Cleaner Research Direction for Ergonomics in the Era of Big Data. *International Journal of Environmental Research and Public Health*, *19*, 813. DOI: https://doi.org/10.3390/ijerph19020813
8. Dul, J., Neumann, W.P. (2009). Ergonomics contributions to company strategies. *Applied Ergonomics*, *40(4),* pp. 745-752. DOI: https://doi.org/10.1016/j.apergo.2008.07.002
9. Gabryelewicz, I., Krupa, P., Sadłowska-Wrzesińska, J. (2015). IT Tool for Aiding Assessment of Safety Culture Level in an Organization. *Applied Mechanics and Materials*, *795*, pp. 77-83. DOI: https://doi.org/10.4028/www.scientific.net/AMM.795.77

10. Glendon, A., Stanton, N. (2000). Perspectives on safety culture. *Safety Science*, *34*, pp. 193-214. DOI: 10.1016/S0925-7535(00)00013-8
11. Hasanain, B. (2024). The Role of Ergonomic and Human Factors in Sustainable Manufacturing: A Review. *Machines*, *12(3),* 159. DOI: https://doi.org/10.3390/machines12030159
12. Kalteh, H.O., Salesi, M., Mokarami, H. (2022). The mediator role of safety motivation and knowledge between safety culture and safety performance: The results of a sociotechnical and macroergonomics approach. *Work*, *72(2),* pp. 707-717. DOI: 10.3233/WOR-205085
13. Podgórski, D. (2000). Systemowe zarządzanie bezpieczeństwem i higieną pracy – normalizacja i promocja. *Bezpieczeństwo Pracy*, *12*, pp. 1-5 [in Polish].
14. Ponto, J. (2015). Understanding and Evaluating Survey Research. *Journal of the Advanced Practitioner in Oncology*, *6(2),* pp. 168-171.
15. Robertson, M.M., Ciriello, V.M., Garabet, A.M. (2015). Office ergonomics training and a sit-stand workstation: Effects on musculoskeletal and visual symptoms and performance of office workers. *Applied Ergonomics*, *36(5),* pp. 511-519. DOI: https://doi.org/10.1016/j.apergo.2014.12.008
16. *Safety Climate Measurement User Guide and Toolkit.* Available at: http://plataforma.responsable.net/sites/default/files/safety-climate-assessment-toolkit_1.pdf, 17.07.2024.
17. *Safety Climate Questionnaire – NOSACQ-50.* Available at: https://nfa.dk/vaerktoejer/spoergeskemaer/safety-climate-questionnaire-nosacq-50/, 17.07.2024.
18. *Safety Culture in Nuclear Installations. Guidance for Use in the Enhancement of Safety Culture*. Available at: https://www-pub.iaea.org/MTCD/Publications/PDF/te_1329_web.pdf, 17.07.2024.
19. *Safety Health of Aviation Maintenance Engineering (SHoMe) Tool: User Guide*. Available at: https://www.caa.co.uk/publication/download/12622, 17.07.2024.
20. Schulman, P.R. (2020). Organizational structure and safety culture: Conceptual and practical challenges. *Safety Science*, *126*, 104669. DOI: https://doi.org/10.1016/j.ssci.2020.104669
21. *Score Your Safety Culture – TP 13844*. Available at: https://tc.canada.ca/en/aviation/publications/score-your-safety-culture-tp-13844, 16.07.2024.
22. Tappura, S., Jääskeläinen, A., Pirhonen, J. (2022). Creation of satisfactory safety culture by developing its key dimensions. *Safety Science*, *154*, 105849. DOI: https://doi.org/10.1016/j.ssci.2022.105849.
23. *Understanding Your Culture Online Survey*. Available at: https://heartsandminds.energyinst.org/toolkit/UYC-online, 16.07.2024.
24. Van Nunen, K., Li, J., Reniers, G., Ponnet, K. (2018). Bibliometric analysis of safety culture research. *Safety Science*, *108*, pp. 248-258. DOI: https://doi.org/10.1016/j.ssci.2017.08.011

25. Wijesinghe, D., Jayakumar, V., Gunarathne, N., Samudrage, D. (2023). Implementing health and safety strategies for business sustainability: The use of management control systems. *Safety Science*, *164*, 106183. DOI: https://doi.org/10.1016/j.ssci.2023.106183
26. Wolniak, R., Olkiewicz, M. (2019). The relations between safety culture and quality culture. *System Safety: Human – Technical Facility – Environment*, *1(1),* pp. 10-17. DOI: 10.2478/czoto-2019-0002
27. Zink, K.J. (2014). Designing sustainable work systems: The need for a systems approach. *Applied Ergonomics*, *45(1),* pp. 126-132. DOI: https://doi.org/10.1016/j.apergo. 2013.01.003