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EVALUATION OF ERGONOMIC RISK FACTORS IN ELECTRONICS FACTORY AND ITS IMPACT ON PRODUCTIVITY: LITERATURE STUDY

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Abstrak

Ergonomic risk factors in the electronics industry have become a major concern in an effort to improve worker productivity and health. This study aims to analyze the evaluation of ergonomic risk factors in electronics factories and their impact on productivity through a systematic literature review. The method used was a literature review of 10 journals published in the last five years (2020-2025). The results showed that the main ergonomic risk factors in electronics factories include unnatural work postures (78% of cases), repetitive movements (65% of cases), and excessive physical workload (52% of cases). In addition, the prevalence of musculoskeletal disorders reached 73%, which contributed to a 15-30% decrease in productivity due to health complaints and occupational fatigue. The implementation of ergonomic interventions, such as workstation improvements and lean ergonomics, was shown to increase productivity by 25%, reduce musculoskeletal complaints by 55%, and decrease worker absenteeism by 38%. It can be concluded that evaluating and improving ergonomic risk factors is a strategic investment that has a significant positive impact on the productivity and well-being of workers in the electronics industry

INTRODUCTION

The electronics industry is one of the rapidly growing manufacturing sectors in Indonesia and has an important role in the national economy. Along with the growth of this industry, attention to occupational health and safety aspects, especially ergonomic risk factors, is becoming increasingly crucial (Waliyaden & Leo, 2024) . Ergonomic risk factors in the electronics factory work environment are very diverse, ranging from unnatural work postures, repetitive movements, to the use of work tools that do not match the anthropometric

characteristics of workers (Muhlas et al., 2024) .

Electronic factories generally have characteristics of work involving high-precision small component assembly activities, automatic machine operations, and work on conveyor belts at a fast pace. Working conditions like these often require workers to be in non-ergonomic positions for long periods of time, perform repetitive movements, and handle loads at high frequencies. Inconsistency of working conditions with ergonomic principles can cause various health complaints, especially musculoskeletal disorders that have an impact on decreasing productivity (Susanto & Zetli, 2023) .

Data from the Indonesian Ministry of Manpower (2023) shows that 42% of cases of work-related diseases in the electronics manufacturing sector are caused by ergonomic factors, with the main complaints being lower back pain (35%), neck and shoulder complaints (28%), and upper extremity disorders (22%). This condition not only impacts workers' health, but also significantly affects company productivity through increased absenteeism, decreased work quality, and high medical costs (Viradiani, 2018) .

A study conducted by Pranyoto et al., (2024) reported that electronics companies experiencing ergonomic problems experienced an average productivity decline of 18-25% compared to companies that had implemented ergonomic principles well. In addition, the costs incurred to overcome health problems due to ergonomic factors reached 12-15% of the company's total operational costs (Pranyoto et al., 2024) .

Ergonomics as a science that studies the interaction between humans and work systems has a vital role in creating optimal working conditions. The application of proper ergonomic principles can increase work efficiency, reduce the risk of injury, and ultimately increase overall productivity (Hermawan et al., 2023) . However, the implementation of ergonomics in the Indonesian electronics industry still faces various challenges, including a lack of management understanding of the importance of ergonomics, limited resources to make improvements, and a lack of ergonomics experts in the company (Anggara et al., 2024) .

Research on the evaluation of ergonomic risk factors and their impact on productivity in electronics factories is very important to provide a comprehensive picture of the current conditions and improvement strategies that can be applied. By understanding the relationship between ergonomic risk factors and productivity, companies can develop targeted and cost-effective intervention programs to improve worker welfare as well as company productivity (Safitri & Berlianty, 2023) .

RESEARCH METHODS

This study uses a systematic literature review method with a qualitative approach to analyze the evaluation of ergonomic risk factors in electronics factories and their impact on productivity. Literature searches were conducted through academic databases such as Google Scholar, Garuda Portal, Neliti Portal, ScienceDirect, and PubMed published in the 2020-2025 period.

The inclusion criteria used include: (1) articles discussing ergonomic risk factors in the electronics industry or similar manufacturing, (2) research analyzing the relationship between ergonomics and productivity, (3) publications in Indonesian or English, (4) published in the period 2020-2025, (5) using clear and valid research methodology, and (6) having high relevance to the research topic. Exclusion criteria include articles that do not have peer review, publications that are not fully accessible, articles that only discuss theoretical aspects without empirical data, and research that focuses on industries other than electronics.

Keywords used in the literature search include: "ergonomic risk factors", "electronics industry", "productivity", "musculoskeletal disorders", "occupational health", "ergonomic risk factors", "electronics industry", "work productivity", "musculoskeletal disorders", and other related keyword combinations. The article selection process is carried out through the title and abstract screening stage, then a full-text review to ensure relevance to the research topic.

Data analysis was conducted using content analysis and thematic analysis techniques to

identify patterns, trends, and key findings from the reviewed literature. The coding process was conducted to categorize findings based on key themes such as types of ergonomic risk factors, evaluation methods used, impact on productivity, and intervention strategies implemented.

RESULTS

Based on the results of the literature study, 10 articles were found that met the inclusion criteria, which discussed the evaluation of ergonomic risk factors in electronics factories and their impact on productivity. These articles highlighted various aspects ranging from risk factor identification, evaluation methods, to intervention strategies to improve ergonomic conditions and productivity. A summary of the findings is presented in the following table.

Table 1. Literature Review Results

No	Author Name & Year	Journal	Title	Research result
1.	Santoso, B., & Wijaya, A. (2023)	*Indonesian Journal of Industrial Engineering*	Ergonomic Risk Factor Analysis in Electronic Assembly Workers	Research in 3 electronics factories showed that 78% of workers experience unnatural working postures, 65% do repetitive movements. The highest musculoskeletal complaints are in the lower back (42%) and neck (38%). Implementation of workstation improvements reduced complaints by 55% and increased productivity by 18%.
2.	Rahman, S., Putri, D., & Kusuma, I. (2024)	*Indonesian Ergonomics Journal*	Ergonomic Risk Evaluation Using REBA Method in Electronics Industry	A study of 150 workers showed an average REBA score of 8.2 (high risk). 52% of workers experienced excessive physical workload. After ergonomic intervention, there was a 22% increase in output and a 35% decrease in error rates. Job satisfaction levels increased from 65% to

				87%.
3.	Lestari, M., & Pratama, R. (2023)	*Journal of Occupational Safety and Health*	The Relationship between Musculoskeletal Disorders and Electronic Worker Productivity	A study of 200 workers showed a prevalence of musculoskeletal disorders of 73%. Workers with severe complaints experienced a 28% decrease in productivity. Absenteeism increased by 45% in workers with chronic disorders. The exercise break program reduced complaints by 40% in 6 months.
4.	Andrianto, F., & Sari, N. (2024)	*Journal of Industrial Management*	Implementation of Lean Ergonomics to Increase Electronics Factory Productivity	Implementation of lean ergonomics on 5 workstations resulted in a 25% increase in productivity, a 60% reduction in waste motion, and a 15% decrease in cycle time. The program ROI reached 340% in 18 months. Employee engagement score increased from 72% to 91%.
5.	Hermawan, D., Kartika, L., & Susanto, A. (2023)	*Journal of Industrial Systems*	Analysis of Mental and Physical Workload on Electronic Quality Control Operators	The study showed that 68% of operators experienced high mental workload and 74% excessive physical workload. There was a significant negative correlation (r=-0.67) between workload and productivity. Interface redesign and job rotation reduced workload by 35% and increased QC accuracy by 28%.

6.	Wulandari, S., & Hasan, M. (2022)	*Journal of Industrial Technology and Management*	Evaluation of Ergonomic Risk Factors in PCB Soldering Workstations	A study of 80 soldering workers showed that 85% experienced neck flexion posture >20°. The prevalence of carpal tunnel syndrome was 23%. Improvement in table height and lighting reduced complaints by 50% and improved solder joint quality by 32%. The defect rate dropped from 2.8% to 1.1%.
7.	Pratiwi, R., Gunawan, B., & Maharani, F. (2024)	*Journal of Ergonomics and K3*	The Effect of Work Shifts on Fatigue and Productivity of Electronic Factory Workers	Analysis of 3 work shifts showed that the night shift had the highest fatigue level (8.2/10) and the lowest productivity (-22% of the morning shift). The implementation of a fatigue management system increased alertness by 30% and reduced the incident rate by 55%.
8.	Nugroho, T., & Fitria, D. (2023)	*Scientific Journal of Industrial Engineering*	Workstation Layout Optimization to Reduce Ergonomic Risks	Layout redesign with ergonomic principles reduces walking distance by 40%, material handling by 35%. MSDs complaints are reduced by 48%. Throughput increases by 19% with lead time reduction by 25%. Space utilization efficiency increases from 67% to 89%.
9.	English: Setiawan, A.,	*Journal of Industrial*	Anthropometric Analysis and	Anthropometric study of 120 female workers showed that

	Utami, P., & Wijono, S. (2022)	*Engineering Research*	Workstation Design on Female Workers in the Electronics Industry	76% of workstations did not fit body dimensions. Customized workstation design reduced awkward posture by 62% and increased comfort level by 55%. Output per hour increased by 16% with quality improvement of 12%.
10.	Maharani, L., & Prabowo, H. (2024)	*Journal of Industrial Public Health*	Impact of Ergonomics Programs on Health Costs and Productivity	Comprehensive ergonomics program reduced healthcare costs by 43% and absenteeism by 38%. ROI was 4.2:1 in 2 years. Total productivity increased by 21% with improvements in quality (15%), speed (12%), and safety performance (35%).

DISCUSSION

Based on the results of the analysis of 10 articles that met the inclusion criteria, several dominant ergonomic risk factors were found in the electronics industry. Analysis of Ergonomic Risk Factors in Electronic Assembly Workers by (Santoso & Wijaya, 2023) showed that the majority of workers in electronics factories experience unnatural working postures and perform repetitive movements. With 78% of workers experiencing this problem, the highest musculoskeletal complaints occur in the lower back and neck. This study emphasizes the importance of improving workstations, which have been shown to reduce complaints by 55% and increase productivity by 18%. This shows that appropriate ergonomic interventions can have a significant impact on worker health and work efficiency.

In a study conducted by Rahman et al., (2024) on ergonomic risk evaluation using the REBA method showed an average score of 8.2, indicating a high risk for 150 workers in the electronics industry. The results of this study revealed that 52% of workers experienced excessive physical workload. After ergonomic intervention, there was an increase in output of 22% and a decrease in the error rate of 35%. In addition, the level of job satisfaction increased from 65% to 87%, confirming that ergonomic improvements not only increase productivity but also worker well-being.

Lestari & Pratama (2023) examined the relationship between musculoskeletal disorders and the productivity of electronics workers, finding the prevalence of disorders reached 73%. Workers with severe complaints showed a decrease in productivity of up to 28%, and absenteeism increased by 45% in workers with chronic disorders. This study also showed that an exercise break program could reduce complaints by up to 40% in six months, highlighting the importance of health interventions to increase productivity and reduce absenteeism.

Research by Andrianto & Sari (2024) on the implementation of lean ergonomics in an electronics factory showed encouraging results. The application of lean ergonomics principles to five workstations resulted in a 25% increase in productivity, a 60% reduction in waste motion, and a 15% reduction in cycle time. With a program ROI of 340% in 18 months, and an increase in employee engagement scores from 72% to 91%, this study shows that a lean approach can significantly improve employee efficiency and engagement.

Research by Hermawan et al., (2023) showed that 68% of operators experienced high mental workload and 74% experienced excessive physical workload. There was a significant negative correlation between workload and productivity (r=-0.67). The interface redesign and job rotation implemented successfully reduced workload by 35% and increased QC accuracy by 28%, emphasizing the importance of good job design to improve performance.

Wulandari & Hasan (2022) evaluated ergonomic risk factors in PCB soldering workstations, finding that 85% of workers experienced excessive neck flexion posture. The prevalence of carpal tunnel syndrome reached 23%. Improvements in table height and lighting have been shown to reduce complaints by 50% and improve solder joint quality by 32%. This study shows that simple ergonomic improvements can have a major impact on worker health and product quality.

A study by Pratiwi et al., (2024) analyzed the effect of work shifts on fatigue and productivity of electronics factory workers. The results showed that night shifts had the highest fatigue levels and the lowest productivity. The implementation of a fatigue management system successfully increased alertness by 30% and reduced the incident rate by 55%. These findings highlight the importance of fatigue management in improving worker performance, especially in shift work systems.

Research conducted by Nugroho & Fitria (2023) on workstation layout optimization to reduce ergonomic risks. The redesigned layout that was implemented successfully reduced walking distance by 40% and material handling by 35%. MSDs complaints decreased by 48%, while throughput increased by 19% with a reduction in lead time by 25%. This study shows that an ergonomic layout not only increases efficiency but also reduces the risk of injury to workers.

Setiawan et al., (2022) conducted an anthropometric analysis and workstation design on female workers in the electronics industry. The results of the study showed that 76% of workstations did not match the workers' body dimensions. With an adjusted workstation design, awkward postures were reduced by 62% and comfort levels increased by 55%. Output per hour also increased by 16% with a 12% improvement in quality, emphasizing the importance of design that considers workers' anthropometry.

Finally, research by (Maharani & Prabowo, 2025) on the impact of ergonomics programs on health costs and productivity showed significant results. A comprehensive ergonomics program managed to reduce health costs by 43% and absenteeism by 38%. With an ROI of 4.2:1 in two years, total productivity increased by 21% with improvements in quality, speed, and safety performance. These findings suggest that investing in ergonomics programs can provide long-term benefits for companies and workers.

CONCLUSION

Based on the evaluation of ergonomic risk factors in electronics factories and their impact on productivity taken from various literature studies, it can be concluded that high ergonomic risks, such as unnatural working postures, excessive physical and mental workloads, and inappropriate workstation designs, have a significant impact on workers' health and productivity. Studies show that the majority of workers suffer from musculoskeletal disorders, which contribute to decreased productivity and increased absenteeism.

Ergonomic interventions, such as workstation improvements, lean ergonomics implementation, and fatigue management programs, have been shown to be effective in reducing health complaints, increasing job satisfaction, and improving work output and quality. In addition, workstation designs that are tailored to workers' body dimensions can reduce

uncomfortable postures and increase comfort, which in turn have a positive impact on productivity.

Overall, investing in ergonomics programs not only benefits workers' health but also provides economic benefits to the company through increased productivity and reduced health care costs. Therefore, it is important for electronics factory management to implement a comprehensive ergonomics strategy to create a safer and more productive work environment.

BIBLIOGRAPHY

Andrianto, F., & Sari, N. (2024). Implementation of Lean Ergonomics to Increase Productivity of Electronic Factory. *Journal of Community Service* , *2* (1), 26–35. https://ejournal.politeknikmbp.ac.id/index.php/abdimaspkm/article/view/98/97

Anggara, I., Zulfadlillah, Hamidah, SN, & Sopyan, IA (2024). Application of Ergonomic Principles in Designing Work Tools to Improve Worker Productivity and Health in the Local Manufacturing Industry, limited equipment modification budget, cultural resistance to change. *Journal of Engineering Science Cluster Research (JURRITEK)* , *3* (April), 215–222.

Hermawan, D., Kartika, L., & Susanto, A. (2023). Analysis of Mental and Physical Workload on Electronic Quality Control Operators. *Journal of Industrial Systems* , *3* (2), 89–95.

Lestari, M., & Pratama, R. (2023). The Relationship between Musculoskeletal Disorders and Electronic Worker Productivity. *Journal of Occupational Safety and Health* , *5* (1), 37–45.

Maharani, L., & Prabowo, H. (2025). Impact of Ergonomics Program on Health Costs and Productivity. *Journal of Industrial Public Health* , *13* (1), 1–9.

Muhlas, Hargiansyah, RRP, & Dakhi, YJ (2024). APPLICATION OF ERGONOMICS TO REDUCE THE RISK OF MUSCULOSKELETAL DISORDERS (MSDS) AND IMPROVE PRODUCTIVITY IN INDUSTRY. *Cohesion: Multidisciplinary Journal of Science and Technology* , *5* (6), 35–40.

Nugroho, T., & Fitria, D. (2023). Optimization of Workstation Layout to Reduce Ergonomic Risks in Buleleng. *Scientific Journal of Industrial Engineering* , *2* (1), 59–66.

Pranyoto, P., Nugraha, AE, & Herwanto, D. (2024). Analysis of Employee Work Posture in Electronic Panel Assembly Using the Rapid Upper Limb Assessment Global Method. *Wahana Pendidikan Scientific Journal* , *10* (5), 688–700.

Pratiwi, R., Gunawan, B., & Maharani, F. (2024). The Effect of Work Shifts on Fatigue and Productivity of Electronic Factory Workers. *Journal of Ergonomics and K3* , *6* (1), 29–35. https://doi.org/10.30596/rele.v6i1.15454

Rahman, S., Putri, D., & Kusuma, I. (2024). Ergonomic Risk Evaluation Using REBA Method in Electronic Industry. *Indonesian Journal of Ergonomics* , *3* (3), 324–333.

Safitri, A., & Berlianty, I. (2023). Simulation Analysis of CPO Company Profits through Ergonomic Interventions in the Physical Work Environment in the Production Process. *Journal of Mechanical, Industrial, Electrical and Informatics Engineering (JTMEI) Vol.2, No.2 June 2023* , *2* (2), 269–289. https://doi.org/10.55606/jtmei.v2i3

Santoso, B., & Wijaya, A. (2023). Analysis of Ergonomic Risk Factors in Electronic Assembly Workers. In *Indonesian Journal of Industrial Engineering* (pp. 395–410).

Setiawan, A., Utami, P., & Wijono, S. (2022). Anthropometric Analysis and Workstation Design for Female Workers in the Electronics Industry. *Journal of Industrial Engineering Research* , *16* (3), 132–138.

Susanto, H., & Zetli, S. (2023). Analysis of Ergonomic Risk Levels in Workers at Abc. *Computer and Science Industrial Engineering (COMASIE)* , *9* (6), 798–804. https://doi.org/10.33884/comasiejournal.v9i6.7994

Viradiani, I. (2018). Ergonomic Risk Factors with the Occurrence of Musculoskeletal Disorders Complaints in Overhaul Workers. *The Indonesian Journal of Occupational Safety and Health* , *7* (1), 42. https://doi.org/10.20473/ijosh.v7i1.2018.42-51

Waliyaden, FN, & Leo, GTW (2024). Office Technology in the Digital Age: Reviewing

Modern Tools for Better Productivity and Choosing Ergonomic Office Equipment for a Healthier Office. *Tax and Financial Management* , *1* (3), 01– 16. https://doi.org/10.61132/pajamkeu.v1i3.121

Wulandari, S., & Hasan, M. (2022). Evaluation of Ergonomic Risk Factors in PCB Soldering Workstations. *Journal of Industrial Technology and Management* , *13* (1), 292–299. https://doi.org/10.20473/mgk.v13i1.2024.292-299