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Chapter

Introductory Chapter: Contemporary Topics in Ergonomics

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1. Introduction

The human body is physically and physiologically limited. Also, human brain has boundaries. Therefore, the human is capable of implementing certain abilities, both physically and intellectually. In order to minimize the limitations of the human and maximize its efficiency in the system it exists, its interactions with the elements of the system should be investigated and understood carefully.

Ergonomics is a multidisciplinary science that optimizes human well-being and overall system performance by using theory, principles, data, and methods.

The term ergonomics refers to the science of work and is derived from the Greek *ergon* (work) and *nomos* (laws). Ergonomics is also known as “human factors,” and both terms can be used together or interchangeably [1].

Ergonomics is therefore regarded as a science and a profession at the same time. It is the study of how humans interact with other system components. It also seeks to maximize human well-being and system performance through the application of facts, principles, theories, and methods to design concepts.

The study of “physical, cognitive, sociotechnical, organizational, environmental, and other important elements, as well as the complex interactions between humans and other humans, the environment, tools, goods, equipment, and technology” is known as ergonomics [1]. Thus, it can be subdivided further into physical, cognitive, and organizational ergonomics to assess their individual and combined effects on people working within a given system.

In summary, physical ergonomics deals with the human physical body, cognitive ergonomics with the human brain, and organizational ergonomics with systems and the cultures that exist within them.

This chapter is designed to discuss each type of ergonomics in detail, indicate the recent advancements, and propose future studies that can be conducted in these fields in the last section.

2. Physical ergonomics

The study of the human body’s responses to physical and physiological job demands is known as physical ergonomics. It studies how anatomy, anthropometry, biomechanics, physiology, and the physical environment influence physical activity [2].

Physical ergonomics addresses the effects of repetitive motion, materials handling, workplace safety, and comfort in the use of portable devices, keyboard design, working postures, and the work environment. The most common types of difficulties are repetitive strain injuries caused by repetition, vibration, force, and posture and thus have design implications [3]. Thus, the main research areas of physical ergonomics include repetitive movement, work-related musculoskeletal disorders, health, working postures, workplace layout, safety, equipment design, and material handling.

Studies have indicated that when workers have less physical strain and difficulties completing their jobs, they are more productive. Moreover, quality and profitability can be directly harmed by poor ergonomics. Errors and decreased work quality can result from physically and mentally exhausted users of ergonomically flawed designs [4, 5].

3. Organizational ergonomics

Organizational ergonomics, which is also known as macroergonomics, examines the interaction between systems and organizations interact, as well as designs of the systems. It entails knowing how to improve work systems in order to improve overall performance and effectiveness of an organization. Thus, it entails optimizing an organization's sociotechnical system's policies, processes, and structures.

Within an organization, organizational ergonomics can be approached in a variety of ways, including top-down, bottom-up, and middle-out. Those in leadership or management positions may recommend the work flow, structure, and resources available to perform work in order to improve organizational ergonomics using a top-down approach. A middle-out strategy entails investigating an organization's internal workings to ascertain the efficiency of its work systems and procedures at all levels of the "organizational hierarchy." When using a bottom-up strategy, employees must actively participate and contribute in order to identify issues and potential fixes [6].

To enhance organizational ergonomics in a business, it may be necessary to assess certain workplace factors, including; work design, virtual organizations, teamwork, quality management, telework or remote work, participatory design, new work paradigms, design of work times, crew resource management, cooperative work, community ergonomics, and communication [7, 8].

4. Cognitive ergonomics

The field of cognitive ergonomics examines how the human brain interacts with and processes information, and how well a person performs within a particular system as a result.

This branch of cognitive ergonomics studies "mental workload," which includes training and decision-making. Mental functions like perception, attention, memory, reasoning, making decisions, learning, and motor response are taken into account because they have an impact on how people interact with other mechanical components of a system. The ways in which a person interacts with and completes their work are influenced by perception, memory, reasoning, and motor response. The worker feels more stress as a result of a heavier cognitive workload [9].

Ergonomists in this field evaluate and offer recommendations on education, design, usability, skill training, physical training, human-technology interaction, work stress, decision-making processes, social stress, and fatigue in addition to mental workload.

5. Discussion and conclusion

The human remains the most important component of any production system despite of the technological advances. Gaining knowledge of the three main sorts can help us better understand the complicated workplace found on today's sophisticated manufacturing floors.

In today's technologically competitive production environment, physical ergonomics is evolving into automation of the repetitive manual tasks, and manual handling involving logistics and transportation are being improved by new digital technologies such as autonomous robots. Even though ergonomic response is getting better with wearable and handheld devices, there are still risks arise from close human-machine collaboration.

Organizational ergonomics, on the other hand, is moving toward studying the requirements of hybrid production systems where humans and machines are becoming more integrated. Thus, the design and organization of work will be impacted by this new human-machine interaction. It is expected that employers will gain from human-centered design. So, the interaction of the new technologies and work organization will determine how future skills of the human operators to be developed.

The most important aspect of ergonomics will be the cognitive ergonomics in this new technology dominated era. Virtual models facilitate timely interactions and enhance perception, cyber physical systems are developing new ways for people to interact with machines, the use of augmented reality tools will lessen mental stress, and data exchange between departments is expected to enhance cognitive ergonomics. Thus, IT and problem-solving abilities will be unavoidably required.


Therefore, each element of organizational, cognitive, and physical ergonomics can be used separately or more effectively in combination with one another. Even though each of these lists might seem overwhelming in its entirety, rest assured that focusing on even one will help increasing the efficiency.

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References

- [1] IEA - International Ergonomics Association. What is Ergonomics? Available at: <https://iea.cc/what-is-ergonomics/>. [Accessed: September 6, 2022]
- [2] Helander M. A Guide to Human Factors and Ergonomics. Second ed. Boca Raton, FL, USA: CRC Press; 2005
- [3] Karwowski W, editor. Handbook of Standards and Guidelines in Ergonomics and Human Factors. Lawrence Erlbaum Associates. Boca Raton, FL, USA: CRC Press; 2005
- [4] Salvendy G. Handbook of Human Factors and Ergonomics. Hoboken, New Jersey, USA: John Wiley & Sons, Inc; 2012
- [5] Woodson WE. Human Factors Design Handbook: Information and Guidelines for the Design of Systems, Facilities, Equipment, and Products for Human Use. New York, USA: McGraw-Hill; 1992
- [6] Becker T, Stern H. Future trends in human work area design for cyber-physical production systems. In: *Procedia CIRP – 49th CIRP Conference on Manufacturing Systems (CIRP-CMS 2016)*. Vol. 57. 2016. pp. 404-409. DOI: 10.1016/j.procir.2016.11.070
- [7] Dworschak B, Zaiser H. Competences for cyber-physical systems in manufacturing – first findings and scenarios. In: *Procedia CIRP - 8th International Conference on Digital Enterprise Technology – DET 2014 – “Disruptive Innovation in Manufacturing Engineering Towards the 4th Industrial Revolution Competences*. Vol. 25(C). 2014. pp. 345-350. DOI: 10.1016/j.procir.2014.10.048
- [8] Müller U, Gust P, Feller N, Schiffmann M. WorkDesigner: Consulting application software for the strain-based staffing and design of work processes. In: *Procedia Manufacturing – 6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015*. Vol. 3. 2015. pp. 379-386. DOI: 10.1016/j.promfg.2015.07.179
- [9] Vernim S, Walzel H, Knoll A, Reinhart G. Towards capability-based worker modelling in a smart factory. In: *2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*. Vol. December. Singapore: IEEE; 2017. pp. 1576-1580. DOI: 10.1109/IEEM.2017.8290158