Chapter 106
Trends in Macroergonomics Applications for Improved Work Systems

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ABSTRACT

Macroergonomics is the subdiscipline of ergonomics that is concerned with the analysis, design, and evaluation of work systems. It means, macroergonomics focuses on harmonizing the organizational structure of a company and not only one workstation or one task, as microergonomics does. Macroergonomics is a top-down, middle-out, and bottom-up approach. In the top-down approach, the overall general work system structure may be prescribed to match the organization's sociotechnical characteristics. On the other hand, the middle-out approach focuses on the analysis of subsystems and work processes, which can be assessed both up and down the organizational hierarchy from intermediate levels, and also, up and down some changes may be done to ensure the work system design is harmonized. Finally, the bottom-up approach comprises an extensive participation of employees in the identification of problems. Currently, macroergonomics is considered an emergent subdiscipline, and there is the need to promote current theories and methods and propose new ones.

INTRODUCTION

Traditionally, work systems have been the focus of attention with the aim of increasing productivity. Here, it is principally from the economic perspective and is focused to obtain profits considering a purely consumption approach. However, this has evolved considering human and social aspects in such a way that economic advantages are put at the same level that the promotion of positive changes on individual and collective work environments. It is seen when organizations have adapted the work system conditions to the limitations, abilities and needs of their employees. One result of this view is Ergonomics, which arises supporting the design of products and systems enhancing human well-being and performance (Hassall, Xiao, Sanderson, & Neal, 2015).

Consequently, Macroergonomics, as a nested discipline of Ergonomics, emerges basically with the aim of design a fully "harmonized" work system enhancing the key performance indicators (organizational effectiveness, productivity and satisfaction). Herein the sociotechnical systems theory was the fundamental principle, and the industrial and organizational psychology viewpoints were also included (Lauren A. Murphy, Robertson, & Carayon, 2014). Thus, the macroergonomics approach mostly studies the interaction between the elements (machine, environment, software, job and organization) within the work system.

In this line, Hendrick & Kleiner (2002) identified diverse applications of this approach. For instance, reduction of work-related injuries, use of Information and Communication Technology (ICT) and their changes in work life, management of large scale organizational changes, improvement of some manufacturing aspects, development of training systems, relocation of technologies, increment of aviation safety and cut of large scale accidents are examples of these applications. Five years later, Hendrick (2007) analyzed the research trends on the management and organization of work systems, which acknowledged technology, demographic shifts, value changes, ergonomic-based litigation, world competition and failure of traditional Microergonomics as principal objects of study. These applications were frequently done in contexts as manufacturing, service organizations, healthcare, maintenance, telecommunications, maritime vessels, and industrial accident prevention. On the other hand and in an isolated way were in retail, military, typesetting, aviation operations, schools, and government.

The structure of this chapter is as follows. It starts by considering the historical contexts of Macroergonomics applications from 1994 to 2013, and the challenges that they posed for Macroergonomics. Next, it examines those works that took place from 2014 to 2018 and attempted to address the raised challenges and the emerged trends in the field. The chapter concludes with a set of predictions and challenges for macroergonomics in the near future.

HISTORICAL CONTEXTS

A search in the Scopus database of the word Macroergonomics in the article title, abstract or keywords, and filtering the period from 1994 to 2013 was done. 150 documents resulted from the search and were classified and summarized in 70 conference papers, 64 articles, four book chapters and two editorials. After, the analysis was conveniently limited to only articles and book chapters so that 68 documents were used in this phase. Table 1 presents the recurrent researchers in the field.

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