

# Preface

Macroergonomics dates back to 1982 in Seattle, WA, USA. A group of concerned physical ergonomics researchers concluded that increasing the physical aspects of the job was important but not enough to improve human conditions in labor settings. Thus, to improve work conditions, a new approach was necessary for evaluating the organizational context. Under this scenario, the notion of Organizational Design and Management (ODAM) emerged as an attempt to consider the organizational structure in ergonomic evaluations. Then, years later, ODA M gave birth to macroergonomics, a subdiscipline or branch of ergonomics. Since then, macroergonomics has become popular. Originally, macroergonomics addressed work and job positions from an organizational approach, yet now it has evolved and extends beyond these aspects. Nowadays, it is also interested in manufacturing systems, healthcare systems, safety systems, and sustainable systems, among others.

This book proposes a macroergonomic approach to evaluating manufacturing systems, which is why both terms—macroergonomics and manufacturing systems—must be clearly established from the beginning. That said, experts such as Hendrick (1995), Hendrick and Kleiner (2002), Carayon (2012) view macroergonomics as a branch of ergonomics that is both a top-down and a bottom-up approach to sociotechnical systems. Macroergonomics encompasses organizational structures, policies, and processes that support the design of work systems and interfaces, such as the human–work, human–machine, human–software, and human–environment interfaces. Its fundamental purpose is to make sure that work systems are fully harmonized and compatible with their sociotechnical characteristics to achieve synergic improvements within a broad range of organizational effectiveness criteria (e.g., safety and health, comfort, productivity) (Carayon 2012; Zink 2014).

Nowadays, macroergonomics helps organizations and companies meet international standards and norms such as the International Standard Organization (ISO) 14000 and the Occupational Safety and Health Administration (OSHA). Such norms consider ergonomic aspects of the work system at organizational level. For instance, ISO 14000 demands organizations to maintain a favorable environment to

satisfy not only its needs, but also customer necessities and environmental norms. Likewise, ISO helps meet diverse international regulations that provide companies with a certain degree of competitiveness (Clementes 1997; Samaras and Horst 2005).

This book views manufacturing systems as an interactive combination at any level of complexity among people, materials, tools, machines, software, facilities, and processes that are designed to work together and meet a common goal (Chapanis 1996). However, manufacturing systems can also be conceived as a combination of smaller systems, known as subsystems; any changes made to one of such subsystems or parts can affect other parts or the complete manufacturing system (Haro and Kleiner 2008).

To remain competitive, work systems have to be evaluated under different approaches, including productivity, quality, efficiency, flexibility, reliability, and even leanness. Despite the many contributions to the field, the ergonomic evaluation approach is still incomplete. Experts have proposed methods for microergonomic evaluations that generate a microergonomic compatibility index to measure the risk level of tasks or workstations. However, at macroergonomic level, none of the current proposals addresses or discusses an index generation methodology for the macroergonomic assessment of work systems, especially of manufacturing systems. The goal of this work is thus to further develop the concept of macroergonomic compatibility and propose an appropriate index for organizational performance evaluation in work systems. The index relies on employee perceptions to assess the extent to which macroergonomic practices are implemented in a given work system.

The methodology here presented was implemented and validated in the Mexican manufacturing industry. This book aims at business people, ergonomists, healthcare professionals, and company managers and supervisors from all over the world who acknowledge ergonomics as one of the most promising areas to be explored to increase the efficiency, safety, productivity, and competitiveness of manufacturing work systems. Similarly, this book is a useful handbook for graduate and undergraduate students, as it explores a broad range of concepts to better understand what is meant by manufacturing work system elements and factors and why they are important in macroergonomic evaluations.

Throughout its 13 chapters, this book conceptualizes and develops macroergonomics for manufacturing work systems. It also establishes the work system factors and elements that are necessary for performing successful macroergonomic evaluations on manufacturing work systems. Similarly, this book discusses how the index generator methodology, as well as the index itself, was validated through case studies. Such case studies demonstrate how the macroergonomic factors are key elements to achieving the desired organizational performance and reveal to what extent these factors impact on the performance of manufacturing work systems. We believe that this book is the most suitable way of disseminating and sharing with the world a novel index generator methodology for manufacturing system evaluation under an emerging, yet increasingly popular macroergonomic perspective. We hope

that readers view our work as an interesting, plausible, and useful contribution to improving the ergonomic conditions of modern manufacturing work systems.

Ciudad Juárez, Mexico

Arturo Realyvásquez-Vargas  
Aide Aracely Maldonado-Macias  
Jorge Luis García-Alcaraz

## References

- Carayon P (2012) Handbook of Human Factors and Ergonomics in Health Care and Patient Safety, 2nd edn. CRC Press, Boca Raton, FL
- Chapanis A (1996) Human Factors in Systems Engineering. John Wiley & Sons, New York
- Clementes RB (1997) Guía completa de las normas: ISO 14000. Gestión 2000
- Haro E, Kleiner BM (2008) Macroergonomics as an organizing process for systems safety. Appl Ergon 39:450–8. doi:[10.1016/j.apergo.2008.02.018](https://doi.org/10.1016/j.apergo.2008.02.018)
- Hendrick HW (1995) Future directions in macroergonomics. Ergonomics 38:1617–1624. doi:[10.1080/00140139508925213](https://doi.org/10.1080/00140139508925213)
- Hendrick HW, Kleiner BM (2002) Macroergonomics: theory, methods, and applications. Lawrence Erlbaum Associates
- Samaras GM, Horst RL (2005) A systems engineering perspective on the human-centered design of health information systems. J Biomed Inform 38:61–74. doi:[10.1016/j.jbi.2004.11.013](https://doi.org/10.1016/j.jbi.2004.11.013)
- Zink KJ (2014) Designing sustainable work systems: The need for a systems approach. Appl Ergon. doi:[10.1016/j.apergo.2013.03.023](https://doi.org/10.1016/j.apergo.2013.03.023)

Macroergonomics for Manufacturing Systems

An Evaluation Approach

Realyvásquez Vargas, A.; Maldonado-Macías, A.A.;

García-Alcaraz, J.L.

2018, XXVII, 221 p. 30 illus., 9 illus. in color., Hardcover

ISBN: 978-3-319-68683-7