



Organizational Ergonomics in the Digital Workplace: Optimizing Human-System Interactions and Administrative Workflows

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Abstract

The rapid integration of digital technologies into modern work environments has fundamentally transformed organizational structures and administrative workflows. This paper explores the critical intersection of organizational ergonomics (macroergonomics), the sociology of work, and digital transformation.

Keywords: Organizational Ergonomics, Macroergonomics, Sociology of Work, Digital Transformation, Sociotechnical Systems, Cognitive Ergonomics

ملخص:

أدى التكامل السريع للتقنيات الرقمية في بيئات العمل الحديثة إلى تغيير جذري في الهياكل التنظيمية وسير العمل الإداري. تستكشف هذه الورقة البحثية التقاطع الحاسم بين بيئة العمل التنظيمية (بيئة العمل الكلية)، وعلم اجتماع العمل، والتحول الرقمي.

الكلمات المفتاحية:

بيئة العمل التنظيمية، بيئة العمل الكلية، علم اجتماع العمل، التحول الرقمي، الأنظمة الاجتماعية التقنية، بيئة العمل المعرفية

1. Introduction

The modern workplace is undergoing a profound evolution driven by the relentless pace of digital transformation. Organizations across all sectors, including higher education and public administration, are increasingly relying on complex digital platforms, automation, and management software to streamline operations. However, the introduction of these technologies often outpaces the adaptation of the workforce, leading to friction between human capabilities and system requirements. This friction is the primary domain of ergonomics, a discipline that has evolved from its industrial roots to address the complexities of the knowledge economy.

Ergonomics, or human factors engineering, is traditionally understood as the science of fitting the workplace to the worker. While classical microergonomics focuses on physical health—such as the design of chairs, desks, and keyboards to prevent musculoskeletal disorders—contemporary challenges require a broader perspective. Organizational ergonomics, or macroergonomics, views the organization as a complex sociotechnical system. It examines how work systems, organizational structures, and technological interfaces interact with human behavior and social dynamics within the workplace (Hendrick & Kleiner, 2002).

The objective of this article is to analyze the role of organizational ergonomics in the context of digital workflows. It seeks to answer how macroergonomic principles can be applied to mitigate the negative consequences of digitalization, such as cognitive overload and technostress, while promoting a more harmonious and efficient administrative environment.

2. Literature Review

2.1 The Evolution of Ergonomics: From Micro to Macro

The discipline of ergonomics has historically developed through three generations. The first generation focused on physical ergonomics, heavily utilized during the industrial revolution to optimize physical labor and reduce injury. The second generation, cognitive ergonomics, emerged with the advent of computing, focusing on human–computer interaction (HCI), mental workload, and decision–making processes (Stanton et al., 2017).

The third generation, macroergonomics, represents a top–down approach to work system design. According to Hendrick and Kleiner (2002), macroergonomics ensures that the organizational structure and work processes are designed before the specific microergonomic details are finalized. This approach aligns closely with the sociology of work, emphasizing that human interactions, social hierarchies, and communication networks are just as critical to productivity as the physical tools used by employees.

2.2 Cognitive Ergonomics in Digital Administration

In administrative settings, the primary ergonomic hazards are no longer strictly physical; they are cognitive. Employees interact with multiple software platforms simultaneously—from email clients and cloud storage to specialized management systems. This constant context–switching demands high cognitive flexibility and memory retention. Sweller's Cognitive Load Theory (1988) suggests that the human working memory has a limited capacity. When digital platforms are poorly designed, requiring excessive navigation or redundant data entry, they generate "extraneous cognitive load." This unnecessary mental effort reduces the

capacity for complex problem-solving and increases the likelihood of human error (Hollender et al., 2010).

2.3 Technostress and the Sociology of Digital Work

The sociology of work examines how technology alters the social fabric of the organization. The digitization of tasks can lead to "technostress," defined as a modern disease of adaptation caused by an inability to cope with new computer technologies in a healthy manner (Tarafdar et al., 2007). Technostress manifests as anxiety, mental fatigue, and a sense of losing control over one's work environment. It is often exacerbated by the "always-on" culture enabled by mobile technologies, which blurs the boundaries between professional and personal life. Addressing technostress requires a macroergonomic intervention that renegotiates work expectations, communication protocols, and system design.

3. Theoretical Framework: Sociotechnical Systems (STS) Theory

The foundation of organizational ergonomics is Sociotechnical Systems (STS) theory. Originally developed by researchers at the Tavistock Institute in the 1950s, STS theory posits that every organization comprises two interdependent subsystems: the technical subsystem (tools, software, processes) and the social subsystem (people, roles, relationships, culture) (Trist, 1981).

For an organization to function optimally, these two subsystems must be jointly optimized. If digital platforms (the technical subsystem) are implemented without considering the existing social structures, workflow habits, and cognitive limits of the staff (the social subsystem), the system will fail to achieve its intended efficiency.

In the context of modern administration, STS theory dictates that the development of management software—such as systems for tracking

student data, handling human resources, or managing academic competitions—must be participatory. End-users must be involved in the design and testing phases to ensure the technology aligns with their actual workflow requirements.

4. The Impact of Digital Ergonomics on Organizational Performance

4.1 System Usability and Efficiency

The usability of an administrative platform directly correlates with organizational efficiency. Ergonomic software design relies on intuitive interfaces, clear visual hierarchies, and minimized cognitive friction. When a system requires a steep learning curve or forces employees to adapt to convoluted workflows, the organization suffers from decreased processing speed and increased training costs. Systems that employ automated data retrieval, standardized input forms, and error-prevention mechanisms significantly enhance user performance.

4.2 Error Reduction and Quality Control

In complex administrative processes, human error can have cascading negative effects. Cognitive ergonomics emphasizes "error-tolerant" systems. For example, a well-designed database interface will use constraints and validation checks to prevent incorrect data entry, rather than relying solely on the user's vigilance. By reducing the mental strain associated with data verification, employees can focus on higher-level analytical tasks.

4.3 Employee Well-being and Retention

Organizational ergonomics recognizes that human well-being is a prerequisite for sustained performance. Chronic cognitive overload and frustration with poorly designed IT infrastructure lead to burnout and decreased job satisfaction. Organizations that prioritize ergonomic principles in their digital environments demonstrate a commitment to

employee welfare, which is a critical factor in talent retention and building a positive organizational culture.

5. Methodological Approaches to Macroergonomic Evaluation

To effectively study and improve organizational ergonomics within a specific institution, researchers and administrators must employ mixed-methods approaches:

1. **Task Analysis:** Breaking down complex administrative workflows into individual steps to identify redundancies, bottlenecks, and excessive cognitive demands.
2. **System Usability Scale (SUS):** Utilizing standardized questionnaires to quantitatively measure employee satisfaction and perceived ease of use regarding existing digital platforms (Brooke, 1996).
3. **Participatory Ergonomics (PE):** Engaging staff members in focus groups and design workshops. In PE, employees are treated as the foremost experts of their own work, allowing them to propose software modifications and workflow redesigns that address real-world challenges.
4. **Sociotechnical Assessment:** Evaluating the alignment between the organizational hierarchy and the software access protocols. For instance, ensuring that the delegation of tasks within the software matches the actual distribution of authority within the administrative department.

6. Discussion: Designing the Ergonomic Organization

The transition to a fully digital workflow is not merely an IT project; it is an organizational transformation. The implementation of digital tools often reveals pre-existing inefficiencies in the sociological structure of the workplace. Therefore, macroergonomics requires a holistic intervention strategy.

Firstly, software customization is essential. Off-the-shelf management software rarely fits the unique cultural and procedural nuances of a specific institution. Ergonomic optimization requires platforms to be adaptable, allowing administrators to remove unnecessary features, simplify dashboards, and automate repetitive data entry.

Secondly, the role of training must be reimagined. Traditional training focuses on how to click through a software program. Ergonomic training focuses on how to integrate the software into the daily workflow without increasing stress. This includes establishing organizational norms around digital communication, such as setting boundaries on email response times to prevent digital fatigue.

Finally, organizational leaders must recognize that technological interfaces shape social interactions. A platform that facilitates transparent communication and easy sharing of resources fosters a collaborative organizational culture, whereas rigid, siloed software can create interpersonal friction and departmental isolation.

7. Conclusion

Ergonomics extends far beyond physical workplace design; it is deeply embedded in the cognitive and sociological aspects of human labor. As organizations continue to digitize their operations, the principles of organizational ergonomics and Sociotechnical Systems theory become

indispensable. By prioritizing the human–system interface, minimizing extraneous cognitive load, and fostering participatory design, institutions can achieve a true joint optimization of their social and technical subsystems. Future research in the sociology of work should continue to explore the longitudinal effects of digital administrative platforms on employee well–being, focusing on the development of highly adaptable, user–centric organizational frameworks.

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