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THE EFFECTS OF THE ERGONOMICS AND AI TRANSITION ON WORKERS, FIRMS, AND SKILLS IN DIGITAL ERA: INSIGHTS FROM INTERNATIONAL EDUCATIONAL PROJECTS AND REAL PRACTICAL EXAMPLES

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Abstract This article examines the effects of the ergonomics and AI transition on workers, firms, and skills in the digital era, improving insights from international educational projects and real-world applications. The study focuses on optimizing work processes through the integration of advanced technologies, ergonomic principles, and AI-driven solutions to enhance efficiency and strategically deploy human resources. Key areas include the implementation of client self-service mechanisms to reduce routine tasks, digitization of repetitive operations to minimize human error, and acceleration of workflows using modern digital tools. The analysis emphasizes reallocating employee expertise toward high-value activities, leveraging practical experience in digital and AI contexts, and improving workplace safety, healthcare through automation of hazardous tasks. Findings highlight how these strategies foster sustainable organizational development, support skill evolution, and create safer, more adaptive work environments. Real examples from international ERASMUS+ projects such as ErgoAI and SAFE-D illustrate practical approaches for integrating ergonomics and AI into business processes, offering actionable insights for organizations navigating the challenges of Industry 5.0 and the digital-green transition.

Keywords: AI; automation; optimization; technologies; ergonomics; human factors; skills; safety; digitalization; ErgoAI; SAFE-D.

1. INTRODUCTION

The digital and green transitions are fundamentally transforming modern workplaces prevention, presenting both opportunities and challenges that require innovative approaches to ergonomics, human factors, healthcare and workplace safety [1-11]. This study aims to explore the potential for optimizing work pro-cesses through the integration of modern technologies, while also outlining the benefits of channeling employee competencies toward more improved activities. The significant impact on ergonomics and AI is the international ERASMUS+ project “ErgoAI: Enhancing Adult Education in Ergonomics through AI at BAEHF” (2025-1-BG01-KA122-ADU-000322917) [12], which expands the scope of digital transformation by focusing on lifelong learning and AI-driven ergonomic solutions. Implemented by the Bulgarian Association of Ergonomics and Human Factors (BAEHF) in collaboration with IA GO! (Spain), ErgoAI aims to equip adult educators and professionals with advanced digital methodologies and AI-powered tools for workplace well-being. The project emphasizes person-alized on-site training programs supported by digital and AI tools, educational materials strongly oriented toward international knowledge exchange, and the integration of state-of-the-art technologies into ergonomic risk assessment. Through mobility activities and practical workshops, participants explore appli-cations of tools such as ChatGPT, Make.com, Power BI, and Lovable, fostering innovation and digital competence in adult education. ErgoAI addresses

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the edu-cational dimension of ergonomics within the context of Industry 5.0 and sustain-able workplace practices. The following links to video sources show the process of on-site ergonomics and AI training with real practice implementations and development of samples led by professional experts:

- Course video 1: https://www.youtube.com/shorts/Jayc0-mZN6Q
- Course video 2: https://youtube.com/shorts/mT01SjHLvvc
- Course video 3: https://youtube.com/shorts/poNd8TQN6L0
- Course video 4: https://youtube.com/shorts/TV8EJi4AYT4

1.1. Gained Results

The training delivered under ErgoAI produced highly encouraging outcomes. Participants reported a substantial improvement in their ability to integrate AI-driven tools into ergonomic assessments and educational practices. Practical sessions demonstrated how technologies such as ChatGPT and Power BI can streamline data analysis, enhance communication, and support decision-making in workplace design. Educators gained confidence in creating personalized learn-ing models using AI, which significantly improves engagement and adaptability for adult learners. Furthermore, the collaborative environment fostered during mobility activities strengthened international partnerships and facilitated the exchange of best practices between Bulgaria and Spain. Feedback highlighted increased awareness of ergonomic risks and the ability to apply preventive strategies using digital platforms. The participants enhanced their technical skills, also inspired innovative approaches to teaching ergonomics in the context of Society 5.0 and Industry 5.0. The integration of AI tools into real-world scenarios proved transformative, enabling professionals to envision future-ready educational models that prioritize both efficiency and human well-being.

Another notable project is a SAFE-D ERASMUS+ project [13, 14] addresses these challenges through a unique collaboration between research institutions and private sector partners, including the Bulgarian Association of Ergonomics and Human Factors (BAEHF) [15] and innovative and progressive companies like WildArt [16] This partnership model ensures that theoretical advancements in sustainable ergonomics and digital workplace solutions are tested and refined through real-world implementation.

At the core of SAFE-D's experience is the integration of academic expertise with practical industry experience. BAEHF brings specialized knowledge in ergonomics and human factors, which informs the development of adaptive digital tools for workload management and mental health preservation in hybrid work environments. This theoretical framework is then implemented and validated through partnerships with private companies - WildArt LTD serves as an exemplary case, having integrated SAFE-D's digital assisted ergonomic assessment tools into their electronic workplace infrastructure while maintaining their creative workflow processes. Digital Transformation with Human Focus: Through cognitive ergonomics framework, SAFE-D lines real practice that support employees at partner companies monitor and optimize their work patterns. WildArt's team follow the balance creative work with necessary administrative tasks, reducing cognitive overload while maintaining productivity.

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Cross-Sector Knowledge Exchange: The collaboration between SAFE-D researchers and WildArt's designers created a feedback loop where academic concepts were tested against real creative industry challenges. Working with agile companies like WildArt helped shape SAFE-D's open-access Preventive Ergonomics Toolkit into a practical resource that creative businesses can implement. Validating the practicality of theoretical ergonomic solutions include:

- Identifying unforeseen challenges in digital workplace transitions
- Developing implementation strategies that account for real; business constraints;
- Creating training materials grounded in actual workplace experiences;
- Other specific with the company.

The ongoing knowledge exchange between researchers and business continues to inform the development of SAFE-D's outputs, ensuring they remain relevant to the evolving needs of modern digital workplaces. This partnership exemplifies how research institutions and private companies can work together to navigate the complexities of the digital-green transition while prioritizing employee wellbeing and sustainable business practices.

In the forthcoming research phases of the research will present detailed case studies provided by WildArt company showcasing concrete examples of digital optimization in business practice. These findings will demonstrate how the company successfully implemented digital tools to streamline their workflows while enhancing employee wellbeing. The analysis reveals specific applications including: (1) the integration of adaptive interface systems that reduced visual fatigue among designers during prolonged creative sessions, (2) deployment of real-time posture monitoring solutions that decreased musculoskeletal complaints without compromising productivity, and (3) implementation of cognitive load balancing algorithms that improved task scheduling across hybrid teams. WildArt's experience particularly highlights the practical challenges and solutions in applying digital ergonomic principles to creative industries, offering valuable insights about hardware/software compatibility issues, employee adoption curves, and measurable productivity impacts. The case study will provide granular data on implementation timelines, staff training approaches, and the iterative refinement process that helped adapt models to business oriented company serving navigating digital transformation while prioritizing workplace health and sustainability.

2. USE OF MODERN TECHNOLOGIES

In today’s work environment, process optimization through the automation of routine tasks represents a fundamental component for enhancing organizational efficiency and sustainability. This is particularly relevant in cases where the provision of a service involves collecting basic parameters through recurring client interactions. Contemporary technologies offer solutions that significantly reduce operational time and ease the workload on staff.

A typical example is the order intake process, which generally takes around eight minutes. Time distribution analysis reveals that approximately two minutes are spent recording basic client data, four minutes on defining standard criteria such as service type, selected options, or dimensions, and the remaining two minutes on individual clarifications specific to the client. Clearly, about six out of the eight minutes are dedicated to processing standardized information that can be structured and automated.

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By implementing interactive online forms, mobile applications for pre-entry of data, or self-service kiosks, clients can independently provide standard parameters by selecting from predefined options. This approach significantly shortens the service time while preserving the opportunity for personalized interaction with staff. The time thus released allows employees to focus on complex and specific customer requirements that demand expert assistance and creative input.

To evaluate the actual impact of such automation in a concrete work setting, an empirical observation of service times and order values was conducted. Quantitative analysis confirms the efficiency potential of automating routine processes. In a real-world measurement, the average daily number of processed orders was found to be 47, of which 32—over 68%—were for basic services with fixed parameters. These orders were identified as suitable for handling through a self-service module. Additionally, significant differences were observed in both service duration and economic value between the two types of orders. Basic, standardized orders required an average of 2 to 4 minutes to process, while personalized requests took around 8 minutes on average. In terms of purchase value, orders eligible for self-service averaged approximately 2.50 BGN, while personalized ones exceeded this amount more than tenfold, with an average value of 28 BGN (Figure 1) Productivity by Order Type.

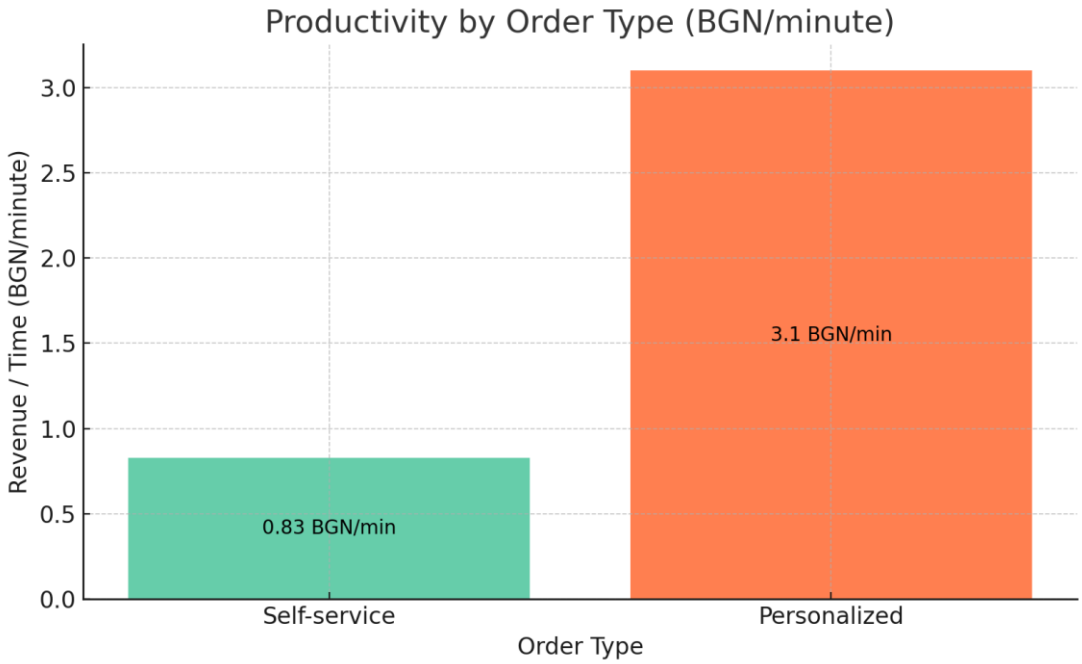

Figure 1. Productivity by Order Type.

Calculations reveal that servicing 32 orders of the first type occupies approx-imately 68% of total working time, generating around 80 BGN in daily revenue. Meanwhile, the remaining 15 highly personalized orders—completed within just 32% of the time—account for a significantly higher turnover of 375 BGN. This imbalance between time invested and value generated underscores the strategic necessity of automating the first category of orders through the implementation of a self-service module. By transferring standardized tasks to a digitized plat-form, a substantial amount of human resources can be redirected toward handling high-value orders that offer greater client-specific value. In addition to shorten-ing service time, this approach reduces the risk of mechanical errors and enhanc-es the overall productivity of the team. These results provide quantitatively grounded support

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for the implementation of a technological solution that not only streamlines processes but also improves the organization's financial per-formance (Figure 2) Time and Value Distribution Across Orders with Varying Lev-els of Personalization.

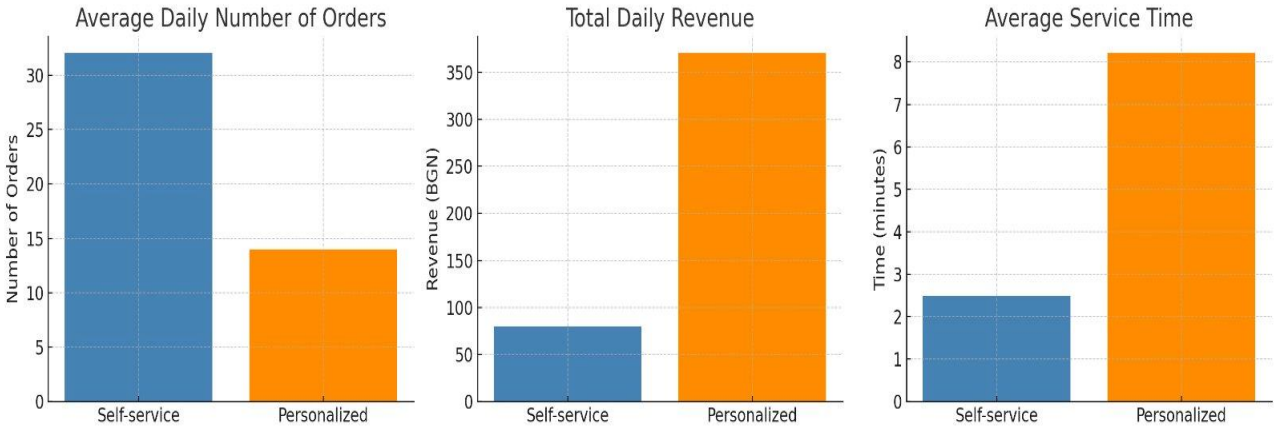

Figure 2. Time and value distribution across orders with varying levels of personalization.

These data clearly indicate that the transfer of routine and low-value activities to self-service technologies not only leads to better time allocation of resources but also creates an opportunity for staff to focus on more profitable and complex orders. As a result, significant optimization of both productivity and the value of human labor is achieved.

Although 68% of working time is spent on processing quick and standardized orders (self-serviceable), they contribute only 17.6% to the overall turnover. On the other hand, customized orders, which account for just about one-third of the time, generate over 82% of the revenue. This clearly demonstrates that automating the first group through a self-service module would free up valuable time that could be redirected towards more profitable and complex services.

Table 1. Comparison between self-serviceable orders and customized orders.

Indicator	Self-Service Orders	Customized Orders
Average number of orders per day	32 orders (68%)	15 orders (32%)
Average service time	2–4 minutes	8 minutes
Average order value	2.50 BGN	25.00 BGN
Total daily turnover	80.00 BGN	375.00 BGN
Share of total time occupancy	68%	32%
Turnover per unit of time (approx.)	1.18 BGN/min	11.72 BGN/min

The implementation of such technological solutions contributes not only to improving the efficiency of the work process but also to enhancing the quality of service, reducing the risk of errors, and increasing customer satisfaction. Addi-tionally, employees are relieved from monotonous and repetitive tasks, which boosts their engagement and motivation. In this way, automation becomes a stra-tegic tool for the sustainable development of the organization.

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3. THE OPTIMIZATION OF WORK PROCESSES

The optimization of work processes through the automation of routine tasks creates an opportunity to redirect employees' efforts toward activities that require higher qualifications, analytical thinking, and a creative approach. Automating routine tasks not only frees employees from repetitive actions but also creates the conditions for the strategic reallocation of human resources toward activities with higher added value. Employees, relieved from tasks that can be digitized, are given the opportunity to focus their efforts on complex, specific, and creative processes that require an individualized approach, expert knowledge, and analytical thinking.

This process leads to a significant reduction in the time required to perform core activities, as routine operations are handled with high speed, precision, and minimal human involvement. Along with optimizing time costs, automation significantly reduces the frequency of human errors, particularly in the stages of entering and processing standardized information. By eliminating mechanical and repetitive actions, such as manual data entry or checking basic parameters, a higher level of accuracy and reliability of results is ensured.

As a result of these changes, employees direct their expertise toward specific customer requirements, processing non-standard cases, and developing new solutions that add value to the overall work process. This not only enhances the quality of service and customer satisfaction but also strengthens the professional motivation and engagement of the staff. A work environment is created in which technologies complement human skills, facilitating the building of teams with high adaptability and resilience to changes in the market environment.

In this context, automation should be viewed not as a means of replacing human labor, but as a tool for its strategic enhancement and redirection toward areas where human expertise remains irreplaceable.

4. SKILL DEVELOPMENT AND PRACTICAL EXPERIENCE

The optimal application of employees' practical experience is crucial for enhancing productivity and maintaining high efficiency in a dynamic work environment. Accumulated experience should be purposefully directed toward areas that require specific expertise, an individualized approach, and the ability to make complex decisions.

In the modern digitalized work environment, skill development requires constant adaptation to new technologies and processes. Training and upgrading competencies should be integrated as part of the daily work process, with a focus on the ability to work with automated systems, interpret data, and apply analytical approaches.

Skill development approaches include combining practical experience with targeted training programs, internal organizational mentorship, and the active use of e-learning platforms. Emphasizing the practical aspects of training ensures that accumulated knowledge is not merely theoretical but directly applicable to real-world work practice.

This process not only enhances individual employee competence but also helps build teams with high flexibility, capable of responding to the challenges of modern technological transformation.

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5. THE OPTIMIZATION OF WORK PROCESSES

The automation of high-risk activities and the digitization of standard operations significantly reduce workplace incidents and human errors. By transferring dangerous processes to automated systems and using digital tools for control, a safer, more resilient, and predictable work environment is created. This not only reduces safety risks but also frees up time and resources that can be used for skill development and enhancing employees' expertise.

The implementation of automation and new technologies sets new skill requirements, as employees need to be capable of working with the new systems and adapting their knowledge to the new work environment. Combining practical experience with modern training programs ensures that the workforce is not only qualified but also capable of meeting the demands of a modernized work environment.

6. CONCLUSIONS

The transition toward ergonomics and AI in the digital era represents a strategic shift that redefines how organizations manage processes, skills, and workplace safety. This study demonstrates that automation and AI-driven solutions are not merely tools for efficiency but catalysts for sustainable development and human-centered innovation. By transferring repetitive and hazardous tasks to digital systems, companies can significantly reduce operational risks while unlocking opportunities for employees to engage in high-value, creative, and analytical work.

International projects such as ErgoAI and SAFE-D illustrate the practical benefits of integrating ergonomic principles with advanced technologies. These initiatives highlight how targeted training, mobility programs, and real-world applications foster digital competence, enhance adaptability, and strengthen collaboration across sectors. The empirical evidence confirms that automation improves productivity, minimizes errors, and optimizes resource allocation, while simultaneously requiring continuous skill development and lifelong learning strategies.

Ultimately, the convergence of ergonomics and AI supports the vision of Industry 5.0, where technology complements human expertise rather than replacing it. Organizations that embrace this approach will not only achieve operational excellence but also create safer, more inclusive, and future-ready workplaces. The findings underscore the importance of aligning technological innovation with human factors to ensure resilience, well-being, and long-term competitiveness in the digital-green transition.

Moreover this article highlights with real examples the importance of optimizing work processes through the automation of routine tasks and the implementation of ergonomics principles and modern technologies. By effectively utilizing these tools, not only is productivity improved, and time costs reduced, but the risk of human errors and incidents is also significantly decreased. Automation frees employees from repetitive and monotonous tasks, allowing them to focus on more complex, creative, and value-driven activities that require expert skills and analytical thinking.

The implementation of new digital technologies not only optimizes operational processes but also requires new skills and adaptation to changes in the work environment. Continuous skill development and the integration of practical experience are essential for successful functioning in a digitalized

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work environment. Approaches to training and upgrading competencies are equally important, as they ensure that employees can effectively work with modern technologies and respond to the dynamics of market conditions. Through digitalization and automation, a safer and more predictable work environment is created, ultimately leading to higher efficiency, fewer incidents, and increased satisfaction for both customers and employees. The collaborative implementation experience demonstrates practical, scalable solutions that offer valuable insights for a wide range of stakeholders seeking to modernize their business operations. These real-world applications showcase how integrating digital technologies with ergonomic principles can drive sustainable adaptation to the demands of the digi-tal era, while maintaining workforce wellbeing and operational efficiency.

The article results had been presented on virtual workshop: Technology for co-working on health and active life: 2nd conference (11 December 2025, https://kohs.at/cms/en/2025/10/29/technology-for-co-working-on-health-and-active-life-2nd-conference/), organised by: AAL Europe, FEES - Federation of the European Ergonomics Societies, KOHS – Austria, BAEHF – Bulgarian Association of Ergonomics and Human Factors, MET – Hungarian Ergonomics Society, Ergonomics Society of Serbia, IEA Technical Committee for Safety and Health, ÖAE – Austrian Ergonomics Society.

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- IA GO!
- DSGI Ergonómiai Mérnökiroda kft.
- CAPPADOCIA INNOVATION INSTITUTE TEKNOLOJİ LİMİTED ŞİRKETİ
- Wild Art LTD

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