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TECHNO-BURNOUT AS A SYSTEM SAFETY HAZARD: A MULTILEVEL MODEL OF THE DIGITAL WORKPLACE

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Abstract: Digitalisation and, increasingly, artificial intelligence adoption are transforming workplaces and increasing psychosocial risks that current occupational safety and health (OSH) systems only partially address. We propose a multilevel model that redefines burnout from an individual issue to a systemic hazard, shifting the emphasis from HR practices to system safety.
Combining the Job Demands–Resources (JD–R) theoretical framework, academic research and survey evidence, we highlight how features of the digital/AI workplace (algorithmic management, constant connectivity, biometric monitoring, flexibility, digital metrics over human judgment) create a double feedback loop of reactivity (incidents → tighter monitoring → higher demands) and silencing (burnout → under-reporting), which might cause systemic failure.
We propose three ideas that position techno-burnout as a key factor in socio-technical reliability, and argue that recognising techno-burnout as a systemic safety risk can shape the governance discourse by examining its implications and suggesting its inclusion in national AI legislation.
Keywords: risk management, health and safety, job hazard, occupational risk, risk assessment

1. INTRODUCTION

The rapid adoption of artificial intelligence tools is the latest in several waves of digital technology integration that have dramatically changed workplaces. While these tools are being progressively integrated, they are still only weakly incorporated into occupational safety and health (OSH) systems.
This revolution, which could have resulted in more sustainable and ethical organisations (Kuzior et al., 2021), also introduced new forms of coordination, control, and evaluation between workers and managers. Extensive research indicates that this emerging data-

driven oversight has reshaped managerial control, bringing socio-legal consequences such as reduced worker autonomy, faster work rhythms, unfair practices, and pervasive surveillance (Kellogg et al., 2020; Duggan et al., 2020).
E-monitoring is consistently linked to lower job satisfaction and wellbeing (Ajunwa et al., 2017). Digital work outside regular hours and constant connectivity are linked to feelings of exhaustion, stress, and detachment (Barber and Santuzzi, 2015; Cambier et al., 2019), affecting both mental health and the very productivity that digital technology boosts (La Torre et al., 2020).
In recent years, 43% of surveyed companies in 2024 reported integrating digitalisation into risk assessments (ESENER 2024), but, given that disempowerment and detachment were a primary driver of the Gen Y/Z Great Resignation phenomenon among the native digital generations (Kuzior et al., 2022), this form of technostress has prompted policy debates on issues such as the "right to disconnect", in hybrid and remote work (Eurofound, 2020).
OSH Pulse surveys (OSH Pulse 2022; 2025) consistently show high prevalence of stress, fatigue and eyestrain linked to digitalization and reveal a misalignment: cognitive technologies are advancing in the workplace faster than OSH systems can adapt, leaving psychosocial risks unmanaged. Furthermore, boundaries between constructs are thin, and burnout is often confused with related yet distinct concepts.
Table 1 briefly presents these constructs, along with their triggers, symptoms, and systemic impacts, and shows how they interrelate and influence safety concerns.

Table 1
Theoretical and conceptual framework

Construct	Definition	Triggers in Digital Workplaces	Systemic Implications
Stress	General psycho-physiological response when demands exceed resources	High workload, time pressure, and monitoring	Short-term errors, reduced decision quality
Technostress	Stress is linked explicitly to ICT and digital systems	Algorithmic management, connectivity, and digital surveillance	Less autonomy, disengagement, and error-prone performance
Fatigue	State of reduced energy, vigilance, and recovery capacity	Always-on culture, disrupted rest, multitasking	Attentional gaps, slower reactions, and increased accident risk
Burnout	Chronic, unmanaged workplace stress syndrome (exhaustion, cynicism, inefficacy)	Prolonged technostress without sufficient resources/support	System-wide reliability decline, under-reporting of risks, erosion of safety margins.

Source: own work

Occupational safety and health (OSH) studies mainly record the prevalence of digitalisation-related psychosocial demands and associate these conditions with increased stress, fatigue, and reduced well-being. On the other hand, research in human-

computer Interaction (HCI) reveals how continuous availability, notifications, and digital interruptions hinder recovery and increase cognitive load, leading to chronic stress (Barber and Santuzzi, 2015; Cambier et al., 2019). Ergonomics provides a different perspective, demonstrating how digitalisation acts as a control mechanism, reshaping autonomy and trust, diminishing human reliability, increasing violations, and reducing reporting (Kellogg et al., 2020; Jensen et al., 2024).
Combining these elements reveals a conceptual gap. These issues are primarily treated as health or performance concerns rather than as parts of larger organisational risk management frameworks. To support this argument, we draw on the Job Demands–Resources (JD-R) model to explain how high employer demands (e.g., increased work pace, continuous monitoring, or information overload) and limited resources (e.g., autonomy, participation, and support) can lead to burnout, while increased socio-economic resources can address higher demands and support worker-employer interactions (Bakker and Demerouti, 2017; Bakker et al., 2023).
We present a multilevel model that (1) details psychosocial mediators linking digital/AI features to burnout, (2) highlights reinforcing feedback loops that impair safety, and (3) develops testable propositions and governance levers aligned with ISO 45003 (ISO, 2021) and the EU AI Act.

2. METHODOLOGY

This article is conceptual and synthesises secondary evidence (such as ESENER and OSH Pulse); therefore, the standard Methodology section does not apply. Instead, the model combines and synthesises existing empirical evidence from various sectors through theoretical integration.

3. RESULTS

3.1. Psychosocial mediators of Digitalisation and AI adoption

Digitalisation and the spread of artificial intelligence (AI) in workplaces are often presented as neutral tools, but they function as organisational control systems. However, the pathways from adopting cognitive technologies to burnout are complex and can be understood through psychosocial processes within the Job Demands–Resources (JD–R) model.
Five features of this new type of workplace are especially consequential.
1) The distribution and evaluation of work increasingly rely on predictive analytics and performance metrics.
2) The development of IoT systems has increased electronic and biometric monitoring of workers' activities and bodies.
3) The positive effects of hybrid and remote work on work/life balance, a practice widely adopted during the pandemic, can be diminished by employees' expectations of always being digitally available. The pressure to stay constantly connected makes it difficult to disconnect from work outside regular hours. Over time, insufficient recovery from this continuous connectivity can lead to faster exhaustion and decreased resilience.
4) The socio-technical character of Industry 4.0 environments is driven by production systems that adapt in real time to reconfigure workflows. While this improves process flexibility, it also makes workflows unpredictable for workers, potentially increasing cognitive load.

5) The introduction of opaque algorithmic decision-making can indirectly reduce the sense of purpose within the organisation, disempowering workers, undermining perceptions of fairness and legitimacy, if metrics replace human judgment on professional achievements. These psychosocial mechanisms act as mediators within the model, illustrating how technologies tend to weaken key social resources previously available to workers.

3.2. Multilevel causal architecture

The dynamics described in the model operate at both the institutional and organisational levels, down to the individual employee level. Understanding the psychosocial hazards of digitalisation requires a multidimensional approach that links micro-cognitive processes with meso-organisational dynamics and macro-governance constraints. In environments requiring high precision and focus even slight drops in concentration can lead to serious accidents or safety hazards.

At the meso level, these features influence organisational processes by triggering a socio-technical feedback loop. However, at the systemic level, burnout weakens the reliability of socio-technical systems. When a significant portion of the workforce is exhausted or disengaged, the chances of errors, near misses, and rule violations rise.

Figure 1 illustrates a multilevel causal structure where governance and involvement serve as moderating layers. It outlines how digital and AI features lead to psychosocial mediators, which then influence burnout and ultimately impact safety outcomes.

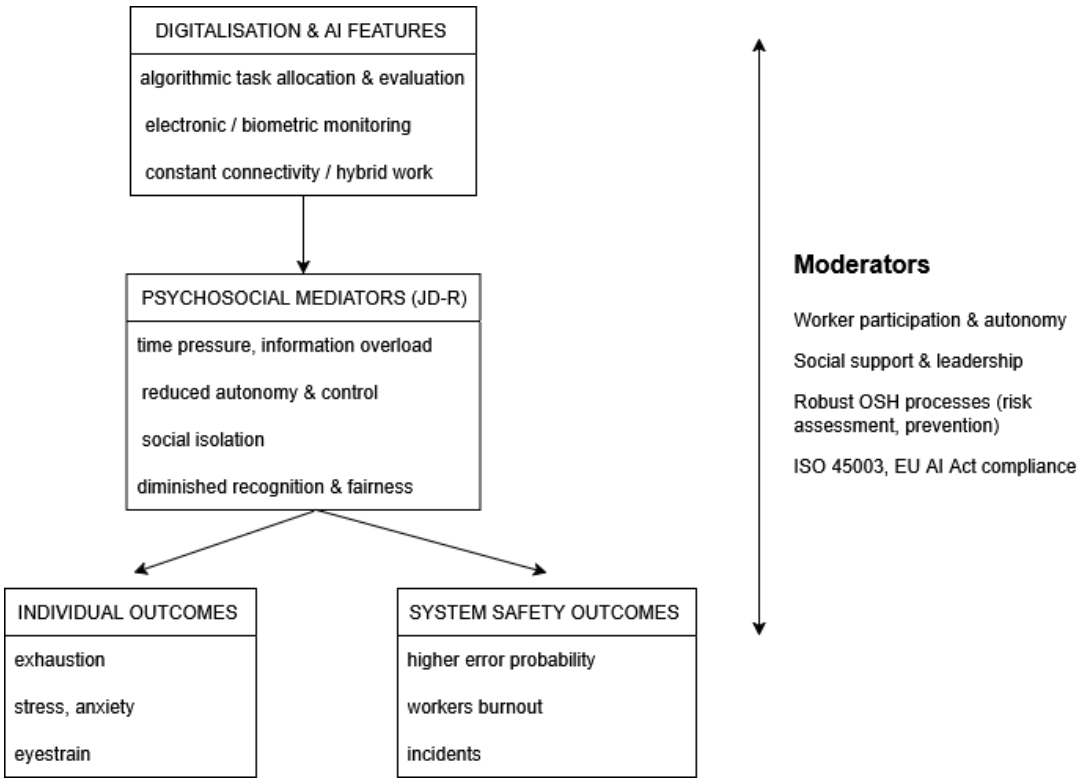

Fig. 1. Conceptual model of how digitalisation and AI features generate psychosocial demands that contribute to burnout and system safety risks, moderated by resources, governance, and worker participation.

3.3. Feedback dynamics

The pathways described above are not solely linear. In many organisations, the interaction between ICT adoption and psychosocial stress evolves through recursive feedback loops that strengthen risk. We can utilise system dynamics mechanisms to explain why psychosocial hazards, once present, are hard to reverse and why burnout may become a structural aspect of work systems.

One such mechanism is the reactivity loop. This pattern is clearly seen in logistics and gig-economy settings, where studies show that incidents or delays often lead to stricter algorithmic controls, shorter time buffers, and more detailed performance monitoring (Li et al., 2024; Mbare et al., 2024).

Figure 2 illustrates the reactive feedback loop triggered by incidents, when organisations often respond by increasing monitoring and control through tighter surveillance or more detailed data collection. Although these measures aim to reduce risk, they raise work demands, and as a result, stress increases the likelihood of further incidents, prompting even stricter monitoring. The cycle then repeats, raising risk rather than lowering it.

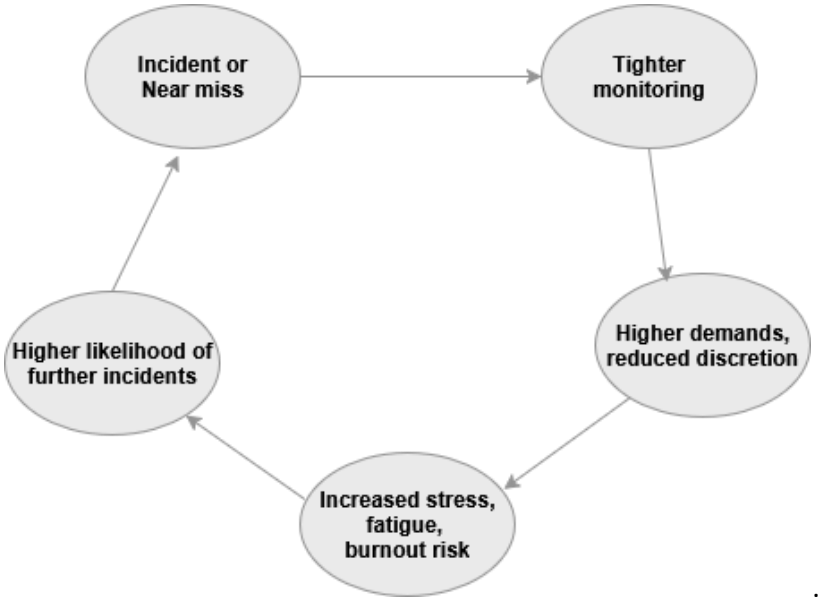

Fig. 2. Reactivity loop of incidents triggering monitoring, escalating demands, and stress.

Another mechanism is the silencing loop, particularly in healthcare. AI triage tools, clinical decision support systems, and digital dashboards can heighten moral stress and reduce clinicians' sense of autonomy. Evidence shows that in such settings, staff who are fatigued or under digital surveillance are less likely to report concerns, often due to fear of repercussions or skepticism that reporting will result in change (El-Helaly, 2024; Consiglio et al., 2023). Recent data from emergency care and hospital informatics show that digital escalation pathways can unintentionally hide signals when staff experience cognitive overload or depersonalization (Tu et al., 2025).

As stress builds into burnout, workers often stop speaking up, reporting “near misses, " or raising safety concerns, viewing reporting as unhelpful or too costly. This withdrawal of communication reduces the early warning signals that compliance and safety teams rely on to detect emerging risks. Without feedback to address these hazards as they develop,

the organisation's safety margins can erode over time, potentially only becoming apparent after a serious incident occurs.
Figure 3 illustrates the silencing loop, showing how under-reporting happens, along with the panel in Figure 2, which illustrates the recursive processes through which entrench psychosocial risks.

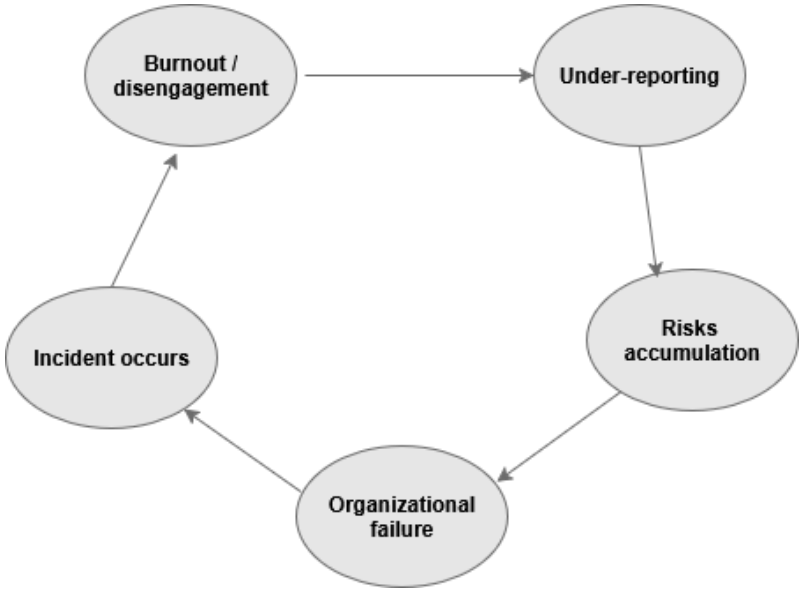

Fig. 3. The panel shows the silencing loop in which burnout leads to under-reporting of risks, which hampers the detection of weak signals and can ultimately precipitate organizational failure.

These loops show how psychosocial risks can become self-sustaining, acting as systemic dynamics that heighten vulnerabilities over time, and highlight the need for organizations to actively work to restore the balance between technological efficiency and human resilience.
The conceptual model can be summarised as a set of propositions that outline its central claims and act as a foundation for future empirical analysis.
Proposition 1 suggests that the integration of digitalisation and AI features elevates job demands while reducing job resources, which in turn heightens the risk of burnout.
Proposition 2 suggests that burnout mediates the impact of psychosocial stress on system safety.
Proposition 3 suggests that integrating psychosocial and digital risks into OSH systems, supported by worker participation and governance frameworks, can help mitigate these risks.
Each proposition can be operationalised using multilevel data (e.g., unit-level demands/resources; worker-level strain; incident/near-miss rates), enabling longitudinal testing in future research.
Together, these propositions form the core of the model's theoretical contribution by emphasising burnout as a central safety issue in workplaces powered by AI. They also highlight governance and participation as crucial tools for mitigation. The sectoral patterns in Table 2 demonstrate how digital and AI features can act as psychosocial hazards, illustrating how the mechanisms in the conceptual model function across different socio-technical settings.

Table 2

Sectoral examples of how digital and AI features create psychosocial mechanisms, burnout pathways, and safety impacts

Sector	Digital and AI Feature	Psychosocial Mechanism	Burnout loop mechanism	Safety / System Impact	Sources (2022–2025)
Manufacturing in Industry 4.0 & 5.0)	Real-time workflow reconfiguration; IIoT monitoring; Human-robot collaboration	Unpredictability, vigilance demands, cognitive overload	Cognitive strain → fatigue → burnout	Reduced attention, automation, and near-miss accident risks	Castagnoli et al. 2024; Giallanza et al. 2024; Zorzenon et al. 2022; Farmaneshet al. 2025
Healthcare	AI triage; clinical decision support; digital supervision	Time pressure, moral strain, reduced autonomy	Emotional exhaustion → depersonalization → burnout	Decision errors, underreporting of near misses	El-Helaly 2024; Tu et al. 2025; Consiglio et al. 2023
Logistics and Gig Work	Performance scoring, and dynamic route optimisation	Loss of control, fragmented tasks, continuous evaluation	Fatigue → frustration → burnout	Unsafe driving, errors, turnover instability	Li, 2024; Mbare et al. 2024; Jiao 2023
Office and Hybrid Work	Email pressure, notifications, monitoring, virtual workload	Telepressure, boundary erosion, recovery deficit	Chronic exhaustion → disengagement → burnout	Reduced decision capacity; cognitive slips	Consiglio et al. 2023; Ioannou et al. 2023; Marsh et al. 2024
Remote Education	LMS platforms, a/synchronous load	Attentional demands, work–life conflict	ICT-driven fatigue → burnout	Lower accuracy, delayed responses	Tu et al. 2025
Public Administration	Algorithmic decision; digital workflows	Autonomy loss, procedural overload	Strain → cynicism → burnout	Reduced reliability; error escalation	Berger 2024

Source: own work based on sectoral literature (2022–2025).

The following discussion examines the broader implications of this reframing. Specifically, we explore how viewing burnout as a system safety hazard alters how organisations, regulators, and researchers should approach psychosocial risk.

4. DISCUSSION

Beyond the general dynamics outlined in the model, the sectoral evidence presented in Table 2 clarifies how digital and AI features can become psychosocial hazards with safety-relevant consequences, rather than remain abstract "risk factors".

Our findings support the argument that psychosocial risks, like physical dangers, should be incorporated into OSH governance. Regulations and standards, such as ISO 45003

(ISO, 2021), offer practical guidelines for organisations to identify, analyse, and mitigate psychosocial hazards. Simultaneously, the EU Artificial Intelligence Act (Regulation [EU] 2024/1689) explicitly designates AI systems used for employment and worker management as "high-risk."

Governments are influential because public funding directly correlates to AI adoption among businesses (Gualandri and Kuzior, 2024b). However, national AI strategies differ widely and include a range of safety measures, but the application is uneven. In more advanced economies, governance tends to restrict risks, but in developing economies, it is guided towards opportunities (Gualandri and Kuzior, 2024a).

The model presented here encourages further empirical research to investigate how feedback loops evolve over time and under which conditions they become fixed or fade away.

Future research could pursue several avenues:

1) As a set of measurable drivers, such as perceived usefulness/ROI, total and switching costs (including incentives), ease of integration/usability, and trust/privacy, influence most technology adoption, according to evidence from adjacent diffusion studies (Gualandri and Kuzior, 2023). Governments and monitoring organisations must focus on psychosocial controls, as these drivers offer a template for predicting where workplace AI will focus.
2) Connect organisation-level practices to worker social outcomes using multilevel data to assess employer–worker relationships. Current surveys face challenges due to diverse designs, varying in units, sampling methods, and wording; consequently, measurements are often not comparable.
3) Another emerging factor is to examine sectoral differences in AI adoption, as exposure is likely uneven across industries, particularly in sectors where safety is a top priority, such as manufacturing, healthcare, and construction.
4) Although digital and AI governance frameworks are pretty recent, longitudinal studies are necessary to evaluate whether and to what degree their implementation genuinely impacts OSH practices and alleviates psychosocial burdens over time.

5. CONCLUSION

This paper argues that techno-burnout should be viewed as a systemic safety hazard rather than merely an individual health concern. Digitalisation and AI transform work by elevating cognitive, emotional, and time-related demands while depleting crucial resources like autonomy, predictability, and recovery. Using the JD-R framework and evidence from various sectors, we demonstrated how these pressures build up into chronic stress and create reinforcing feedback loops, ultimately reducing safety margins across socio-technical systems.

Examples across sectors reveal that psychosocial load is an unseen organisational factor that decreases attention, lowers reporting, and impacts reliability long before any critical incidents occur. Recognising these patterns shifts occupational safety and health (OSH) from a reactive, compliance-oriented approach to a proactive governance focus, integrating psychosocial risks, engaging workers, and utilising human-centred AI. Future research should combine long-term, multilevel data with safety metrics to empirically validate these conclusions.

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