Integrating Industry 5.0 Safety Principles into Human Performance Models

Carlos Albarrán Morillo [a], Micaela Demichela[a]

[a] Applied Science and Technology Department, Politecnico di Torino, Turin, Italy

E-mail: *carlos.albarran@polito.it*

The transition toward Industry 5.0 demands a renewed educational focus on technologically integrated, human-centered safety measures within industrial systems. This contribution presents a 7-step framework designed to embed Industry 5.0 safety principles into human performance models, with the aim of improving safety, well-being, and good practices in industrial environments. The framework integrates real-time monitoring, wearable technologies, and AI-assisted risk evaluation, supporting the identification of risks and the proposal of targeted corrective actions. It gathers heterogeneous data from human monitoring, subjective perceptions, environmental conditions, and workplace characteristics—consolidated within an intelligent ecosystem known as live-labs.

The framework has been validated through a series of case studies conducted in diverse industrial settings, including simulated production environments, automotive quality control, and pharmaceutical packaging lines. These applications demonstrate the framework's flexibility in different operational contexts and provide helpful guidance for improving safety performance. Through the live-labs, participants were monitored under real working conditions, enabling the identification of critical physical and cognitive risks. The successful implementation of corrective measures based on these insights demonstrates the framework's value not only as a robust, data-driven safety tool but also as an effective educational resource for integrating Industry 5.0 principles into engineering education and workforce training.

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