HEALTHY WORKPLACES SUMMIT 2025

Safe and healthy work in the digital age

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Healthy Workplaces

- This study investigates **the implications of digital technologies and artificial intelligence-based worker management** (AIWM) **systems for occupational safety and health** through a comparative analysis of two automotive companies in Belgium and Italy.

- The research aims to explore how these technologies influence work organisation, workers' wellbeing and OSH in different organisational settings.

- By examining the **contrasting experiences of a large Original Equipment Manufacturer in Belgium and a smaller Tier 1 supplier in Italy,** the study sheds lights on firm heterogeneities **against a determinist perspective on technological change**, underlining the critical role of **worker participation.**

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Methodology

The two companies, which are located in Belgium and Italy, were selected with the direct involvement of EU-OSHA experts, according to three main criteria:

- belonging to the **automotive industry**, because of the wide adoption of new technologies and the tradition of OSH preventive practices in the sector;
- the **implementation of the technology of interest** at the plant level;
- the **companies willingeness** to allow a comprehensive in-depth field study.

Qualitative case study analysis: 30 interviews of managers and workers, visits to the **two plants** and collection of additional material.

The case studies

	Belgian company	Italian company
Type of company	**OEM** belonging to a large company in Belgium	**TIER 1** belonging to a big international company
Location	Northern Belgium	Southern Italy
Type of production	Paint shop, welding and final assembly plant	Production of carbon coated synchronizer rings for car production
Product	cars	coated synchronizer rings
Number of employees	7000 workers	49 workers
Production volume (2023)	200,000 cars	6,8 million rings
Turnover	High turnover	Almost zero turnover with high level of tenure
Trade Union	Yes	No, but two workers are elected as internal representatives
Work organization model	Standard lean practices	Well developed lean practices
Technologies	Digital and automated technologies	Digital and automated technologies

Main (interdependent) domains of analysis

Technology

Health and safety occupational risks

Work organization

Technology: the role of complementarity

The adoption of AIWM in the workplace can be understood only if accounting for the broader set of **complementary technologies** and devices that, while being used for different goals, contribute to the development of an efficient systems of algorithmic management:

- **digital tools and sensors** (e.g. barcode scanners, wearables);
- **automated machineries digitally connected** (e.g. thermopresses producing data on temperature and number of defects);
- **production software systems** (e.g. MES) **and user interfaces**;

- **workers' management systems** that allow an automated or semi-automated decision-making process (applying both predefined rules in forms of fixed algorithms and learning models based on AI).

Adoption of AIWM in the two plants: converging trends

Despite **some differences in terms of intensity and integration,** AIWM systems are widely used by the two companies for the following purposes:

- **Task allocation**: Automated daily assignment of operators' work via screen devices, and real-time alerts regarding required statistics to be compiled before and during work.
- **Monitoring processes and worker performances**: Providing feedback to management on solution-oriented strategies and alerts on preventive measures.
- **Quality and safety controls**: Validation of batch packaging and machine temperature monitoring to ensure compliance with quality and safety standards.
- **Planning and maintenance strategies**: Adjustments to production plans in response to changing requirements and alerts for preventive and predictive maintenance based on breakdown frequency.
- **Logistics management**: Real-time updates on raw material deliveries, final product picking, warehouse management and batch composition validation.

Health and safety risks: the Italian company

The Italian company has **implemented over time an extensive risk assessment process in collaboration with OSH specialists.** This has successfully reduced the incidence of OSH risks **well below the minimum legal thresholds for intervention.**

In this context, the **adoption of AIWM has led to significant improvements** in further reducing ergonomic risks across all departments due to:

- **the reduction in the number of physical movements** necessary for communication and task execution in production and maintenance departments;
- **higher efficiency in logistics** (picking, delivering and packaging). Operations become less physically demanding due to the virtual warehouse system that tracks the composition and location of all batches.

Health and safety risks: the Belgian company

In the Belgian company, a **conflict between productivity goals and OSH risks persists**, often favouring immediate efficiency gains over long-term OSH considerations. This is confirmed by the high rate of workforce turnover (20 workers exit from the company on average every week).

In this case, **AIWM systems are implemented with no clear positive effect on ergonomic and physical risks**, given the **high workload** and **pace intensity**. Detailed health and safety monitoring made possible by these technologies is not comprehensively implemented across departments and lines of production.

Workers' autonomy: contrasting results in the two plants

The Italian company

- Operators report **a sense of greater autonomy** when they can view their work assignments on monitors without consulting with supervisors.
- In logistics, **real-time access to updated information** about each workstation i**mproves the efficiency** of the delivery schedule.
- Maintenance workers benefit from receiving detailed assistance requests and having access to historical breakdown data, which **increases their confidence in the decision-making process.**
- Both middle managers and operators report an amplified sense of **'empowered professionalism',** due to overall standardisation of the process (better control of unexpected events and higher knowledge of the process)

The Belgiam company

- **Minimal autonomy granted to** assembly line operators: the sequence of movements is strictly dictated and closely monitored by the AIWM system, leaving little room for deviation.
- Logistics operators **receive task allocations from the AIWM system**, but they enjoy some degree of autonomy because tasks are not strictly sequenced, Nonetheless, the **prescribed timeframe is very strict and deviations are not allowed**.
- Team leaders enjoy **relatively more autonomy** due to their responsibilities, although the extent of this autonomy is contingent on the specific nature of their workstation.

Cognitive stress and technology: the Italian company

In the **Italian company**, we observe an overall enhancement in mental and cognitive wellbeing along **the entire hierarchical structure:**

- **Managers** benefit from reduced mental stress due to the system's ability to **facilitate preventive interventions**, advanced risk assessments and immediate responses to unexpected issues.

- **Operators** report a **lighter workload due to AIWM tools** such as statistical alerts for production, checklists set up for maintenance and batch validation for logistics. These tools **reduce the cognitive burden by automating task reminders and minimising interruptions that previously contributed to stress at work and at home.** However, concerns about the **potential degradation of essential basic skills** such as memory and prompt reflection arise.

Cognitive stress and technology: the Belgian company

In the **Belgian company**, AIWM and digital technologies **impact workers' stress and workload differently depending on their occupational role:**

- **Team leaders**, who are mostly affected by these technologies, **experience varying levels of stress based on the nature of their tasks and team performance**. Some face high stress due to task overloads and time-sensitive issues, particularly when managing technical malfunctions.

- **Logistics operators** using pick-to-voice systems may face frustration and stress if the system fails to recognise their inputs, resulting in task delays. Additionally, while pick-to-voice and 'pick-to-light' systems are perceived as helpful in reducing errors, **excessive reliance on these systems may lead to decreased attention and potential mistakes.**

Concluding remarks

The **implications** of **AIWM for OSH are not univocal**, since they are strongly affected by the **socio-technical characteristics of the organizations**

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The **implications** of **AIWM for OSH are not univocal**, since they are strongly affected by the **socio-technical characteristics of the organizations :**

- AIWM can **foster greater worker autonomy and enhance job satisfaction**, reducing stress when **workers keep the control over their tasks and are involved in the implementation process.** This will also lead to healthier work environments and lower psychosocial risks.
- AIWM can also determine a **higher intensification and fragmentation of tasks, inducing workers to prioritise speed over their health and safety and to feel disempowered by the technology**, at the expense of their mental and physical wellbeing.

Concluding remarks

Addressing these implications requires adopting a “**human-centred design in AIWM deployment**” and a social-embedded OSH prevention strategy on new technologies, ensuring that **systems are transparent, support workers' empowerment and allow for their direct participation in decision-making processes.**

Thank you!

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Comparative report (Annarosa Pesole and Armanda Cetrulo) available at: https://osha.europa.eu/en/publications/digital-technologies-worker-management- implications-safety-and-health-comparative-study-two-automotive-companies.
Belgian report (Dirk Gillis) available at:https://osha.europa.eu/en/publications/risks-and-opportunities-ai-based-worker-management-systems-automotive- manufacturing-plant-belgium
Italian report (Armanda Cetrulo) available at: https://osha.europa.eu/en/publications/ai-based-worker-management-automotive-parts-manufacturer-italy- implications-occupational-safety-and-health