

**Digital technologies for worker management and
implications for safety and health:
evidence from two case studies in the automotive
sector in Belgium and in Italy**

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Introduction

Digital technologies and artificial intelligence-based worker management (AIWM) systems are increasingly transforming traditional workplace environments.

- Algorithmic technologies are employed to **enhance productivity, streamline operations and optimise labour management** (*Calvino & Fontanelli, 2023; Filippucci et al., 2024*).
- These systems can perform several managerial functions, including **task allocation, performance monitoring and real-time decision support**, altering and modifying schemes of work organisation (*Mateescu & Nguyen, 2019*).
- The collection of **vast amounts of data** is **crucial** as it allows to organise workloads, make predictions or decisions about production processes, monitor workers' performance, control and automate tasks (*Kellogg et al., 2020; Wood, 2021; Baiocco et al., 2022; EU-OSHA, 2023*).

The impact of AIWM on labour in the manufacturing sector

Recent case studies show that the AIWM adoption process and **its implication on labour** are **not univocal**, but rather depend on:

- the level of **standardisation of specific tasks**, the **endowment of digital infrastructures**, the existence of **institutional constraints** on technology use, and the **relative cost of labour** in comparison to technology adoption (Rani et al., 2024);
- the type of **production process**, whether labour or capital intensive (Krzywdzinski, Evers and Gerber, 2024);
- the presence of a **unionized workforce** with strong bargaining power and the degree of **workers' direct involvement** (Krzywdzinski, Schneiß and Sperling, 2024; Dupuis and Massicte, 2024).

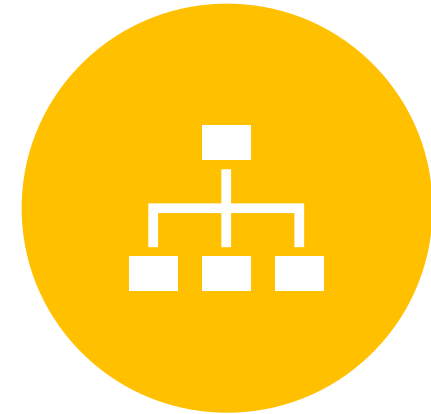
Main (interdependent) domains of analysis



TECHNOLOGY



**HEALTH AND SAFETY
OCCUPATIONAL RISKS**



WORK ORGANIZATION

Digital technologies for worker management: implications for safety and health. A comparative study of two automotive companies in Belgium and Italy

Report

- This study investigates **the impact of digital technologies and artificial intelligence-based worker management systems (AIWM)** on work organisation, workers' wellbeing and OSH in different organisational settings.
- Two qualitative case studies with **30 interviews of managers and workers**, visits to the **two plants** and collection of additional material.
- **The contrasting experiences of a large OEM in Belgium and a smaller Tier 1 supplier in Italy** shed lights on firms heterogeneities **against a determinist perspective on technological change**, underlining the critical role of **worker participation**.

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Warning: The two companies display important differences that need to be considered!

The 2 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

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

Adoption of AIWM in the two plants: converging trends

Despite some differences in terms of intensity and integration, AIWM systems are widely used in both 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 Belgian company

- **Persistent conflict between productivity goals and OSH risks**, 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.
- **Cognitive stress** seems to increase, in particular for team leaders due to intense task overloads and technical bottlenecks.

Workers' autonomy: the Belgian 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.

Health and safety risks: the Italian company

OSH risk incidence **well below the minimum legal thresholds for intervention**. AIWM further reduced ergonomic risks 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.

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 cognitive burden at work and at home due to AIWM tools** such as statistical alerts for production, checklists set up for maintenance and batch validation for logistics. However, concerns about the **potential degradation of essential basic skills** such as memory and prompt reflection arise.

Workers' autonomy: 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 improves 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).

Concluding remarks ⁽¹⁾

- **Implications of AIWM for OSH are not univocal**, but they are strongly affected by the **socio-technical characteristics of the organizations** :
 - AIWM can 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.
 - AIWM can also **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.

Concluding remarks (2)

Among the **socio-technical characteristics** of firms that seem to play a crucial role:

- Position in the **value chain**
- Type of production process (**quality standards, competition**)
- **Lean regimes**: from “lean enough” (Vidal, 2007) to “lean 4.0”
- **Workers’ voice** in shaping the innovation

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Which role for trade unions and which model of redistribution of productivity growth) ?

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>