Sustainable Smart Manufacturing: MES and the Social Pillar of Industry 5.0

BY LUIGI DE BERNARDINI | TUE DEC 9 2025

Empowering People, Communities, and Purpose Through Technology

For much of the past decade, the sustainability conversation in manufacturing has been dominated by environmental goals: reducing emissions, conserving energy, and minimizing waste. While those remain vital, the future of sustainable manufacturing will also be shaped by **social responsibility**—how businesses support people, communities, and equity across the value chain.

This broader view is reflected in the **United Nations 2030 Agenda for Sustainable Development**, which outlines 17 Sustainable Development Goals (SDGs) spanning environmental, social, and economic dimensions. For manufacturers, aligning with these goals is no longer optional. Customers, employees, investors, and regulators are demanding action—not just on climate, but on **human dignity, decent work, diversity,**

inclusion, education, and well-being.

So where does the Manufacturing Execution System (MES) fit into this picture? Surprisingly, at the very center.

While MES is traditionally seen as a system for production control and quality assurance, it is also uniquely positioned to drive transparency, accountability, and equity across the social dimension of sustainability. It does so by embedding **people, processes, and purpose** directly into the digital core of operations.

1. **Reframing MES as a Social Sustainability Enabler**
   Modern MES platforms are no longer limited to tracking machines and materials—they also capture detailed information about **human activity**: who performed each task, under what conditions, how long it took, and what competencies were involved. This data provides the foundation for far-reaching social responsibility strategies, including:

- **Decent work and labor practices (SDG 8)**: MES can help ensure that tasks are assigned based on certified competencies, fatigue is monitored, and overtime patterns are visible—protecting workers from unsafe or unfair conditions.
- **Gender equality and inclusion (SDG 5)**: By anonymizing and analyzing operator data, MES can reveal hidden disparities in task assignments, performance expectations, or advancement opportunities.
- **Health and safety (SDG 3)**: MES can integrate with IoT safety systems to track compliance with protective equipment protocols, report near-misses, and trigger alerts in unsafe conditions.
- **Training and development (SDG 4)**: MES-linked learning management modules can identify skill gaps, recommend training paths, and track learning-by-doing across shift cycles and job roles.

   In other words, MES becomes a **real-time system of record for how work happens**—not just mechanically, but socially.

2. **Human-Centric Manufacturing: Industry 5.0 in Practice**
   Industry 5.0 brings a new philosophy to industrial innovation: humans and machines must **collaborate, not compete**. In this model, MES is more than an execution platform—it becomes the **interface between human potential and digital empowerment**.

   Examples include:

- **Context-aware guidance**: MES can provide operators with visual, step-by-step work instructions adapted to their language, experience level, or even cognitive load.
- **Assisted decision-making**: Integrated AI within MES can suggest corrective actions when errors occur, not just to fix the issue, but to help workers learn.
- **Adaptive workflows**: MES can route complex tasks to experienced personnel while offering simpler variants to those in training—creating **inclusive pathways for upskilling** and contribution.
  These features reflect a shift from automation as replacement, to **automation as augmentation**—supporting SDGs like **reducing inequalities (SDG 10)** and **promoting inclusive, sustainable economic growth (SDG 8)**.

3. **MES and Ethical Supply Chains**
   The social impact of manufacturing extends beyond factory walls. Consumers and regulators increasingly expect transparency about **working conditions throughout the supply chain**—from raw materials to finished goods.

   MES plays a vital role here, especially when systems are integrated across suppliers and partners. With shared MES data and standardized traceability, companies can:

- Monitor compliance with labor and ethical sourcing standards
- Track working time, subcontracting, and quality compliance
- Certify that products were not made under exploitative or unsafe conditions
  This transparency supports **responsible consumption and production (SDG 12)** and strengthens **partnerships for sustainable development (SDG 17)**.

4. **Social Metrics You Can Actually Measure**
   Sustainability reporting is only as credible as the data behind it. MES provides **verifiable, timestamped, auditable records** of everything that happens in production—including human participation.

   This enables manufacturers to track and report on:

- Training hours by role or demographic
- Distribution of tasks across gender and age groups

- Health and safety incident trends by location or shift
- Productivity impact of ergonomic interventions

  These aren't abstract metrics—they are operational realities that MES captures **by design**. As companies prepare ESG disclosures, MES becomes a critical source of **social performance data**—not just environmental.

5. **Strategic Value: Social as a Business Driver**
   Beyond compliance and reporting, investing in social sustainability is **strategically smart**. Manufacturers that create fair, empowering workplaces benefit from:

- **Improved retention**: Skilled workers stay longer where they feel safe, respected, and valued
- **Higher engagement**: Empowered employees are more productive, innovative, and customer-focused
- **Talent attraction**: The next generation of workers prioritizes purpose, not just pay
- **Brand equity**: Ethical operations build trust with customers, communities, and investors

  MES, as the digital core of production, helps bring this strategy to life. It operationalizes values by making **social sustainability measurable, manageable, and improvable**.

6. **Final Thoughts: A New Responsibility for MES**
   As the manufacturing world embraces Industry 5.0 and aligns with the UN 2030 Agenda, it's time to expand how we think about MES.

   Yes, MES still ensures traceability, compliance, and efficiency. But more than that, it now helps define how organizations **treat their people, build community trust, and shape equitable futures**.

   It's no longer enough for technology to be smart. It must also be **ethical, inclusive, and human-aware**. MES, when reimagined, is not just a system of control—it's a **system of conscience**. And that's what tomorrow's sustainable factories will be built upon.