

## **PROSPECTS 5.0 Industry 5.0 Wiki**

### On the Concept of Industry 5.0: Supporting Agile and Resilient Workforces

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## On the Concept of Industry 5.0: Supporting Agile and Resilient Workforces

Industry 5.0 advances the principles of Industry 4.0 by integrating human-centricity, sustainability, and resiliency as foundational elements. While Industry 4.0 focused on the integration of cyber-physical systems, automation, and the Internet of Things (IoT), Industry 5.0 brings humans back to the centre of production. It emphasizes human-centricity, sustainability, and resilience, aiming to create a harmonious collaboration between humans and technology. This shift is particularly relevant to personnel scheduling, especially in industries dealing with labour shortages and the pressure to enhance operational efficiency.

### Integrating Strategic, Tactical, and Operational Decision-Making

Multi-level integration of strategic, tactical, and operational decision-making is essential for Industry 5.0-aligned personnel scheduling. Each layer plays a distinct role, and their combined integration enables companies to dynamically adapt workforce management to long-term goals and real-time disruptions, embedding flexibility throughout the system.

1. **Strategic Decision-Making** involves long-term workforce planning to align with business goals, including forecasting labour needs, capacity planning, and investing in skills development to meet future challenges.
2. **Tactical Decision-Making** bridges the gap between strategy and operations, focusing on medium-term adjustments in workforce deployment, addressing seasonal fluctuations, and ensuring a multi-skilled workforce ready to meet changing demands.
3. **Operational Decision-Making** deals with the immediate allocation of personnel, using **real-time scheduling**, dynamic shift adjustments, and **machine learning algorithms** to handle day-to-day disruptions, such as absenteeism or demand spikes.

### Synergy Across Decision Levels

What makes Industry 5.0's approach innovative is the **synergy** between these levels. Strategic decisions set the framework for tactical plans, which provide the structure for operational actions. In turn, operational data feeds back into tactical and strategic adjustments, creating a feedback loop that optimizes **personnel scheduling** in real time. For instance:

- **Strategic decisions** guide workforce size and skills development to ensure long-term capacity.
- **Tactical decisions** translate these strategies into agile medium-term plans, enabling flexible deployment.
- **Operational decisions** adjust personnel allocation in real-time based on immediate needs, ensuring minimal disruption.

### Embedding Flexibility into Scheduling Systems

The essence of Industry 5.0 in personnel scheduling lies in embedding flexibility across all decision-making layers. This flexibility is achieved through several innovative methods:

- **Agility policies:** Techniques such as shift-swapping and annualized hours provide both managers and employees with the ability to adjust schedules in response to fluctuating demand.
- **Proactive and reactive scheduling:** Proactive scheduling incorporates buffer hours for high-demand periods, while reactive approaches adjust schedules in real time when disruptions occur.
- **Agile algorithms:** Using prescriptive approaches, these algorithms not only predict outcomes but also recommend optimal personnel deployment strategies in real time.

### Embedding Human-Centricity, Sustainability, and Resiliency in workforce scheduling for Industry 5.0

1. **Human-Centricity:** Personnel scheduling in Industry 5.0 prioritizes employee well-being and autonomy. Innovations like self-scheduling systems and shift-swapping mechanisms offer employees more control over their schedules. This approach not only improves employee satisfaction and retention but also ensures operational efficiency. By balancing performance with human-centric policies, organizations can meet business needs while ensuring that employee satisfaction is a key metric.
2. **Sustainability:** Sustainability in Industry 5.0 goes beyond environmental impact, extending to sustainable workforce management. Sustainable scheduling models, such as annualized hours, help businesses distribute labour more evenly throughout the year, minimizing reliance on temporary labour and overtime. These models optimize resource use, and reduce operational waste, particularly in volatile production environments.
3. **Resiliency:** Incorporating resiliency into personnel scheduling is crucial for adapting to unpredictable demand or operational disruptions. Industry 5.0 fosters the development of agile workforce systems that can dynamically adjust staffing levels in response to real-time data. Dynamic rescheduling algorithms allow companies to reallocate personnel in response to sudden demand surges or absences, ensuring continuity without sacrificing productivity. This is especially relevant for sectors such as logistics and manufacturing, where just-in-time production requires agile responses to workforce fluctuations.

### Conclusion

The integration of strategic, tactical, and operational decision-making in personnel scheduling is central to optimizing workforce deployment in the Industry 5.0 landscape. By embedding flexibility at every level of decision-making, companies can improve operational efficiency and align with human-centric, sustainable, and resilient principles. This approach enables businesses to better adapt to labour shortages and demand

fluctuations while enhancing employee well-being and satisfaction, making the workforce more agile and responsive to the dynamic needs of modern industries.

### References

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