

Simulation-based Assessment of the Impact of the Learning Curve and Robust Worker Scheduling on a PI Inspired Assembly Factory

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Conference Domain Fitness: *This paper falls in the domain of enhancing the economic and environmental efficiency, resiliency, and sustainability of fulfilling needs for physical objects and the service they provide, and more specifically of the way we move, deploy, realize, supply, design, and use physical objects in a manufacturing facility which acts as a PI node in a larger manufacturing physical intranet.*

Physical Internet (PI) Roadmap Fitness: *Select the most relevant area(s) for your paper according to the PI roadmaps adopted in Europe and Japan: ☒ PI Nodes (Customer Interfaces, Logistic Hubs, Deployment Centers, Factories), ☐ Transportation Equipment, ☐ PI Networks, ☐ System of Logistics Networks, ☐ Vertical Supply Consolidation, ☐ Horizontal Supply Chain Alignment, ☐ Logistics/Commercial Data Platform, ☐ Access and Adoption, ☐ Governance.*

Contribution abstract

When operating any manufacturing facility, the resources required for performing tasks need to be scheduled based on the estimated processing time distribution. Nevertheless, when introducing new products or setting up a new facility these times are unknown and subject to the workers' ability to grasp the tasks quickly. Therefore, there is a learning process in which the processing times will decrease as the tasks continue to be repeated. For dealing with this phenomenon, a robust resource scheduling methodology is proposed for planning for the delays caused by the learning process.

A high-fidelity discrete-event agent-based simulator built using the commercial software Anylogic allows simulating individual tasks with different resource requirements and precedencies, and captures some important KPIs such as labor utilization, labor cost, throughput, and workstation service level status (if tasks are on time or getting late). A physical internet inspired assembly factory was selected to be evaluated, which consists of one fractal cell with 11 stations as described by Bao et al., -2024. This paper evaluates the impact on the key performance indicators (KPIs) of the workers' learning curves at different learning rates and the effect of different resource scheduling policies, giving managerial insights on how to implement a resilient resource scheduling.

References

- Bao, W., McGinnis, L., Campos, M., Zhihan, L., Maurice, J., Montreuil, B., & Babalou, S. (2024). A Modular and Flexible Design of Hyperconnected Assembly Factory. International Physical Internet Conference. Savannah, USA.