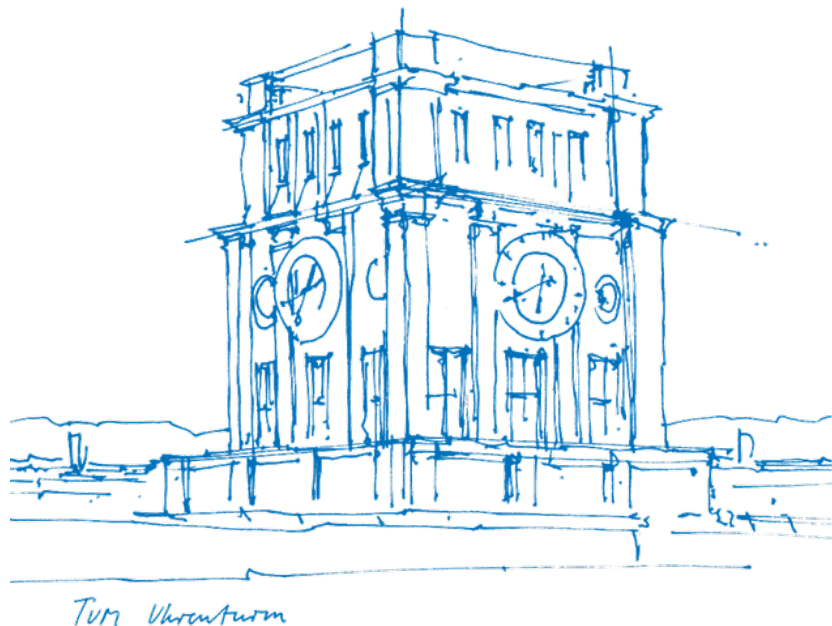


Interdisciplinary Project (IDP) Master's of Informatics

Chaeun (Joy) Lee, Duc Trung Nguyen

Production Order Release Agent in SAP S/4HANA Public Cloud Edition



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Produktionsauftragsfreigabe-Agent in der SAP S/4HANA Public
Cloud Edition

Examiner

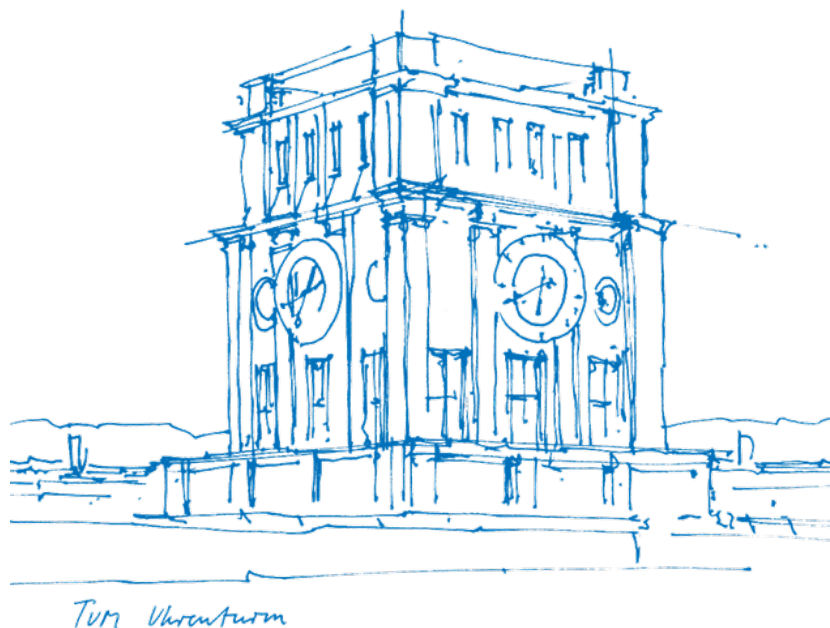
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Garching, 30.09.2025

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Nguyen

Abstract

This project explores the automation of production order release in SAP S/4HANA Public Cloud Edition through an Artificial Intelligence (AI)-powered agent. Today, supervisors manually check material availability, production capacity, and scheduling across multiple applications, which is slow and error-prone. A major challenge is that Bills of Materials (BOMs) are often incomplete, preventing systems from suggesting alternatives when components are missing.

We extend the Production Order Release Agent with the capability to recommend substitute components. By integrating Joule Functions with OData Application Programming Interfaces (APIs), the agent can detect shortages, propose alternatives from stock or BOM data, and recommend rescheduling if no substitutes exist.

Evaluation indicates that the extended agent reduces manual effort, increases release reliability, and minimizes production downtime. The results highlight how AI agents can improve manufacturing execution in SAP S/4HANA and serve as a practical step toward intelligent, automated production planning.

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Introduction

Context and Motivation

Efficient production order release is a prerequisite for initiating manufacturing execution in SAP S/4HANA. Supervisors must ensure that all required materials and capacities are available before orders are released. This task is traditionally performed through multiple manual checks in different applications, which creates delays, inefficiencies, and risk of human error.

Production Order Domain Terminology

To establish a common understanding of the manufacturing domain, this section defines key terminology related to production orders and factory plant operations.

General Manufacturing Concepts

Work Centers represent specific areas within a plant where manufacturing operations are performed. Each plant typically contains several work centers such as paint, weld, and final assembly stations.

The **Production Supervisor** serves as the mission control for daily production operations, with key responsibilities including:

- Prioritizing order execution
- Solving production problems
- Managing daily production operations

In manufacturing systems, there are typically two types of orders:

- **Planned Orders:** Preliminary production plans
- **Production Orders:** Final instructions to manufacture specific quantities

Production Order Definition and Attributes

A **Production Order** is an instruction to manufacture a specific quantity of a material at a specific time and place. Each production order contains the following key attributes:

- **Material:** What to build

- **Quantity:** How many units to produce
- **Plant + Work Center:** Where the production will occur
- **Start and Finish Date:** When production should begin and end
- **BOM (Bill of Materials):** List of required components
- **Routing:** Which steps and stations to follow
- **Production Version:** Combination of BOM and routing

Production Order Statuses

Production orders progress through various statuses during their lifecycle:

Table 1

Production Order Status Definitions

Status	Description
CRTD	Created but not released
REL	Released for execution
PCNF	Partially confirmed
CNF	Fully confirmed
TECO	Technically completed (no more work expected)
CLSD	Closed (final stage)

Production Order Process Flow

The production order lifecycle follows a structured process flow:

1. **Order Creation:** Convert planned orders to production orders and check material reservation
2. **Release:** Enable material withdrawal for production
3. **Material Staging:** Verify parts availability and issue materials from inventory to shop floor
4. **Execution:** Operators perform manufacturing steps and confirm operations in the system
5. **Good Receipt:** Report finished goods as received and update inventory
6. **Order Settlement & Closure:** Settle costs to cost centers and close the order

Problem Statement

Although SAP S/4HANA Public Cloud already provides ATP checks, capacity validations, and exception handling, these checks rely on accurate and complete BOM data. In practice, production planners often neglect to maintain BOMs properly, leaving gaps in component information. This makes it difficult for existing systems to automatically suggest alternatives when shortages occur, forcing supervisors to manually investigate, cross-check, and reschedule production orders.

Objectives and Research Questions

This IDP develops an AI-powered Production Order Release Agent that goes beyond standard release checks. Specifically, the project extends the agent's capability to:

- Detect missing or unavailable components,
- Propose suitable alternatives from the BOM or current stock using Joule functions,
- Recommend rescheduling if no alternatives are available.

By embedding these features, the agent reduces downtime caused by missing materials and increases the reliability of automated production release.

The project is guided by the following research questions:

1. How can AI agents integrated with SAP Joule Functions and OData APIs support production supervisors in automating order release?
2. How effective is the agent at recommending alternatives when BOM data is incomplete?
3. To what extent does the extended agent reduce manual effort and improve operational efficiency in production order release?

Structure of the Report

The report is organized as follows: Chapter 2 reviews related work in production release automation and AI in manufacturing. Chapter 3 presents the solution design, including system requirements and architecture. Chapter 4 details the implementation in SAP S/4HANA Public Cloud with Joule functions. Chapter 5 evaluates the agent against key performance indicators. Chapter 6 discusses results, interdisciplinary aspects, and limitations. Finally, Chapter 7 concludes with key contributions and future work.

Related Work

Production Order Release in SAP S/4HANA

The release of a production order marks the transition from planning to execution in manufacturing. Before release, supervisors must ensure that all required components are available (*availability*

checks) and that machines and labor have sufficient free capacity (*capacity evaluation*). In SAP S/4HANA Public Cloud, these validations are often performed manually across multiple applications, which is time-consuming and error-prone. Although automation can improve efficiency, current systems still assume that the BOM is complete and up to date—an assumption that rarely holds in practice and complicates automated decision-making **sapprodrelease2025**.

SAP Joule

Joule is SAP's generative AI copilot, designed to support business users across different domains of the intelligent enterprise **sapjoule2025**. It provides natural language interfaces, decision recommendations, and integration with enterprise data. In the context of manufacturing, Joule can be extended with custom functions that access transactional data through OData Application Programming Interfaces (APIs). These so-called *Joule Functions* enable developers to implement domain-specific logic, such as retrieving stock levels or proposing alternative materials. SAP provides sample repositories to illustrate how Joule Functions can be created and embedded into workflows, lowering the barrier for extending AI-driven support in S/4HANA.

SAP Agent Builder

The SAP Agent Builder framework allows the creation and orchestration of AI agents within the SAP ecosystem. Agents can encapsulate business logic, interact with core S/4HANA modules, and cooperate with Joule to deliver contextual recommendations. In manufacturing scenarios, Agent Builder offers a structured way to automate repetitive tasks such as production order release checks, while ensuring compliance with enterprise security and governance standards. Previous work has demonstrated the potential of multi-agent systems in industrial settings **wuest2016**, and Agent Builder brings these concepts into the SAP Public Cloud. For this project, it serves as the foundation for developing an AI-powered Production Order Release Agent that can dynamically suggest alternatives and guide supervisors in decision-making.

Solution Design

Requirements

System Architecture

Workflow

Design Decisions

Implementation

Technical Setup

Development Steps

UI Mockups and UX

Challenges During Implementation

Evaluation

Evaluation Criteria

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Results

Discussion of Results

Discussion

Interpretation of Results

Interdisciplinary Aspects

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Contributions

Future Work

Appendix

Project Timeline and Milestones

Additional Figures