



How AI Really Works for HMLV SMEs

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A practical Q&A on AI in manufacturing, planning and ERP with limited data

As a High-Mix, Low-Volume (HMLV) manufacturing business, whether you're a metalworking firm, a machine builder, an assembly workshop or another SME with a strong focus on bespoke manufacturing, you are facing a huge structural paradox. Your production environment is complex, highly varied and full of exceptions. But this complexity is precisely where your added value lies. At the same time, efficiency depends on your ability to capture those activities in automated systems such as ERP/MRP, MES and supply chain and planning systems.

The promise of AI in terms of insight and predictability also relies heavily on large volumes of data. In an HMLV environment, such data is typically unavailable. It is therefore easy to conclude that AI in production and planning is only viable for large enterprises with mass production and extensive datasets.

This may have been true initially. Today, however, research and practical cases increasingly show that AI can also deliver tangible value for smaller HMLV businesses. In parallel, more ERP, MES and other software vendors are introducing various forms of AI agents.

Which vendors and agents are involved? How can you achieve strong returns with limited data for your AI? How do you get started in practice? What do you do with incomplete data? And do you actually need AI at all?

This Q&A addresses all of these questions, and more, in detail.

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1. Why are HMLV manufacturing SMEs interested in AI?

HMLV businesses face structural challenges and situations that AI is often well suited to address:

- **Highly variable product mix:** new product variants are introduced continuously, often at the customer's request and usually only in small quantities.
- **Uncertain process and processing times:** because a large share of the work is bespoke, production times vary constantly. The operator involved and the amount of rework also have a significant impact.
- **Uncertainty concerning deliveries:** suppliers often deliver late or sometimes not at all. As a smaller customer, you have limited control over this.
- **Flexibility is crucial:** unexpected changes regularly require ad-hoc rescheduling. Examples include rush customer orders, machine breakdowns, staff illness and similar disruptions.
- **SME-specific constraints:** limited budgets for IT and other infrastructure, limited and fragmented data from different sources (ERP, Excel, MES, paper forms and so on), and little time or budget for large, disruptive AI projects.

In short, although AI offers substantial potential for these businesses, limited time, money and data mean this potential often appears difficult to realise.

2. Which types of AI technologies can currently be used in production planning and shop floor control?

Based on academic and business literature, four main categories can be distinguished.

2.1. Predictive AI: machine learning (ML) and forecasting

- **Demand forecasting**

Modern ERP and supply chain management systems use ML algorithms, such as gradient boosting and neural networks, to forecast demand based on historical data, supplemented with external signals such as weather forecasts or macroeconomic indicators.

- **Predicting processing and lead times**

Studies show that ML models can significantly improve the accuracy of processing times in job shops, [with error margins more than 20% lower than when using traditional master data](#).

- **Predicting rework probability and quality risks**

Case studies in metalworking SMEs show that [by estimating the probability of rework and deviations](#), AI models are able to reveal potential planning risks.

2.2. Optimisation, heuristics and reinforcement learning (RL)

- **A combined ML and simulation approach** to lot sizing and scheduling in HMLV environments improves delivery performance compared with traditional approaches and dispatching rules such as FIFO or earliest due date.
- **Optimisation algorithms**, including MILP, meta-heuristics and RL, can optimise production sequences, resource allocation and batching. In practice, these often operate as a black box in an APS or planning engine.

2.3. Computer vision and robotics for the HMLV shop floor

- **AI-based vision systems** are used for flexible detection, positioning and quality control in HMLV assembly environments. These systems are often based on YOLO ('You Only Look Once') applications: an open-source, fast and flexible AI technology for **real-time image recognition**.
- Such systems enable '**flexible automation**': robots or cobots (collaborative robots) that can handle multiple variants without requiring a complex, manual learning phase each time.

2.4. Generative AI and co-pilots

- **Gen-AI in ERP**: generative models are increasingly integrated into ERP systems to interpret free-text input ('create a schedule for this urgent order'), describe scenarios, and provide explanations or analyses in natural language.
- **Agentic AI** ([for example in Odoo](#)) can execute entire process chains in a semi-autonomous way: planning, making decisions, taking actions and correcting itself through a digital twin or simulation.

3. What are typical AI use cases for HMLV SMEs?

Based on the technologies described above, AI can be applied in several ways in the day-to-day operations of HMLV SMEs. For clarity, we have divided these use cases into planning-related applications and shop floor control.

3.1. Production planning

3.1.1. Demand planning and order intake

This category includes ML algorithms for demand forecasting (at SKU level, by customer segment or by region). You can combine internal data with external signals such as weather, promotions or macroeconomic indicators. Scenario planning is also possible, allowing you to prepare both a best-case and a worst-case plan.

An example of such an AI tool can be found in **Microsoft Dynamics 365 Supply Chain Management**. Its Demand Planning module uses ML algorithms and can integrate external signals. The latest version also includes planning agents that detect deviations and propose solutions.

This type of AI tool is particularly useful for components with recurring demand, spare parts and standard items, and for medium-term capacity planning (over the coming week or month).

3.1.2. More accurate processing and lead times

At present, machine learning models such as random forest and gradient boosting are mainly encountered in **academic research**. These models learn processing times based on historical orders, quantities, materials, machines and operators. And they are promising, as their predictions are significantly more reliable than those produced by traditional models.

Once such models can be integrated into ERP (Enterprise Resource Planning) **or APS** (Advanced Planning and Scheduling) software, they provide far more realistic routing and processing times as the basis for planning. This leads to more reliable capacity planning and less firefighting caused by unforeseen disruptions. In practice, these models could be deployed as an AI service that periodically updates routings in the ERP system.

3.1.3. Scheduling and lot sizing in HMLV

Current [research](#) is looking at combining discrete-event simulation with ML to test different planning rules and identify the most effective scheduling strategy for an HMLV environment.

In **practice**, you can already find APS modules within ERP systems (or as add-ons). These modules use heuristics, constraint-based planning and, increasingly, AI to determine order priorities, detect resource conflicts and run what-if scenarios.

A specific example is **Epicor Kinetic, an SME-focused tool for discrete manufacturing**. It offers forecasting, MPS, MRP and finite, constraint-based scheduling, with real-time visibility of capacity. More recently, additional AI layers have been introduced ('Epicor Grow AI'), adding predictive insights and automated recommendations.

3.1.4. Capacity planning and commit-to-order

The best-known example of such a tool is **SAP S/4HANA pMRP (Predictive Material and Resource Planning)**, although it is primarily aimed at medium-sized and large enterprises. pMRP simulates future material and capacity consumption based on forecasts and orders, allowing

capacity issues to be detected early and scenarios to be evaluated. Its focus is on medium- and long-term planning. Strictly speaking, it is not pMRP itself that uses AI, but the preceding forecasting step, implemented in SAP Integrated Business Planning (IBP), which relies on robust and explainable supervised ML models trained on historical demand data.

Integration with pMRP:

1. IBP generates a forecast
2. The forecast is converted into PIRs (**Planned Independent Requirements**) in S/4HANA
3. pMRP simulates the material and capacity impact.

3.2. For production and execution (shop floor/MES)

AI-driven MES and production monitoring

Modern MES solutions combine real-time machine data, quality measurements and ERP orders, and use AI to detect deviations, estimate scrap risk, predict maintenance needs and trigger automatic actions such as stopping a line or initiating a quality inspection.

Vision and quality control in HMLV

Computer vision (YOLO variants, see above) is used to detect deviations across different product variants, for drill hole detection and position checks in HMLV assembly, and for flexible pick-and-place and robot guidance.

For SMEs, this is often feasible as a **stand-alone tool** (camera, edge PC and an interface to ERP or MES), without first having to make the entire ERP system 'intelligent'.

4. Can you already find AI in ERP systems for HMLV planning?

The answer to this is straightforward: yes, in fact, more than we can list here. Nevertheless, we would like to highlight the most relevant examples below in a handy overview.

4.1 Odoo (strong presence in SMEs)

- **Target group:** SMEs in discrete and process manufacturing; particularly well suited to high-mix environments (flexible configuration and modular structure).
- **Manufacturing modules:** MRP, work orders, planning, quality control, maintenance, IoT integration.
- **AI features** (current and announced):
 - AI-driven demand forecasting in Odoo 18/19.
 - Integration with AI for adaptive production planning and automatic rescheduling in the event of disruptions (material shortages, machine breakdowns).
 - Development of 'agentic AI' capable of autonomously planning, monitoring and adjusting processes, potentially linked to digital twins.

Use cases: typically suited to SME job shops in metalworking, machine building, custom equipment, make-to-order and engineer-to-order environments.

4.2 Epicor Kinetic (discrete manufacturing, mid-market/SMEs)

- **Target audience:** discrete manufacturers (metal, machine building, electronics, industrial machinery) with multi-site operations and HMLV characteristics.
- **AI and planning:**
 - Advanced Planning and Scheduling with finite scheduling, MRP/MPS and real-time planning boards (no AI).
 - 'Grow AI' as a predictive layer in ERP (anomaly detection, stock optimisation, planning recommendations).

Use cases: SMEs with complex job shops, many processing steps and capacity conflicts, potentially across multiple plants.

4.3 Microsoft Dynamics 365 Supply Chain & Business Central

- **Target audience:** medium-sized to larger SMEs in manufacturing and trade.
- **Delivery date calculation and further planning:** based on deterministic ATP/CTP logic using lead times and supply-demand netting. This does not use AI or machine learning; the system does not learn from historical performance and does not optimise adaptively.
- **AI functionality:**
 - Advanced demand forecasting and demand planning using ML algorithms, external signals and planning agents that monitor and adjust forecasts (available in Supply Chain, not Business Central core).
 - Integration with Azure Machine Learning for custom forecasting models, prediction of lead times (custom order promising, late-delivery risk) and quality or maintenance models.
 - Copilot:
 - Explaining planning outcome
 - Summarising exceptions

Use cases: SMEs with international supply chains, where AI-driven demand and supply planning adds significant value.

4.4 NetSuite and other cloud ERP systems

Cloud ERP systems such as NetSuite, Oracle Cloud ERP, SAP Business ByDesign and other AI-enabled ERPs integrate ML for:

- Demand forecasting
- Stock optimisation
- Anomaly detection
- Cash and supply chain analytics.

For pure HMLV production, an additional APS layer or MES integration is often required, potentially with its own AI methods. However, where the production environment shows high variability, it is

often advisable to use the simplest possible pull-based control system (see Lean and Quick Response Manufacturing). For longer-term and higher-level planning, basic AI applications such as forecasting and risk scoring are already embedded in these ERP systems.

5. What AI can we expect in ERP and planning in the future?

A review of the professional literature and vendor road maps reveals several clear trends:

- **From predictive to prescriptive and collaborative**

AI is moving from 'predicting' to 'prescribing' (what should I do now?). Employees increasingly receive support from digital co-pilots that propose scenarios and explain risks in natural language.

- **Generative AI in predictive analytics**

Generative AI will become more deeply embedded in the daily work of planners and other users. It will be used to generate features automatically, explain outcomes and formulate more complex scenarios ('what if we move shift X and postpone batch Y?').

- **Agentic AI and digital twins**

Advanced ERP and MES environments are experimenting with agents that continuously run micro-experiments on a digital twin (energy optimisation, lead-time reduction) and take action based on the results, within clearly defined boundaries.

6. Why are SMEs still hesitant to start with AI?

Both research and practical experience point to a clear conclusion: **data is the bottleneck**, particularly for SMEs.

Typical issues surfacing at SMEs include incomplete or incorrect master data (routings, standard processing times, bills of materials), missing or inconsistent production statuses (start and stop times, rework registration), low data density (little repetition, small batch sizes), and data scattered across ERP systems, Excel files, paper forms and machine PLCs.

In short, there is limited data, and the data that does exist is not always reliable. Yet these are essential prerequisites for a successful AI project.

In addition, [recent studies](#) point to a 'productivity paradox': businesses often experience a temporary drop in productivity after adopting AI, due to learning curves, process disruptions and the additional effort needed to collect and clean the right data. Research also shows that while 78% of organisations now use generative AI applications, more than 80% report no improvement in their financial performance.

7. Can you deploy AI with little data?

Yes. There are several strategies to compensate for data scarcity:

7.1. Start small: build use cases with existing ERP data

Select narrowly defined, **high-impact use cases** based on data you do have, such as:

- Demand forecasting for A-items
- Processing times for one or two critical work centres
- Scrap analysis for a single critical product family.

Use historical ERP data, order data and production data. Even 'noisy' data can deliver value, provided it is cleaned thoroughly.

7.2. Put a data quality programme in place before moving to 'heavy AI'

Set up lightweight **data governance** by appointing a single owner for routings and standard processing times. Standardise work order registration and aim to reduce the number of Excel-based 'shadow systems'.

AI projects in planning often fail because basic data is not properly structured. Experience with APS implementations, such as Epicor, shows that success depends heavily on realistic data and correct configuration.

7.3. Transfer learning and data-lean models

Research shows that **transfer learning** and pre-trained models can help when local datasets are small. Models are trained on large datasets from comparable contexts and then fine-tuned using limited SME data.

This approach is relevant for applications such as predictive maintenance, quality inspection and process optimisation.

7.4. Synthetic data and simulation

Synthetic data, realistic but artificially generated data used to compensate for a lack of real data, is becoming increasingly important in reducing data scarcity in production and supply chains.

As an SME, you can use **discrete-event simulation** of your factory, for example existing planning or layout models, to generate synthetic data on lead times, queues, utilisation rates and similar indicators. Combine this with limited real-world data to train ML models. Care is required to ensure data quality and to avoid bias when using synthetic data.

7.5. Human in the loop and knowledge-based rules

Combine AI with **explicit planning rules** and human expertise. Work with a collaborative model in which AI proposes a solution, such as a sequence or lot sizes, and the human planner accepts or adjusts it. This feedback is then reused as training data for the AI.

This approach reduces the need for large datasets and accelerates user acceptance.

7.6. Use vendor models and sector templates

ERP vendors and niche tooling solutions in areas such as AI planning, computer vision and supply-chain analytics increasingly offer **preconfigured models** trained on the data of multiple customers from your sector.

This reduces the amount of internal data required to get started and accelerates time to value, provided your own processes are sufficiently similar to those contained in the templates.

8. How does an SME get started with AI in practice? Is there a road map for this purpose?

Even if you have addressed data quality and quantity issues by following the tips in the previous question, many SMEs still struggle with where and how to begin.

For that reason, a pragmatic roadmap is set out below.

1. Define your strategic focus

Identify where planning causes the most difficulties today. Typical pain points include delivery reliability, rush orders, capacity constraints and quality issues.

2. Select data-compact use cases

Start with one or two use cases for which usable ERP data is already available, such as A-items or critical work centres.

3. Clean your data and define minimalist data governance

Create a 'golden dataset' for the selected use cases, covering routings, processing times and measurement data.

4. Integrate AI through existing ERP or MES functionality where possible

Activate AI modules in your current ERP system, such as Odoo AI forecasting, Epicor Grow AI or Microsoft Dynamics Demand Planning.

5. Experiment with simulation and AI for more complex scheduling

Use discrete-event simulation or synthetic data to test scenarios without production risks.

6. Deploy co-pilots and generative AI for planners

Start with AI assistants that summarise planning data, flag exceptions and explain scenarios.

7. Scale up in short cycles and gradually increase adoption

Take into account the productivity paradox discussed in question 6. Plan for training, change management and realistic expectations.

9. So... is AI ready for HMLV SMEs?

As an SME manufacturing business, you can already deploy AI today for demand forecasting, more accurate processing times and lead times, intelligent scheduling and capacity planning, AI-driven quality inspection and vision systems, and co-pilots and assistants in ERP.

AI is increasingly embedded in mainstream ERP systems, lowering the barrier for SMEs.

Data quality and data volume are still the main hurdle. With small, well-chosen use cases, transfer learning, synthetic data and simulation, vendor templates and human-in-the-loop approaches, it is nevertheless possible to roll out realistic and valuable AI applications with limited data.

Briefly put: **start small, choose carefully, and scale step by step.**

10. And... are you ready for AI?

Are you now convinced that AI can also add value for your SME? Would you like to explore how AI could strengthen your planning and production processes? Sirris would be pleased to support you in taking the first steps that make the most sense for your environment.

If you have specific questions or would like more information on a particular section of this article, feel free to contact [Mark Van Pee](#).

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