



Optimizing Inventory Management with AI at Towa International

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in the Digital World

We apply advanced artificial intelligence techniques to automate stock planning at Towa International's Martorelles plant, achieving more efficient, proactive management aligned with real demand.

The challenge

Towa International is the international hub of Towa Pharmaceutical, a leading company in the generics market in Japan. Towa International focuses on the research, development, manufacturing, marketing, and distribution of generic drugs, with the goal of contributing to people's health. At their production plant in Martorelles (Barcelona), they identified the need **to improve stock management** to ensure product availability, optimize working capital, and automate manual processes.

Towa International aimed **to enhance operational efficiency through digitalization and the implementation of an intelligent inventory management system**. Specifically, they needed to align planning with actual demand, improve material coverage, and free up the planning team to focus on more strategic tasks.

The project

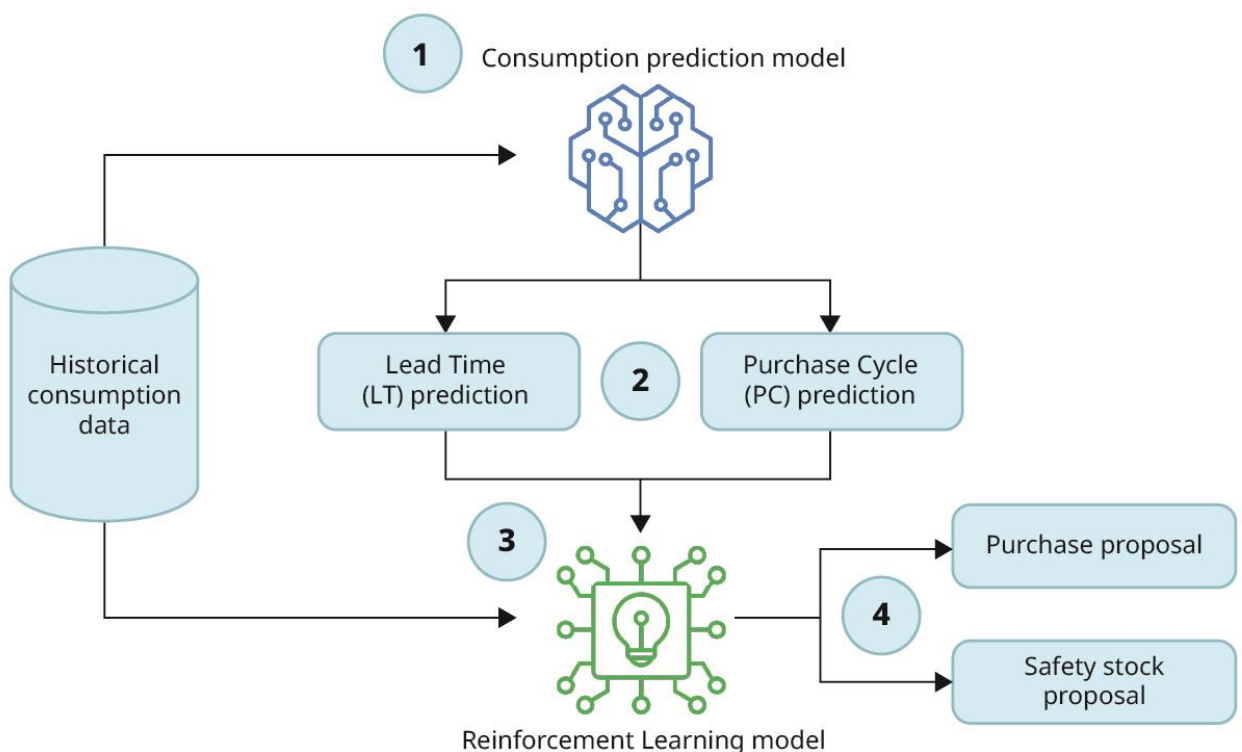
To achieve these goals, at IThinkUPC, the technology consultancy of the Universitat Politècnica de Catalunya, we designed a solution based on **two AI models** that work in a coordinated manner:

- 1. Consumption Prediction Model (XGBoost):** the first challenge was the lack of detailed consumption forecasts. To address this, we developed a predictive model based on the XGBoost architecture. This system analyzes historical data to generate accurate consumption forecasts, a key element for planning.
- 2. Stock Optimization Model (Reinforcement Learning):** using the consumption forecasts as a foundation, we implemented a Reinforcement Learning model. The goal of this model is to learn the optimal ordering policy to maximize a reward function that balances two opposing costs: the cost of holding inventory and the cost of stockouts.

The function is defined as:

$$\text{Reward} = -(\text{StockCost} * \alpha + \text{StockoutCost} * \beta)$$

By adjusting the α and β parameters, the model's behavior can be tailored. This allows Towa International to fine-tune their strategy, either prioritizing the reduction of warehouse stock (tied-up capital) or maximizing availability by avoiding stockouts. Therefore, the system not only automates purchase orders but does so based on a financial and operational strategy defined by the company.



Pilot case: validation with different molecules

To validate the system's effectiveness, we carried out a case study focused on several representative molecules. The pilot included the analysis of all components (active ingredients and excipients) and manufacturing recipes. Based on the predictions from the new model, we calculated the required safety stock, assigned an economic value to it, and validated the results through detailed reports. This test enabled us to simulate material coverage across various scenarios and assess the system's ability to effectively anticipate purchasing decisions.

The results

This project demonstrates how AI can transform supply chain management. The key to success lies in the creation of **a customized solution for each raw material production molecule**, taking into account its specific characteristics.

The system **incorporates consumption trends** through the predictive model, allowing it to **dynamically adapt to demand fluctuations**. This capability, combined with the Reinforcement Learning model, has enabled us to help Towa International strike the optimal balance between inventory cost and stockout risk, transitioning from a reactive management model to a fully proactive and strategic one.

The project's implementation has led to **a significant reduction in tied-up inventory**.



Project expansion and new challenges

Following the success of the pilot case, the project has entered an expansion phase to scale the solution across more molecules in Towa International's portfolio. This new phase presents a significant challenge: some of these molecules have more limited consumption history, making it harder to train the initial models.

To tackle this challenge, the team is adapting the AI algorithms to work effectively with smaller datasets. We are also exploring advanced techniques that allow similar predictions to be made with less historical information. The ultimate goal is to ensure that the solution remains equally effective across the entire product catalog, enabling optimized inventory management regardless of the amount of available data per molecule.