

# Future-Proofing Pharmaceutical Supply Chains

By Dina Smirnov-Mereino

**EXECUTIVE SUMMARY** | Future-proofing pharmaceutical supply chains is critical in an increasingly complex and unpredictable business environment. While redesigning the asset footprint is often impractical due to high costs and stringent regulations, pharmaceutical companies can ensure their supply chain is future-ready by selecting a fit-for-purpose technique. This article explores three data-driven strategies of future-proofing supply chains in the pharmaceutical industry: scenario modelling, allocation optimization, and capacity expansion – along with illustrative examples based on real-life projects in the Life Science industry.



**DINA SMIRNOV-MEREINO** | Dina has over 15 years of experience leveraging operations research and data science to solve business challenges. At EyeOn, a Netherlands based supply chain forecasting and planning consulting firm, she leads the future-proof supply chain design area. She holds a PhD in Industrial Engineering from the Technion – Israel Institute of Technology, focusing on the inventory optimization of products with short lifecycles by leveraging data. She has also completed postdoctoral research on long-term capacity planning for the high-tech industry at Eindhoven University of Technology.

**T**he pharmaceutical industry plays a crucial role in health-care, providing essential medications and treatments to patients globally. However, the pressure on pharmaceutical companies continues to mount as supply chains become more global and decentralized, the global population grows and ages, and chronic diseases become more prevalent. Supply chain future-proof-

ing is therefore imperative for pharmaceutical companies.

Normally, part of supply chain future-proofing includes redesigning the asset footprint. In the pharmaceutical industry, however, the tremendous costs and stringent regulatory aspects involved in altering the asset footprint itself make such a move rather impractical. This does not mean that pharmaceutical sup-

ply chains need not undergo future-proof design: rather, it means that they require a customized approach by carefully selecting techniques and strategies appropriate for this booming and incredibly complex industry.

I identify three key strategies to future-proof supply chains in the pharmaceutical industry: scenario modelling, allocation optimization, and capacity expansion. For each

strategy, we provide an illustrative example, based on recent projects we have done for our Life Science customers.

## SCENARIO MODELLING

Scenario modelling is a powerful tool for future-proofing any supply chain, and the pharmaceutical industry is no different. It enables companies to proactively identify vulnerabilities in their supply chain, assess the effectiveness of different mitigation strategies, and make informed decisions to increase resilience and agility. Using advanced modelling techniques, companies can evaluate multiple factors and provide a trade-off. By working together with our customers, we created insights to analyse changes in market demand, alternative asset footprints, supply chain disruptions, regulatory changes, and geopolitical risks. Mitigation strategies may involve diversifying suppliers, establishing redundant production lines, securing alternative transportation routes, and maintaining safety stock levels for critical products with highly volatile demand.

While suitable for any industry, scenario modelling is a necessity for pharma due to its complex dynamics, multitude of exceptions and stringent regulations, which limit the usability of standard methodologies. The key role pharmaceutical companies play in healthcare, and the rapid response required from them to public health emergencies like pandemics or other forces majeure, pose additional pressures and require incorporating flexibility into supply chain operations.

In a project we conducted for

a global leader in pain management, the main challenge was a high amount of uncertainty surrounding an introduction of a new product. At the time of the project, many key business decisions had not been made yet. We tackled this challenge by analysing different scenarios related to demand, preferred supplier, production schedule, and more. The rather short shelf life of the end product posed additional risk. Tweaking five planning parameters resulted in as many as 60 different scenarios. EyeOn experts have built a digital twin mimicking the customer's end-to-end supply chain, calibrated it to a reference case reflecting the most probable situation, and used it to evaluate the different scenarios based on predefined KPIs. The analysis provided clarity on the possibilities of positioning production and a clear understanding of the impact of lead times, production frequency, and demand forecasts.

## ALLOCATION OPTIMIZATION

We carry out scenario modelling in any supply chain future-proofing assignment. Yet, some of the studies have additional focus points. While altering the asset footprint is usually not a viable solution in pharma, we often see in projects that the allocation of product flows and storage locations can be adjusted to introduce cost savings and align supply chain capabilities to fit the business strategy.

In allocation optimization, we treat the supply chain and its asset footprint as given. By applying optimization techniques and developing algorithms and sets of rules, we determine the best possible alloca-

tion of products and materials to customer or storage locations, against a metric of choice such as cost or demand fulfillment.

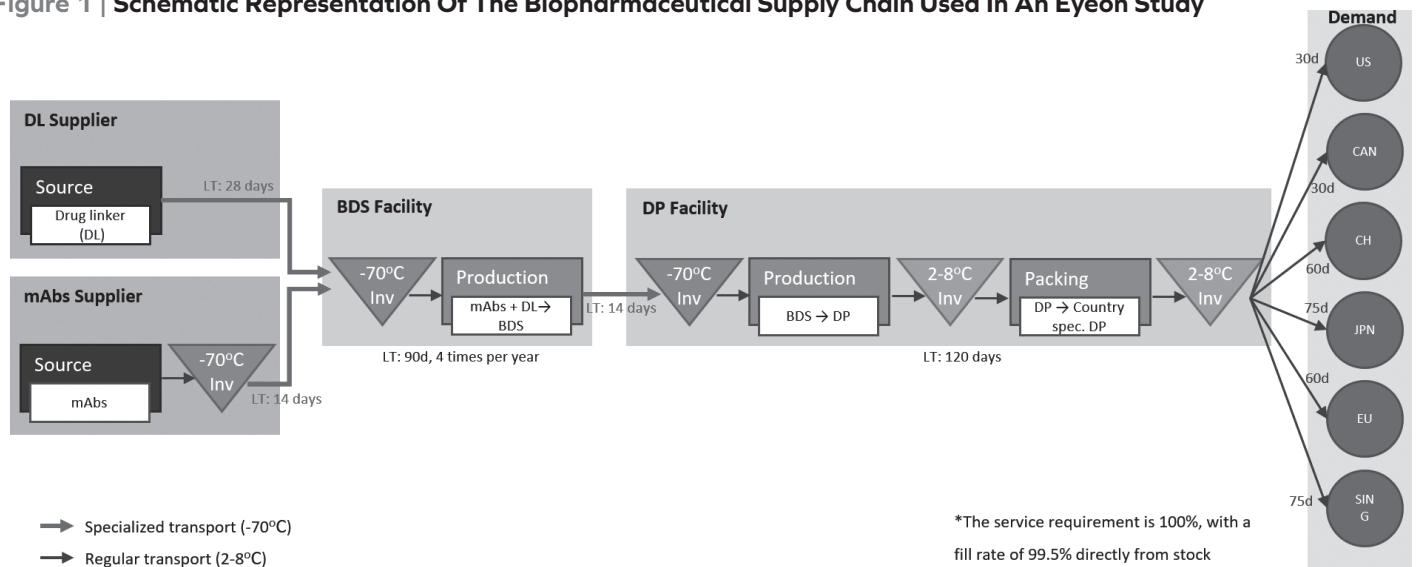
In a different assessment we carried out for a Life Sciences customer, we focused on two packaging sites in Europe. Anticipated double-digit growth, combined with limited storage space in own assets, had resulted in a steadily increasing need to resort to 3PL storage services. The company stocks a variety of materials: from raw materials and APIs, bulk substances, packaging material and operating supplies, to finished and trading goods. In the face of evolving demand, which material types were better stored in-house and which ones were better outsourced to 3PL storage was unclear. Other questions concerned strategic decisions such as expanding their own warehouses, outsourcing export and domestic market operations, freight flows, and building export capabilities in a country from where no goods are currently exported.

Together with the customer, we have defined meaningful scenarios and developed allocation rules of material type by storage location (either in-house or 3PL) based on inventory projections per country, per scenario. We have also optimized the freight flows for each scenario. The most cost-effective elements from the scenarios were combined into a solid business recommendation.

## CAPACITY EXPANSION

Next to scenario modelling and allocation optimization, a cornerstone strategy for future-proofing pharmaceutical supply chains is capacity ramp-ups. Whether the implication

**Figure 1 | Schematic Representation Of The Biopharmaceutical Supply Chain Used In An Eyeon Study**



is adding production lines to a facility, expanding in-house storage assets or sourcing more storage space with a 3PL partner, it is always a strategic decision with far-reaching consequences in terms of both CAPEX and OPEX, and long lead times before the new capacity becomes available for use. Typical questions revolve around the amount of the investment and its initial timing. The complexity, demand volatility, and long lead times make these questions challenging to answer.

One of the most burning topics for biopharmaceutical companies nowadays is the worldwide shortage of specialized freezers to store ingredients and substances in -70oC conditions until they become drug products. Excess capacity should be avoided due to high investment and

energy consumption considerations.

One of our customers has faced the key decision of how to manage freezer acquisition and placement. We determined that given future growth plans of 10% per year, it would be most cost-effective to increase the storage capacity at the bulk drug substance (BDS) facility by two freezers and add one freezer to the inbound inventory storage at the drug product (DP) facility, which would operate at an average utilization rate of around 70% for the next three years. As supplier lead times were relatively short (2 weeks), placing freezers at suppliers was also considered as an option, although it was not selected. The study provided clarity on the capacity expansion possibilities and preferred setup.

## SUMMARY

In an increasingly complex and unpredictable business environment, future-proofing pharmaceutical supply chains is essential to ensure the availability and affordability of essential medications and treatments. Supply chain future-proofing goes far beyond strategic asset footprint redesign, which may be impractical for pharma. By adopting a data-driven approach and applying the strategies detailed out in this article such as scenario modelling, allocation optimization, and capacity projection – pharmaceutical companies can better equip their supply chains to adapt to change, mitigate risks and continuously deliver value.

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