HEALTHCARE SUPPLY CHAIN INSTITUTE

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Batch Size Optimization for Pharma- and Biopharmaceuticals

Prof. Dr. David Francas

About us

Healthcare Supply Chain Institute

The **Healthcare Supply Chain Institute** is a research institute and think tank focusing on supply chain management and logistics in pharmaceutical and healthcare industries.

We are a legally dependent part of the **Steinbeis** foundation, headquartered in Stuttgart, Germany. Steinbeis is dedicated to the transfer of academic findings and knowledge into business. In 2018, Steinbeis achieved a turnover of 172 million euros.

We support companies and organizations in healthcare and pharmaceutical industries in improving their logistics, supply chains, and digital analytics. Our services include:

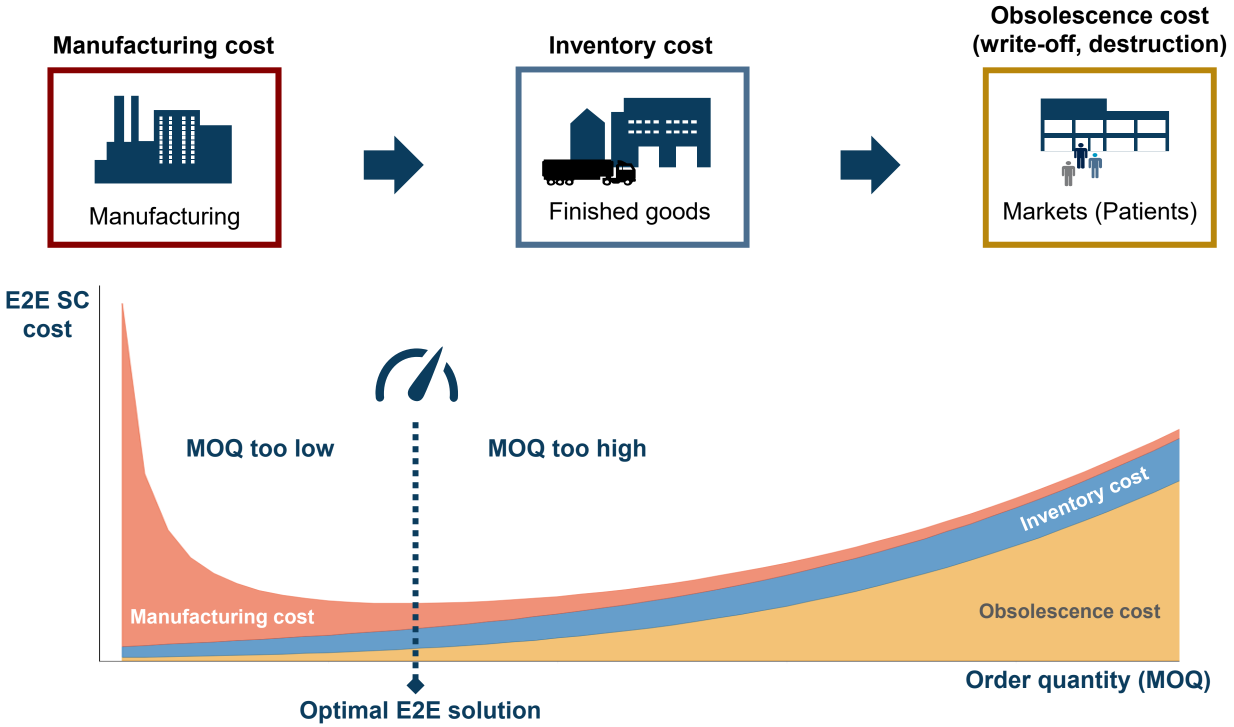
- Consulting, coaching, knowledge transfer
- Studies, surveys, and expert reports
- Customized analytics and planning solutions
- Training and executive education

Competencies

Our research and consulting expertise lies in planning and optimization of supply chain management and logistics and the design of patient-centric networks.

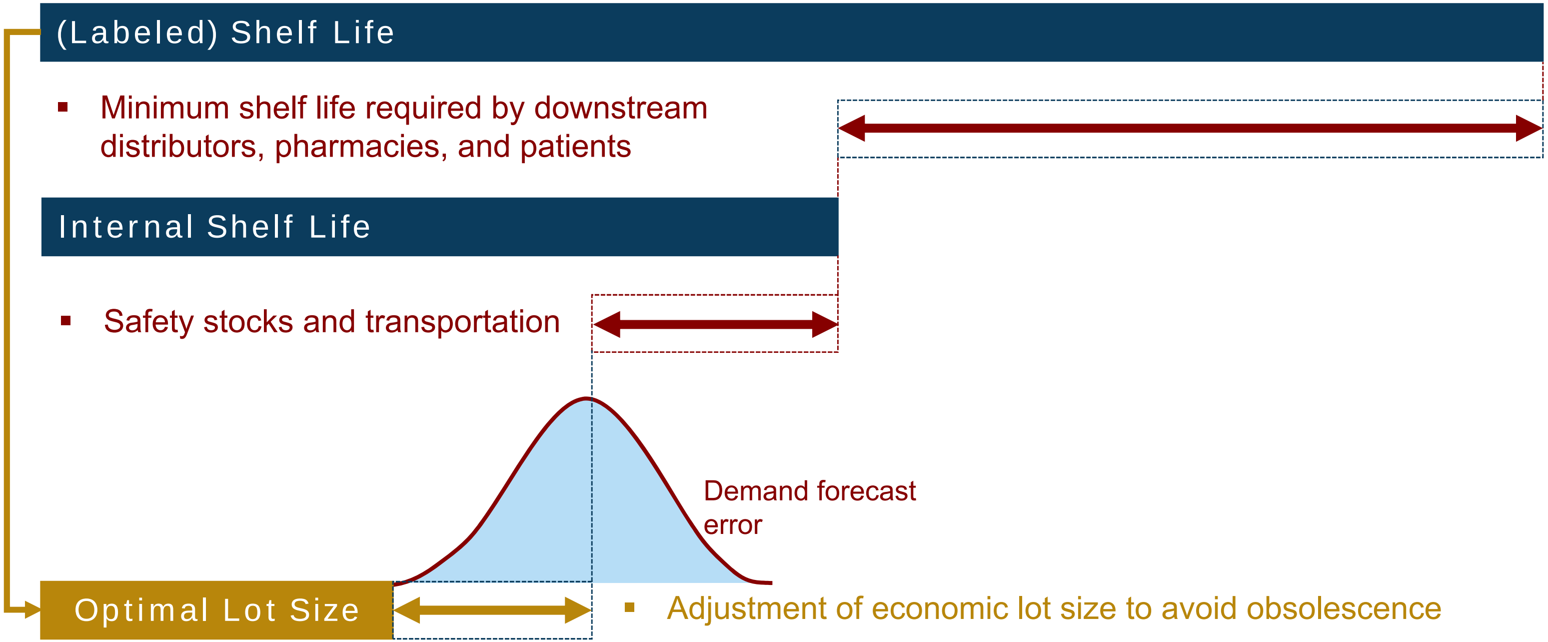
Our special focus is on creating value with analytics (machine learning and optimization) and the better management of risk, complexity, and uncertainty.

The goal is to optimize overall supply chain cost E2E and to minimize risk of obsolescence when setting batch sizes (MOQ)



MOQ: Minimum order quantity/ manufacturing batch size | EOQ: Economic order quantity | SL: Service level

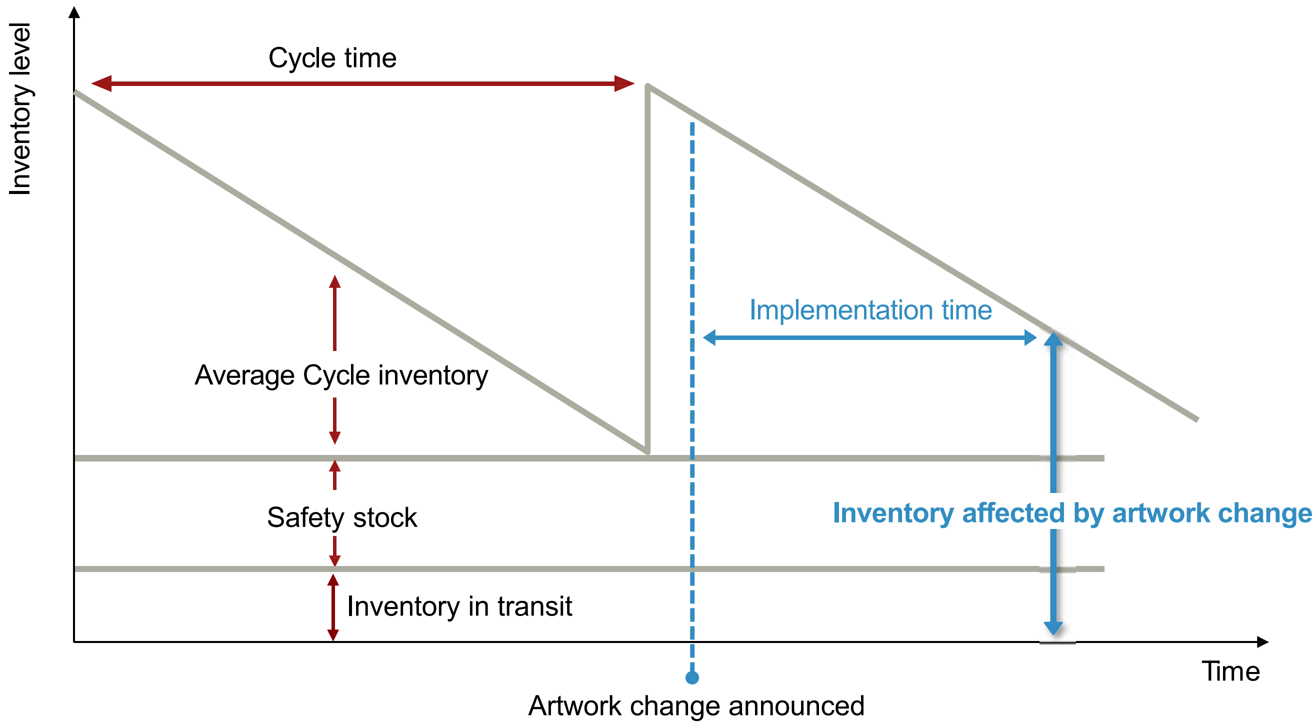
Shelf-life constraints and forecast errors must be considered to optimize batch sizes successfully in Pharma and Biotech companies



- Especially biopharmaceuticals face often significant shelf-life constraints. Labeled shelf life is further reduced by requirements of distributors / wholesalers (McKesson, Phoenix etc.) and safety stocks and transportation.
- However, standard lot size models do not take shelf life or forecast errors into account.
- To ovoid obsolete drugs, both shelf-life and forecast errors must be considered when setting batch sizes.

Source: Francas, D. (2018): Supply Chain Planning for Biopharmaceuticals - How to Avoid Inventory Obsolescence, Pharm. Ind. 80 (7)

In addition to shelf-life considerations, artwork changes are an significant cost driver for inventory management in some markets



- Optionally, our model considers the impact of artwork changes on inventory cost and optimal batch sizes.
- The calculation considers (estimated) probability of artwork changes, implementation time till artwork must change, and cost for repackaging or destruction of remaining average inventory on hand.

We use a data-driven analytics approach to optimize batch sizes

Analytics Methodology

We use a data-driven stochastic optimization approach to optimize batch sizes.

Data-Driven Approach

The approach relies on data commonly available in ERP and planning systems:

- Demand (volume, forecast error)
- Product shelf life and local minimum shelf-life requirements (at affiliates)
- Fixed costs per batch (manufacturing cost)
- Inventory holding cost
- Destruction / write-off costs per unit
- Safety stock coverage [weeks] (optimization possible)
- Replenishment lead times [weeks]
- Business information on artwork changes [optional]

Business Logic

Standard lot sizing models (e.g., economic order model - EOQ) often fail since key factors such as forecast errors, shelf life, safety stock coverage, or artwork changes cannot be considered.

We provide an approach that takes all pharma-specific factors into account and allows to optimize cost and risk when setting batch sizes (MOQ).

Use Cases

- Optimize batch sizes for large product portfolios (thousands of SKU if required)
- Visualization of results via Cost-Risk curves to facilitate alignment within supply chain
- Simulation of input parameters (cost, volumes etc.) to test robustness

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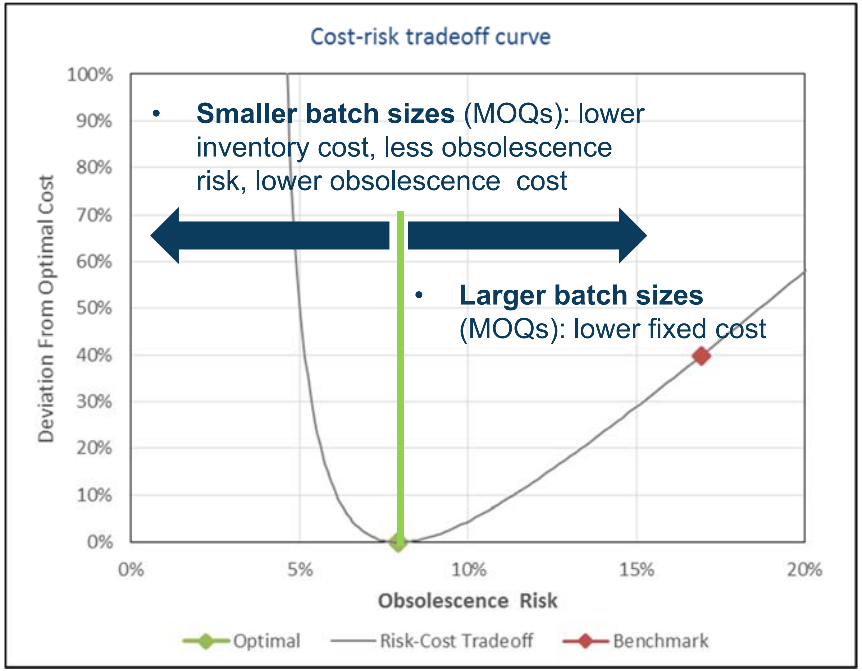
For each SKU, a Risk-Cost Tradeoff Curve can be calculated to visualize how batch sizes affect cost and risk exposure

- **As lower the values, as better the cost performance**



- **As lower the values, as lower the risk of obsolescence**

- Each point on the curve corresponds to a specific batch size. The figure shows cost and risk of the current MOQ and the optimized batch size. The curves visualize the business logic of the underlying stochastic optimization model.

Case Study – We optimized the batch sizes of two biotech brands and identified a >2 mEUR savings opportunity (15% cost reduction)

Scope

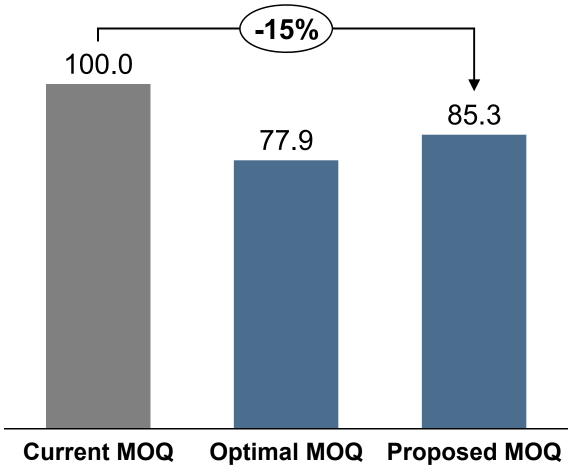
Brand 1 (biosimilar):

- Sales ~ 350m EUR
- Short Shelf Life
- ~ 130 SKUs considered

Brand 2 (biosimilar):

- Sales ~ 200m EUR
- Long shelf life
- ~ 80 SKUs considered

Normalized cost



- The proposed MOQ (batch size) provides a 2 mEUR savings potential and come along with lower inventory changes (the optimal MOQ provides a 3 mEUR savings opportunity).

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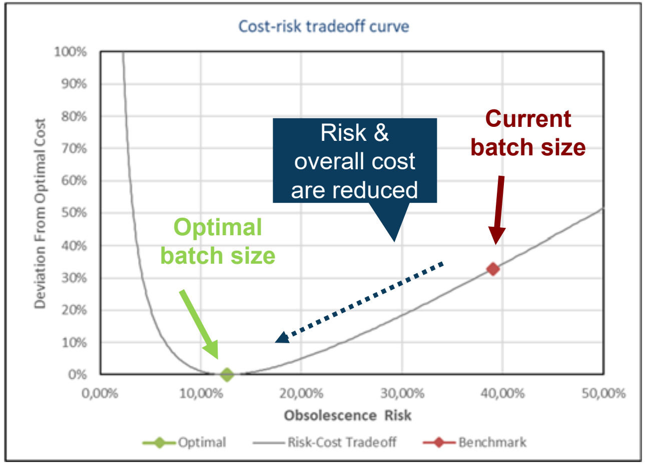
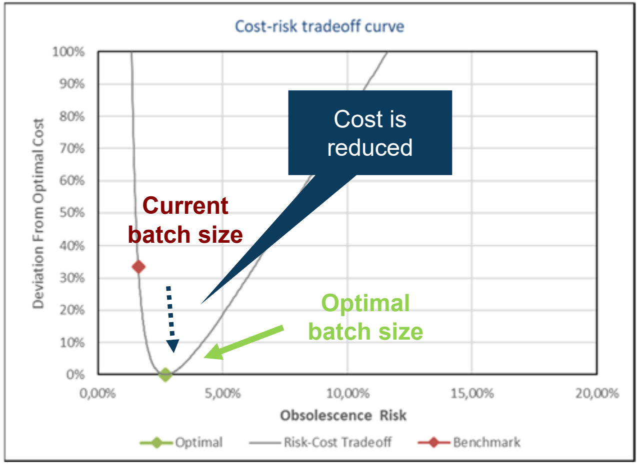
Case Study – The analytics approach takes all product-specific characteristics into account and allows to reduce both cost & risk

Reduce current batch size to reduce risk	Increase current batch size to reduce cost



SKU A (anonymized)



SKU B (anonymized)

- Data-driven model calculates cost-risk trade-off curves for each SKU to reduce overall E2E SC costs & minimize supply risk when setting batch sizes.

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