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Using data-driven insights to enable better business outcomes

How a leading retailer optimized its inventory management

Table of contents

The retailer's dilemma

While "service, choice, convenience" may not have quite the same ring as the real estate adage "location, location, location," retailers should start embracing this mantra as they seek to cater to the demands and expectations of today's consumers.

Increased digitization and online commerce have led to a proliferation of services and platforms offering greater choice and convenience. Not only are retailers expected to carry the assortment of products their customers want, but they are also under pressure to offer services such as expedited or same-day shipping, free returns, and other perks along the path to purchase.

Delivering this kind of frictionless customer experience while maintaining or enhancing margins is a challenge for retailers. To maintain resilience against supply chain disruptions and the agility to capitalize on new trends, retailers are looking for ways to improve operational efficiency and reduce costs within their supply chains.

Achieving this balance requires close collaboration and the synchronization of efforts between multiple business functions, including merchandising, marketing, store operations, and IT. To meet this challenge, retail executives are starting to invest in data science capabilities to mine enormous amounts of data to better connect, optimize, and automate their operations. This data can be used to inform key business decisions across departments and serve as a tool to augment the human touch and experience of existing staff.

Using data, analytics, and visualization tools, insight-driven organizations can transform the way they do business, but blindly investing millions of dollars in multi-year technology implementations to upgrade core IT systems is not itself a recipe for success. It is only by pairing this technology with thoughtful consideration of the potential of these massive new data streams that organizations can genuinely drive insights that can optimize key business decisions and fully achieve the benefits they seek.

From an implementation perspective, it's better to engage in short, agile initiatives that unlock value quickly without large up-front investments. These quick wins help gather momentum and valuable lessons to reinforce the broader transformation along that journey. It's important for transformations to start with activities that allow for rapid value creation—through "testing" and "learning" to establish tangible proof points. The use cases can then be prudently scaled across the enterprise.

This was the approach Deloitte used to elevate a leading national retailer's analytical capabilities. Over a period of 12 months, the company evolved from using a mix of intuition and basic spreadsheets to having near-real-time analytical tools and sophisticated machine learning (ML) models that informed business decisions and freed up resources for more value-added and strategic activities.

Data can be used to inform key business decisions across departments and serve as a tool to augment the human touch and experience of existing staff.

One retailer's journey

The retailer, a mid-sized national chain, had built a reputation as the go-to destination for consumer staples, electronics, and housewares. The company had recently recognized that rising inventory costs were not translating into the expected increases in revenue.

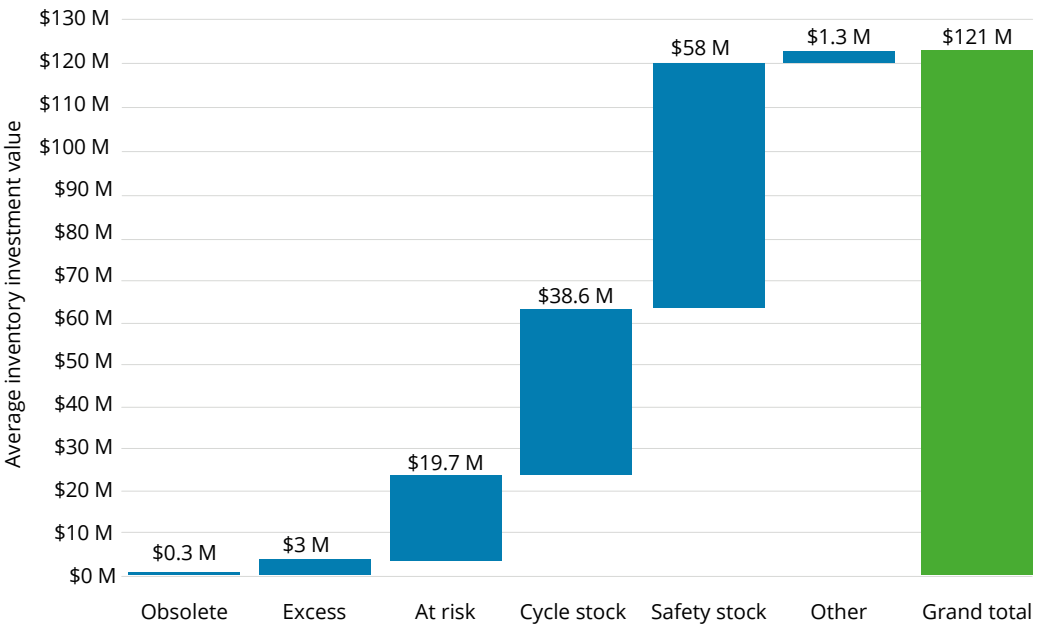
Management engaged a cross-functional team of supply chain and analytics experts to conduct a six-week assessment to identify the foremost issues and secure some quick wins.

To break down inventory across several categories, the assessment combined qualitative interviews and quantitative analysis of big data (billions of data points across sales, inventory, purchases, and shipments) (see figure below). The intention was to identify and isolate unproductive stock buildup across its network of stores and distribution centres (DCs).

By combining the traditional assessment approach with an innovative, data-driven action plan to address the identified issues, the retailer was able to quickly unlock value and turn its focus to the business levers that mattered most. The project helped to reveal a cause of the inventory problems and identify highly targeted short- and long-term initiatives to alleviate immediate pressure points and ensure ongoing synchronization of inventory levels in response to variable demand signals across stores and DCs.

A purpose-built and proprietary analytics engine permitted the client to quantify the reduction in working capital and operating costs of each initiative. Real-world constraints were identified, and learnings were incorporated into the ML models. Data engineers built a highly optimized, robust data pipeline and conducted routine checks to maintain the integrity of the solution. Over an eight-week reporting phase, data was vetted and new fields were created to power the dashboards used to track progress against defined baselines. This resulted in improved reporting accuracy against reliable benchmarks.

Sample waterfall inventory breakdown diagram



Obsolete: Inventory not sold in the trailing 12 months

Excess and at risk: Inventory greater than forecasted demand over the next six months or more than 50% above target levels based on inventory policies

Cycle stock: inventory used to meet regular demand between replenishment cycles

Safety stock: Inventory required to minimize stock-out risk and achieve a given service-level target

Other: One-time buys, seasonal purchases, contractual obligations, etc.

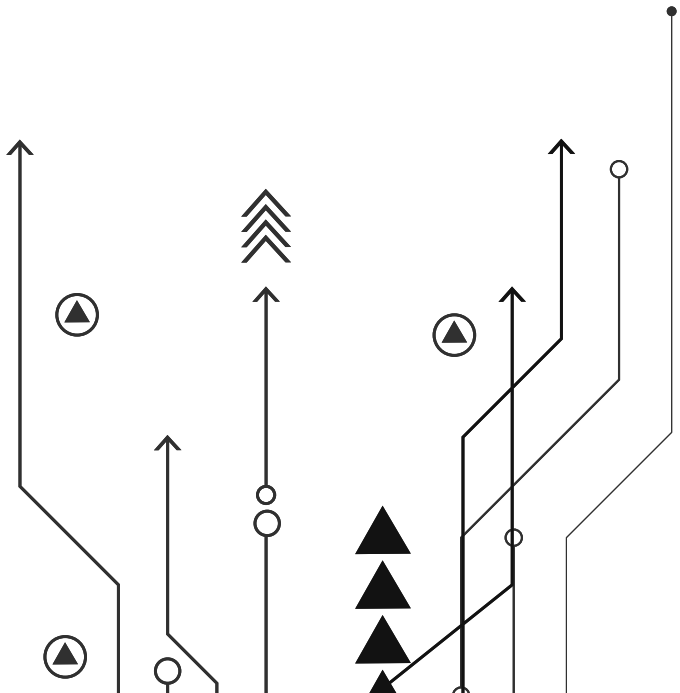
Building momentum through pilots

Once proof of value was established, pilot projects were conducted to demonstrate their effectiveness and uncover new learnings in a low-risk setting prior to network-wide deployment. Subtle business nuances were accounted for, which drastically improved the quality of output, user adoption, and buy-in from stakeholders.

For example, the analysis revealed that the client's buying team placed certain replenishment orders months in advance, requiring adjustments to the algorithm that calculated average lead times. Filtering out these pre-booked orders prevented the incorrect inflation of expected lead times and distortion of downstream metrics, such as target safety-stock levels.

In parallel, comprehensive change management and upskilling programs were set up to explain the workings of the ML models and their impact on the business and technical teams.

Data engineers built a highly optimized, robust data pipeline and conducted routine checks to maintain the integrity of the solution.



Optimizing inventory management using machine learning (ML)

The first three initiatives on the roadmap were carefully designed to help solve distinct inventory problems, specifically relating to inventory obsolescence and the inventory levels at stores and DCs. Each initiative leveraged proprietary statistical and ML models based on billions of cleansed transactional data points.

The initiatives were executed contemporaneously, and the aggregate capital unlocked within one year was used to fund a much larger technology and process transformation that extended into other areas of the business.

The following illustrates the optimization framework of the first three major inventory initiatives.

INVENTORY OPTIMIZATION INITIATIVE 1

Enhancing distribution centre operations using an ML recommendation engine (SmartPurchase)

SmartPurchase provides real-time purchase recommendations that help retailers address three vital considerations: what to buy, how much to buy, and when to buy.

How was it built?

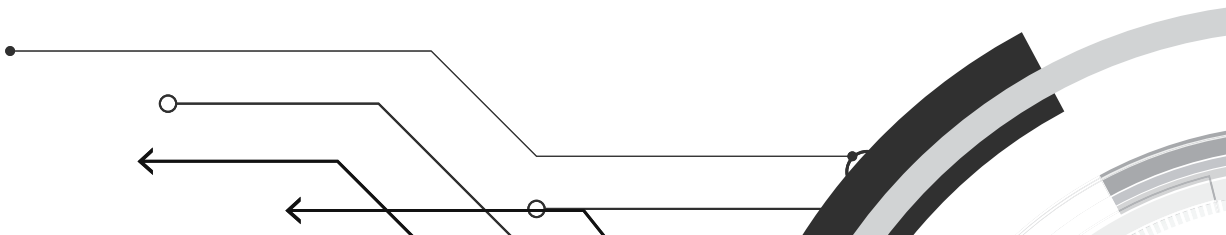
- A statistical model that calculates the lower and upper bound of inventory thresholds in approximately 30 minutes (previously took weeks to measure)
- An ML-based forecasting model (ViewPoint) that predicts demand and suggests buy quantities
- A decision tree that provides recommendations that reflect current and proposed inventory positions to set target thresholds

How was it scaled?

- Design sessions were hosted to integrate business nuances and real-world constraints into the logic/code base
- Power users were engaged early on to uncover learnings on new features
- Training and information packages were provided to broader user base prior to rollout (i.e., go-live)
- Live dashboards were set up to monitor inventory trends and purchasing behaviours

Value provided

- Up to 15% reduction in unproductive stock levels at DCs
- Improved productivity of teams
- Enhanced fulfilment of business-critical products to stores
- Integration of recommendation engine with established purchasing platform



KEY LESSONS FROM INITIATIVE 1

1. **Give sales/purchasing outliers special treatment** | Outliers (special orders, etc.) should be accounted for differently than day-to-day orders/sales to account for how they influence model outputs (replenishment parameters, order amounts, etc.).

2. **Respect pack sizes and vendor minimums** | Pack sizes and vendor minimums can govern the ordering cycles for purchasing and store replenishment.

3. **Use exceptions to improve outputs** | Prior to finalizing any analysis, business users should provide specific exclusions and business intelligence to enhance the outputs.

4. **Recognize that unfulfilled demand is still demand** | When determining demand as a data input, it is important to enhance the source data by modelling "true" demand by accounting for stock-outs and/or unfulfilled shipments to stores.

5. **Minimize labour impacts** | When setting new replenishment parameters, it is important to understand current receiving volumes at the DCs and stores to avoid creating unmanageable receiving issues.

INVENTORY OPTIMIZATION INITIATIVE 2

Elevating store operations using an automated store replenishment system (InStock)

InStock calculates optimized reorder points for an automated store replenishment system.

How was it built?

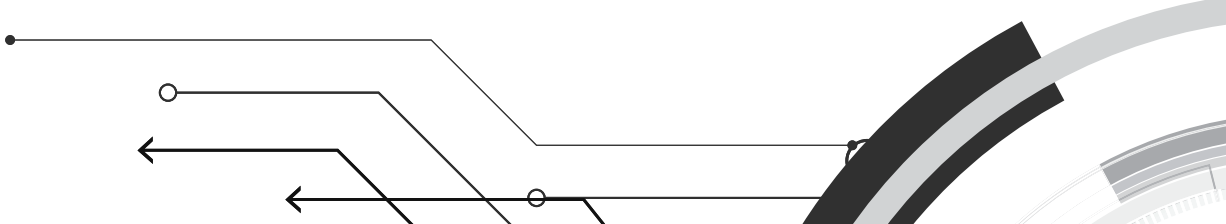
- For SKU-store combinations where the ML forecast (ViewPoint) is effective at modelling demand, the forecast triggers the demand signal
- For remaining SKU-store combinations, a representative historical period is user-selected to represent the inventory flow of the SKU

How was it scaled?

- Design sessions were facilitated to understand the various business nuances and real-world constraints that needed to be incorporated into the logic/code base
- Small pilots at select stores were conducted to validate models and uncover learnings
- Training sessions and information packages were provided to stores prior to network-wide rollout
- Live dashboards were set up to monitor inventory trends at stores and replenishment requests to DCs

Value provided

- 10%–20% inventory reduction
- 2%–5% increase in in-stock service level
- Reduced overstock and days-on-hand
- Reduced manual ordering, freeing up store labour
- Productivity improvements through automated replenishment and upskilled planning/merchandising teams
- Statistical model generates optimized reorder points and order quantity values for two million SKU-store combinations in less than 30 minutes



KEY LESSONS FROM INITIATIVE 2

1. **Make space for details** | When determining optimal order quantities at each store, product dimensions and storage space must be considered to avoid sending excess bulky product (water, paper towels, etc.).

2. **Evaluate current norms** | It is critical to determine how the business treats demo/tester stock. Can a demo be sold? Must there be "one to show and one to go?" This impacts the minimum stock a store must have.

3. **Prepare for extremes** | During extreme external events such as the COVID-19 pandemic, micro-trends of consumer behaviour can emerge that have significant influence on sales. It is critical to refresh replenishment and purchasing targets at a much higher frequency, using a much smaller timescale of historical sales.

4. **Be precise with inventory audits** | Store audits of inventory positions are critical to the success of the replenishment system. Without accurate inventory data, the risk of stock-outs and lost sales is considerably higher.

5. **Get alignment on terminology** | Upfront alignment on definitions for key terms and common vocabulary is critical to ensure clear communication throughout the organization.

INVENTORY OPTIMIZATION INITIATIVE 3

Managing excess and obsolete inventory using a statistical inventory rebalancing model (InvEQ)

InvEQ identifies underperforming items at stores that are more likely to sell-through from other locations across the network.

How was it built?

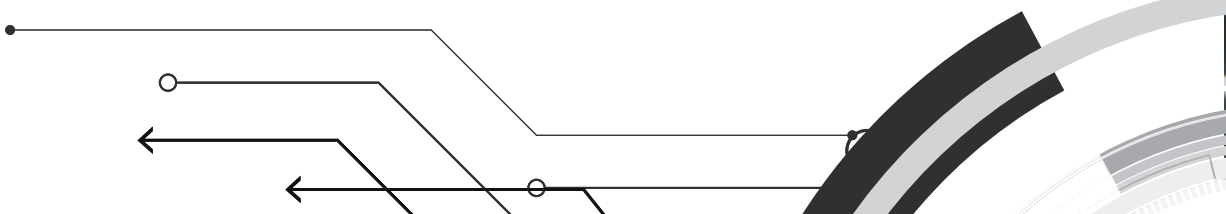
- Statistical model isolates excess and obsolete inventory with the highest potential to sell-through at other stores
- Pullback scope is optimized using store and DC constraints to maximize sell-through of unproductive stock

How was it scaled?

- An in-depth analysis was conducted to understand any DC constraints that needed to be incorporated into the logic/code base
- Design sessions were conducted with DC leadership to define the reverse logistics process
- Small pilots at select stores were used to validate the model and uncover learnings
- Training sessions and info packages were provided to stores prior to network-wide pullback
- Live dashboards were used to monitor excess and obsolete inventory trends at stores

Value provided

- 10%–20% reduction in unproductive stock
- Freed-up shelf space use to merchandise higher-value products, improving margin and revenue
- Identification of products to stop buying/discontinue
- Reporting monitors stock pullback progress and tracks sell-through at new stores



KEY LESSONS FROM INITIATIVE 3

1. **Consider all factors around product reintroduction** | When determining obsolete and excess stock, it's important to understand whether the product had an opportunity on shelves to generate sales in the first place.

2. **Accept the cost of doing business** | While historic sales may not support carrying a large assortment of all products in certain categories (e.g., cosmetics, cameras), sometimes it is a deliberate requirement for a particular category and meant to drive a specific customer or brand perception.

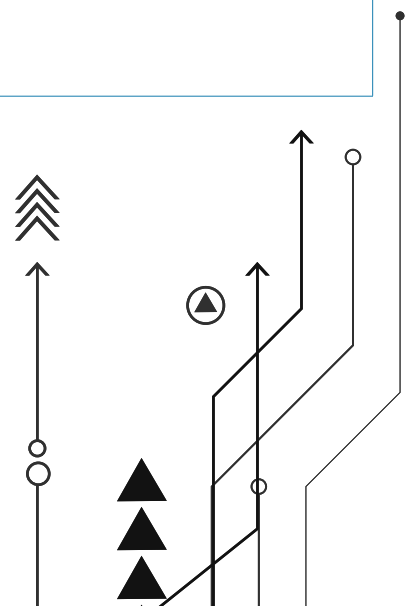
3. **Prioritize loss prevention** | Rebalancing and reverse logistics products for high-dollar-value items require additional loss prevention measures that could add to the rebalancing cost, making them less desirable candidates for this exercise.

4. **Level-load reverse logistics** | Due to the store-to-DC ratio, items requiring wide-scale reverse logistics effort were phased out over multiple days and weeks based on lead time to keep DC receiving volumes more manageable.

5. **Fine-tune instructions for clarity** | For manually intensive initiatives, instructions must be clear and concise (e.g., fragile item packaging for reverse logistics).

Six ways that AI and ML capabilities create business value

1. Cost reductions	2. Speed to execution	3. Reduced complexity
Applying intelligent solutions to automate relatively low-value and often repetitive tasks can reduce costs through improved efficiency and quality. **Example** Automating data entry and customer product stock inquiries using natural language processing.	Minimizing latency to reduce the time required to achieve operational and business results. **Example** Combining assessments with innovative action plans to secure quick wins that demonstrate and unlock value.	Improving understanding and decision-making through analytics that are more proactive, predictive, and able to see patterns in increasingly complex sources. **Example** Using models to calculate lower and upper inventory thresholds with greater accuracy and in less time.
4. Transformed engagement	**5. Fuelled innovation**	**6. Fortified trust**
Enhancing capabilities to change the way people interact with technology and enable businesses to engage them on human terms rather than forcing them to engage on machine terms. **Example** Using conversational bots that can understand and respond to customer sentiments to address their needs more effectively.	Redefining where to play and how to win by using AI to enable innovative new products, markets, and business models. **Example** Recommending new product concepts and features based on customer needs and preferences mined from social media.	Improving quality and consistency and enabling greater transparency to enhance brand trust and security from fraud and cyber risks, among others. **Example** Identifying and anticipating cyberattacks before they occur.



Planning next steps

Balancing inventory management with service levels is a challenge at the best of times. Supply chain disruptions and other external shocks can easily render it a monumental task.

Here are some essential questions that business leaders and their operations and supply chain teams should be asking to determine the next steps they need to take on their transformation journeys.

Finance

- How can big data analytics help unlock more working capital in the short run without impacting revenue?
- How much capital should be allocated to upgrading our existing technology stack vs. improving bricks-and-mortar experiences?
- What can we do to make the use of inventory more productive and efficient?
- How can technology help us automate low-value tasks, reduce errors, and reallocate resources to value-added tasks?

Retail operations

- What opportunities exist to optimize store operations so that staff can spend more time focusing on catering to customers and high-value activities?
- How can we ensure that stores are stocked with the right inventory and displaying it optimally?
- What strategies can we use to improve in-store customer experiences?
- How can we help stores reduce the quantity of unproductive stock on hand?

Distribution centre and transportation logistics

- What opportunities exist to improve the operational effectiveness of DCs across the vital functions of receiving and fulfillment?
- How can we better integrate and collaborate with suppliers to improve visibility into incoming shipments?
- How effective are our operations compared with our competitors'?
- What is the optimal warehouse layout for maximum efficiency and use of space?

Merchandising

- How can we better utilize data and technology to solve our strategic priorities?
- What emerging consumer trends should inform the product selection strategy for stores?
- Which design principles will optimize store layouts to improve customer experiences and sales?

Supply chain planning

- How can big data analytics help streamline purchasing decisions of known replenishment items?
- What is the right inventory level to minimize out-of-stock without over-investing and potentially creating unproductive stock?

Becoming an insights-driven organization requires a thoughtful approach that maximizes both productivity and economy. Define the core purpose of the exercise at the outset. Throwing a lot of money at an issue raises the stakes and risks losing the support of senior leadership if the effort doesn't return results. By focusing on short, agile initiatives that unlock value quickly without big up-front investments, organizations are able to learn from the process and build momentum as they apply those lessons.

Of course, finding the right answers is contingent on asking the right questions. Choosing a partner that thoroughly understands what it takes to become an insights-driven organization can accelerate the process by showing companies what questions they need to ask and then guiding them through their transformation journey.

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