EBOOK

The AI-Powered Supply Chain: Better Demand Forecasting and Operational Excellence

DataRobot

Executive Summary

With 11 million unemployed in the U.S. and an estimated global economic toll of $28 trillion, COVID-19 has introduced unprecedented uncertainties into supply chains -- making a hard job that much harder. Industries such as retail, consumer products, manufacturing, pharmaceutical, and life sciences all struggle to align production and stocking with rapidly shifting purchasing demands. At the same time, some channels have surged ahead: online retailers, delivery services, and pharmacies are thriving. But with this success comes its own set of supply-chain complexities.

In this disruptive time, retailers and manufacturers must work harder than ever to identify supply sources in order to meet demand volatility. They need to identify vulnerable key supplier partners during this disruption, and they need close coordination between supply chain and store operations. Regardless of the pandemic, those who lack a robust and agile predictive capability face supply chain management challenges.

The Power of Machine Learning

Injecting machine learning into existing business intelligence solutions can greatly enhance the ability of retailers and manufacturers to predict future demand for goods, even in uncertain and dynamic times. These platforms provide decision-makers with unprecedented insights, enabling them to make more informed choices across all aspects of supply chain management.

Machine Learning enables:

AI-Driven Demand Forecasting

Using a range of historic data sources to inform the level of future demand, retailers and manufacturers have increased availability in many cases by more than 5 percent, decreased waste by over 8 percent, and reduced losses due to write-offs.

Forecast returns

By predicting how much stock will be returned, retailers will need to procure less stock from suppliers, minimizing the risk of excessive inventory across the supply chain.

Reduce Out-of-Stock

With better forecasting on a store-by-store, week-by-week, and SKU-by-SKU, retailers can rely on better granularity to reduce out-of-stocks.

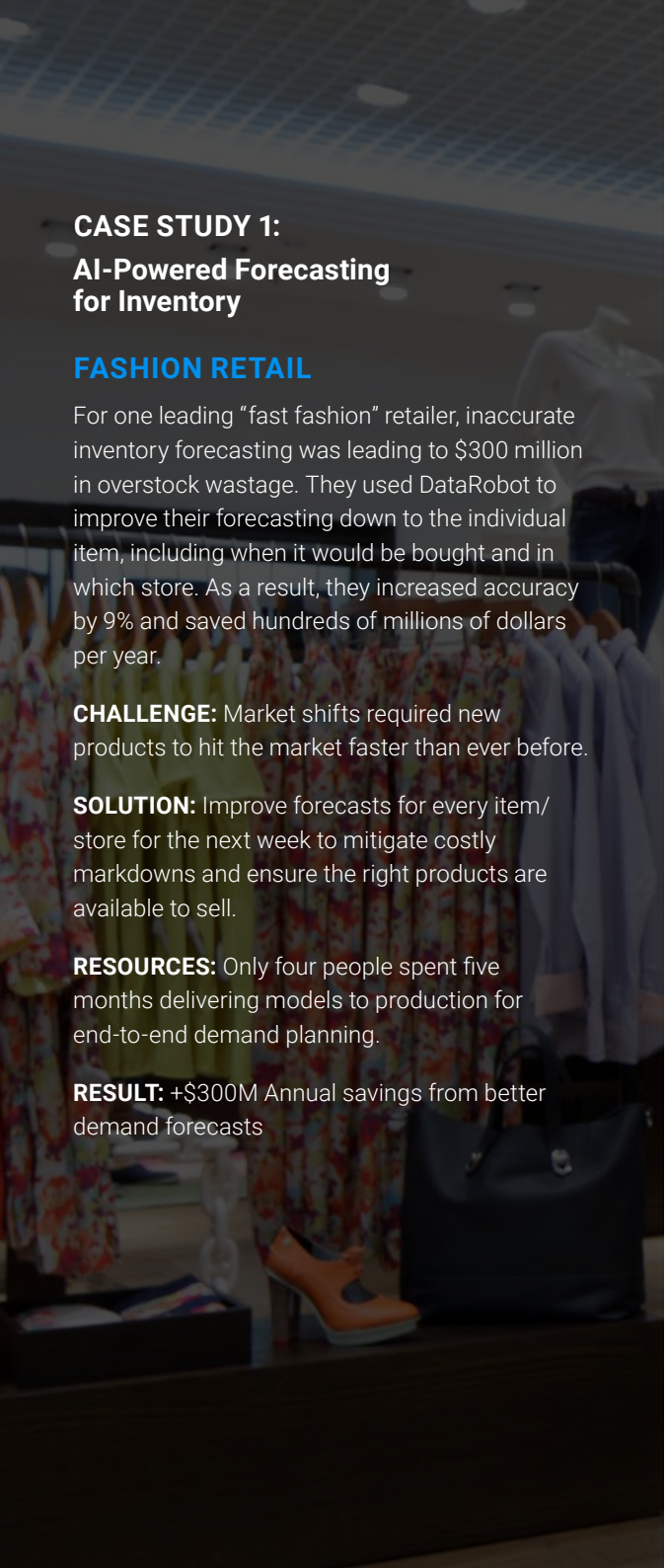
New product forecasting

Machine learning can predict likely sales in the first few weeks and months of selling a new product.

Price Optimization

Identify optimal price points influenced by multiple factors, such as item, brand, sub-category, category, and location, thus optimizing alignment of demand and supply constraints or imbalances.

Retailers who adopt homegrown AI-based solutions have seen challenges, with 96 percent encountering difficulties in developing effective models and 90 percent having trouble moving AI models into production. Those who do add AI can accelerate efficiency and boost the bottom line: one global retailer reported $400 million in annual savings and a 9.5 percent improvement in forecasting accuracy. DataRobot solutions offer a seamless way to significantly improve business results by automating, simplifying, and democratizing AI-driven supply chain management.



CASE STUDY 1:

AI-Powered Forecasting for Inventory

FASHION RETAIL

For one leading "fast fashion" retailer, inaccurate inventory forecasting was leading to $300 million in overstock wastage. They used DataRobot to improve their forecasting down to the individual item, including when it would be bought and in which store. As a result, they increased accuracy by 9% and saved hundreds of millions of dollars per year.

CHALLENGE: Market shifts required new products to hit the market faster than ever before.

SOLUTION: Improve forecasts for every item/store for the next week to mitigate costly markdowns and ensure the right products are available to sell.

RESOURCES: Only four people spent five months delivering models to production for end-to-end demand planning.

RESULT: +$300M Annual savings from better demand forecasts

A Trillion Dollar Problem

Before the pandemic, lost revenue due to overstock or out-of-stock items cost retail and manufacturing industries over $1 trillion a year worldwide. Pandemic-driven store closings and supply-chain snags made this situation worse. To compete in an ever-changing market, it's critical to provide customers with the right product in the right place at the right time.

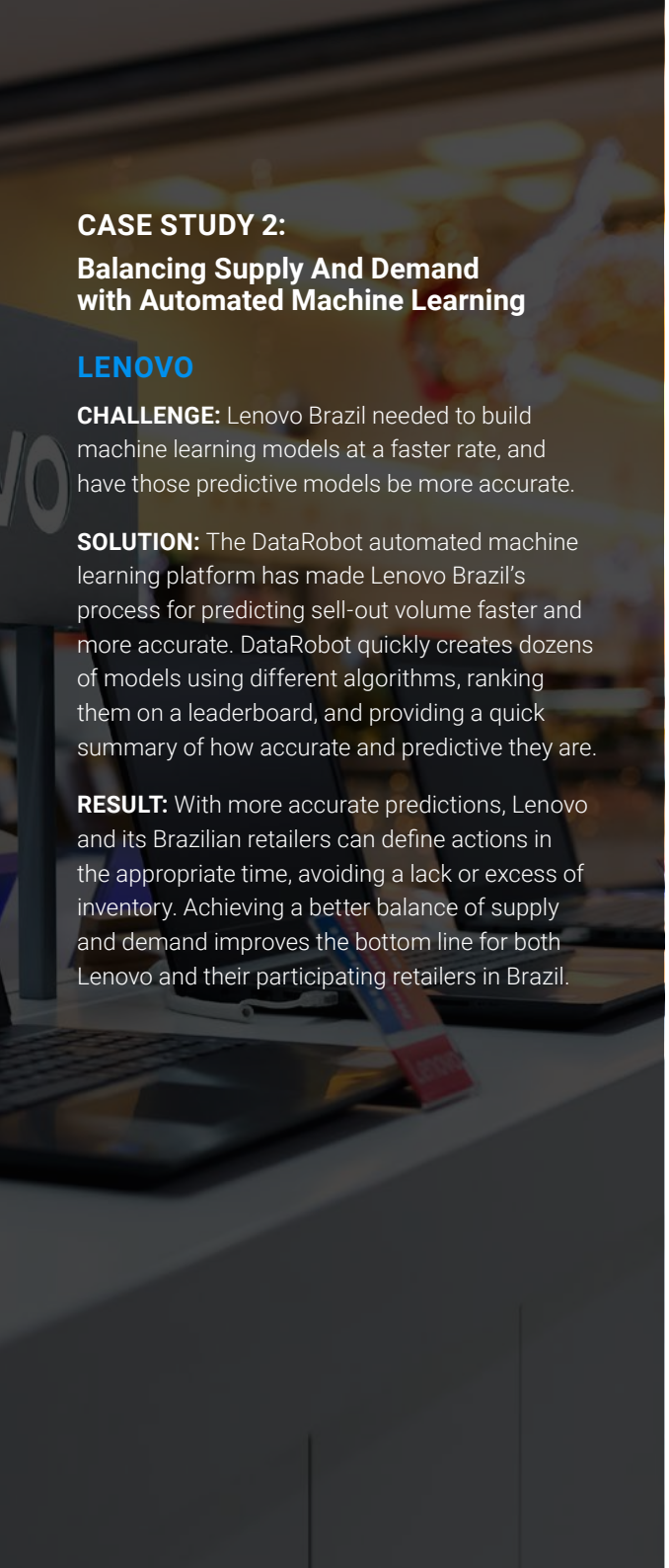
When they are unable to predict how the market will change and what buyers' habits will be in the future, retailers and manufacturers struggle to match inventory with demand.

Pre-COVID Impact of Out-of-Stocks on Retail

$984 BILLION
Lost Sales from Out-of-Stocks, Worldwide

$144.9 BILLION
Lost Sales from Out-of-Stocks, North America

$24.2 BILLION
Additional Safety Stock to Reduce Out-of-Stocks, North America



CASE STUDY 2:

Balancing Supply And Demand with Automated Machine Learning

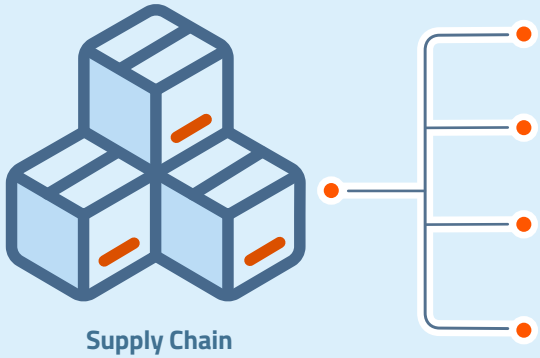
LENOVO

CHALLENGE: Lenovo Brazil needed to build machine learning models at a faster rate, and have those predictive models be more accurate.

SOLUTION: The DataRobot automated machine learning platform has made Lenovo Brazil's process for predicting sell-out volume faster and more accurate. DataRobot quickly creates dozens of models using different algorithms, ranking them on a leaderboard, and providing a quick summary of how accurate and predictive they are.

RESULT: With more accurate predictions, Lenovo and its Brazilian retailers can define actions in the appropriate time, avoiding a lack or excess of inventory. Achieving a better balance of supply and demand improves the bottom line for both Lenovo and their participating retailers in Brazil.

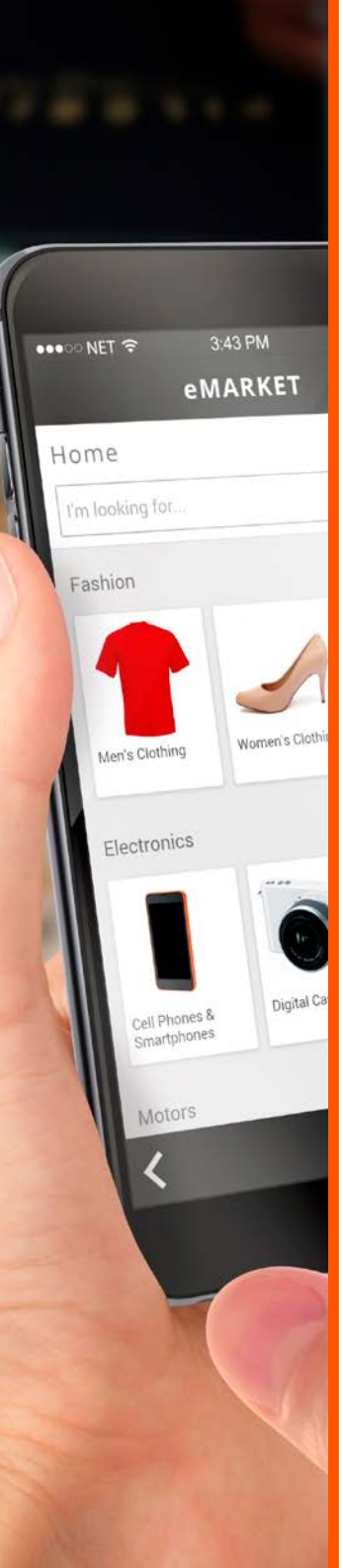
Supply Chain Planning Challenges



COVID-19 impacts on the supply chain

Immediate impact: Sales slump on unwanted items, and sales lost for not producing enough high-demand items. From fashion, furniture, bookstores, sports supplies, and vehicle parts, the full range of manufacturing and retail has been impacted.

Longer range: Unpredictability. No one knows how long it will last or what recovery will look like. All the planning and predictive challenges inherent in the supply chain are multiplied by the inherent uncertainty.



The Empowered Consumer

Today's consumers are more informed and empowered than ever. They expect to find what they want and purchase it as quickly as possible. With the increasing prevalence of online shopping, the online customer experience is influencing experiences at the local retailer. Consumers want a seamless, efficient buying and returns process no matter how or where they shop.

The pressure is on retailers and manufacturers to have an agile supply chain that can adapt to many challenges, including the following:

1. Consumers have evolving needs and habits. They can change their patterns of behavior very quickly in response to seasonality, trends, or other changing circumstances.

2. Consumers are moving to multi-channels, like mobile and online purchasing. This is a trend that began before COVID-19 and solidified during the pandemic, as online shopping increasingly became the norm.

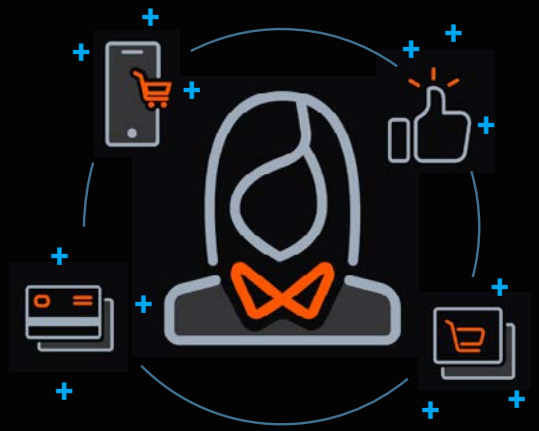
3. Consumers are increasingly shifting to utilitarian, or needs-based shopping, from the local retailer to online merchants. Everyday items like toilet paper and other necessities can be purchased and delivered without leaving the home.

4. Consumers expect accurate information on product availability and time to ship to their home. This requires a high level of supply chain transparency.

5. Consumers want customized options. Supply chains have to enable retailers to easily create "one-offs."

6. Consumers want easy returns, which often leads to a reverse supply chain challenge.

THE MODERN CONSUMER PROFILE



Always Connected
+
Demands Sublime Experience
+
Empowered and Astute
+
Tech Savvy
+
Zero Tolerance

How the Empowered Consumer Impacts the Supply Chain

A number of key factors have driven a fundamental change in consumer behavior, resulting in an impact to the supply chain that ripples through retail and manufacturing.

The Disruptors:

Society

Consumers transcend traditional demographic brackets, from the heartfelt shopper influenced by sustainability to the shopper who is well-informed before purchasing. Spending is shifting from superfluous products to utility and price-comparison activities.

Economy

Economic trends can impact the supply chain. The speed of growth in emerging markets has led Asia to overtake North America and Europe in terms of market size. Income expansion and urbanization will drive addressable population growth. Between 2018 and 2023, China and India alone will add 122 million to the addressable consumer pool.

Technology

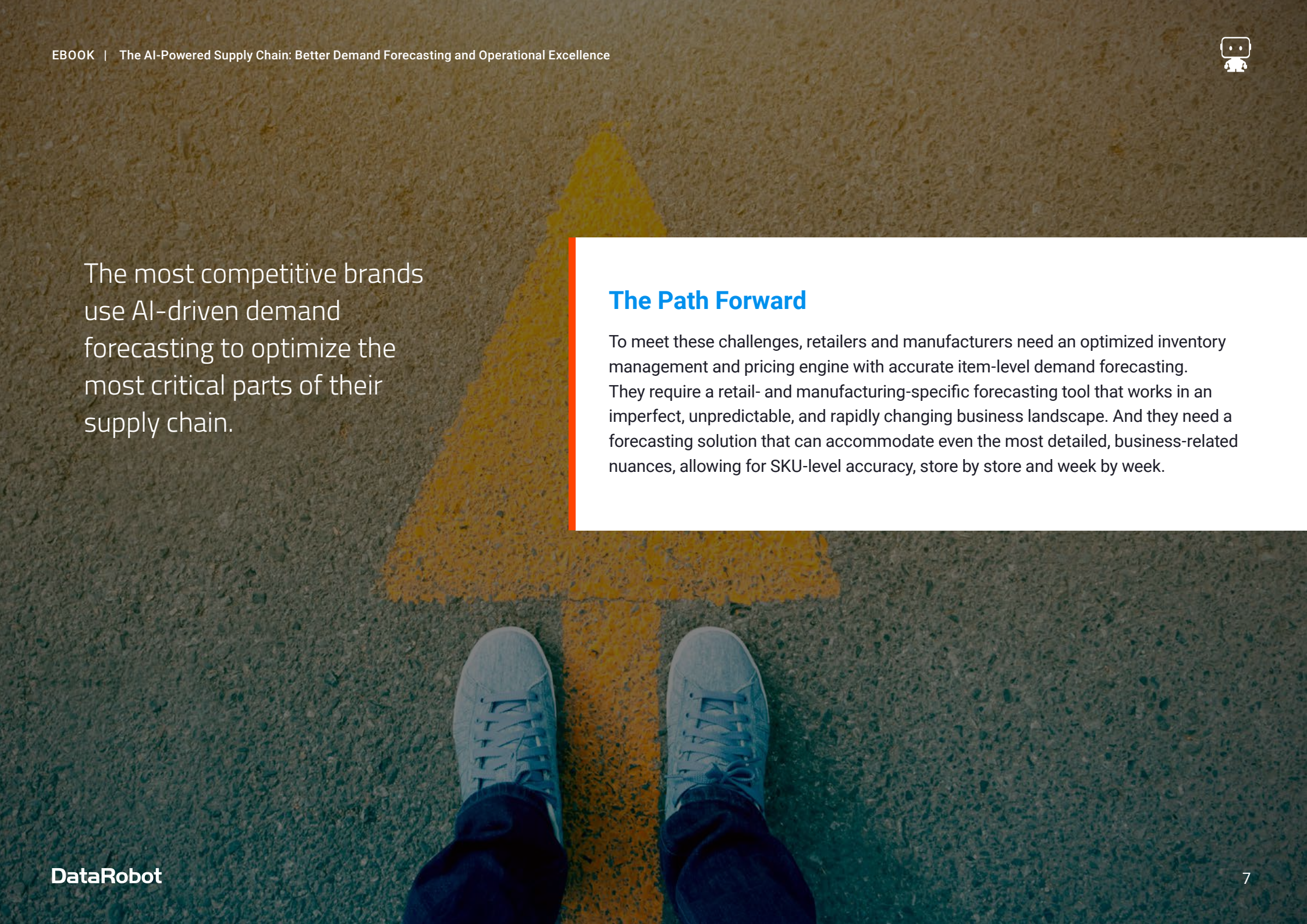
Mobile phones are ubiquitous, driving e-commerce. Over half of the world's population has access to the internet, largely via mobile devices. As a result, there is greater demand for transparency and accountability across the supply chain, including product traceability.

COVID-19

The pandemic has shown that the unforeseen is ever-present. Acts of nature, sudden city-by-city lockdowns, and disruptive events can add new and wholly unexpected complexity to supply-chain dynamics.

Industry

Consumers are looking for low-priced products, driving manufacturing and retail to focus on the discount channel. Discount, convenience and online channels continue to grow, powered in part by digital payments.



The most competitive brands use AI-driven demand forecasting to optimize the most critical parts of their supply chain.

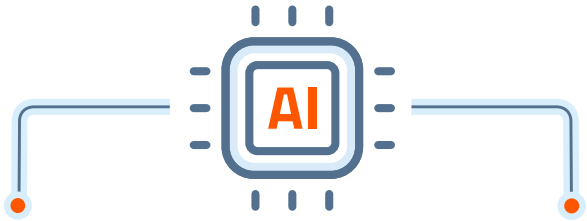
The Path Forward

To meet these challenges, retailers and manufacturers need an optimized inventory management and pricing engine with accurate item-level demand forecasting. They require a retail- and manufacturing-specific forecasting tool that works in an imperfect, unpredictable, and rapidly changing business landscape. And they need a forecasting solution that can accommodate even the most detailed, business-related nuances, allowing for SKU-level accuracy, store by store and week by week.

The AI-Powered Supply Chain – Use Cases

For the supply chain, artificial intelligence powers predictive analytics, using machine learning models from the past to build models that can predict the future. AI drives accurate demand forecasting in the real world, and these accurate predictions, in turn, improve demand response times and decrease unnecessary overhead.

An AI-Driven demand forecasting solution provides retail-specific forecasting in an imperfect and unpredictable business landscape. A multi-series automated time series product can accommodate even the most detailed business-related nuances, allowing a high degree of SKU-level accuracy.



AI-Driven Demand Forecasting Uses Cases

- **Forecast demand by geography, category, brand, store, and SKU on a weekly or daily basis**
- **Forecast product returns**
- **Forecast out-of-stocks**
- **Forecast new product launches**
- **Shipment logistic improvements**
- **Warehouse and distribution center automation optimization**

Additional AI Use Cases

- **Defective product detection**
- **Range and assortment optimization**
- **Price optimization along the supply chain**
- **Identify bottlenecks to improve warehouse throughput**
- **Modeling to optimize shipping**

REVERSE SUPPLY CHAIN (RETURNS)

Reverse supply chain is the new battleground. The Fashion and Apparel industry is the hardest hit, with online returns expected to reach $7.0 billion. In the UK, the average returned item passes through seven pairs of hands before being re-listed for sale. About 8 percent of brick-and-mortar purchases are returned, with e-commerce returns as high as 15 to 30 percent.

Return forecasting offers the opportunity to predict the probability of return for every item purchased through all channels using customer data, basket-level data, and product-level data.

Benefits:

- Operate more effective returns policy
- Incentivize customers to not over-order goods
- Better manage customers with poor return records
- Use estimates within inventory management decisions

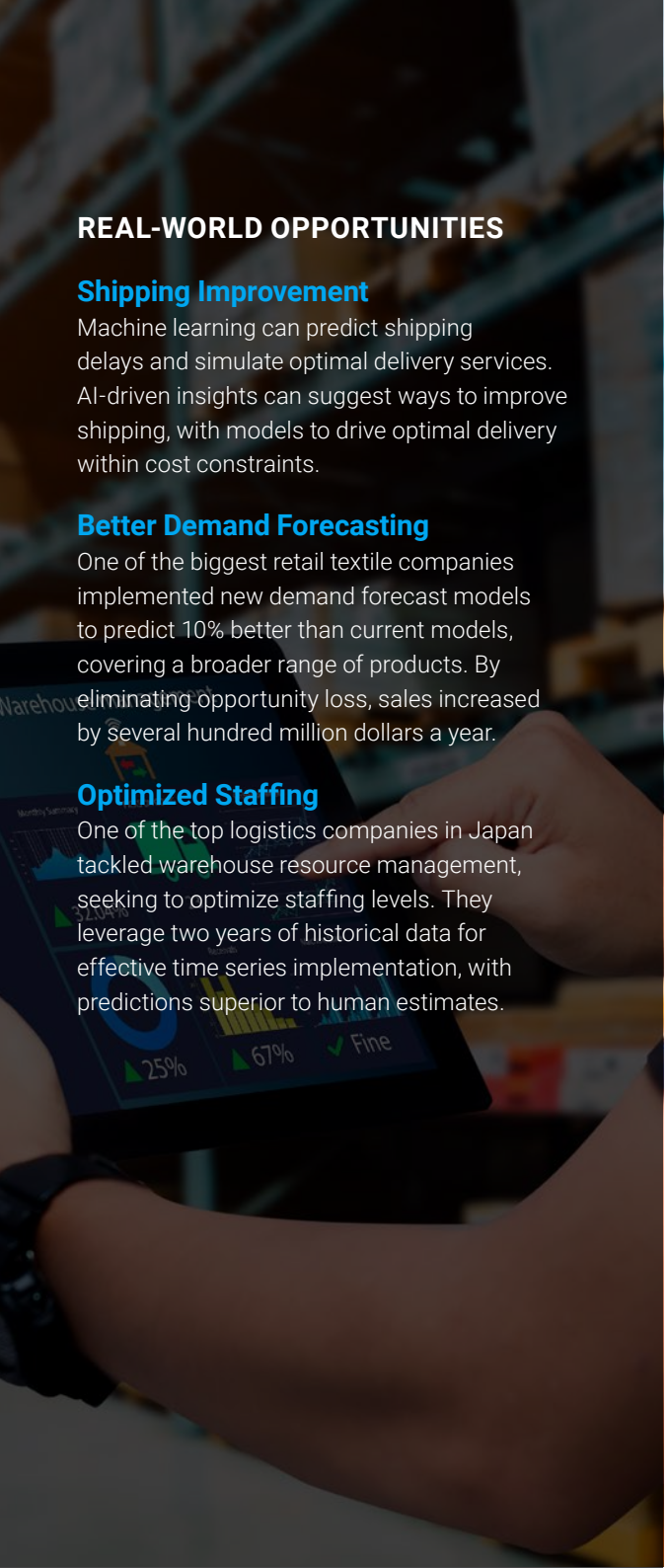
By predicting how much stock will be returned, less stock will need to be procured from suppliers. This helps minimize the risk of excessive inventory while also reducing shipment costs.

Benefits of an AI-Powered Supply Chain

AI and advanced analytics support the ability of retailers and manufacturers to predict demand. AI can help to optimize inventory levels across the entire supply chain to avoid overproducing items. Overproduction leads to waste or price reductions on overstocked items, costing retailers and manufacturers hundreds of millions of dollars annually.

Other advantages of an AI approach to supply chain management include:

- **More** accurate sales and demand forecasts, by SKU, store, and week
- **Optimized** staffing levels across the supply chain from stores to distribution centers
- **Fewer** out-of-stock situations
- **Decreased** excess and safety stock
- **Faster** response to trends, seasonality, and competitors
- **Optimized** curbside pickup and delivery to customers
- **Increased** customer satisfaction



REAL-WORLD OPPORTUNITIES

Shipping Improvement

Machine learning can predict shipping delays and simulate optimal delivery services. AI-driven insights can suggest ways to improve shipping, with models to drive optimal delivery within cost constraints.

Better Demand Forecasting

One of the biggest retail textile companies implemented new demand forecast models to predict 10% better than current models, covering a broader range of products. By eliminating opportunity loss, sales increased by several hundred million dollars a year.

Optimized Staffing

One of the top logistics companies in Japan tackled warehouse resource management, seeking to optimize staffing levels. They leverage two years of historical data for effective time series implementation, with predictions superior to human estimates.

AI Applied to Demand Planning

Where traditional demand forecasting applies static, predetermined sets of rules to analyze data, AI can automatically detect complex interactions and patterns in huge batches of data that would be impossible for humans to recognize.

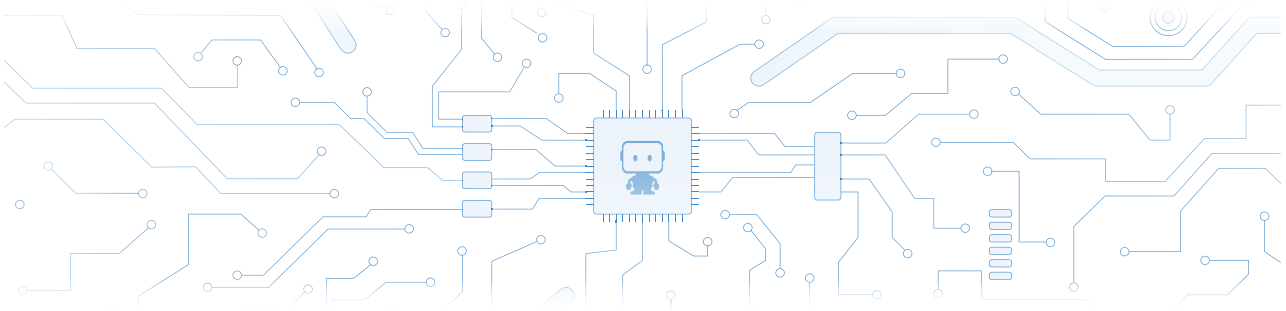
Automated AI systems take it a step further by updating retail demand forecasts over time, adjusting dynamically in response to changes in collected data. This greatly improves demand planning accuracy for launches, promotions, and markdowns involving products that share similar characteristics.

Time Series Forecasting

Automated AI solutions help retailers address one of their most complex tasks: Time series forecasting. Time series is a set of data points indexed, listed, or graphed in time order, and time series forecasting is the use of models to predict future values based on previously observed values.

Time series forecasting models use trends over time along with known future events, such as upcoming holidays, to extrapolate future behavior, making them very powerful for demand forecasting use cases.

By automating best practices, retailers and manufacturers can scale time series modeling to achieve the highest possible accuracy.



Five Steps to AI-Driven Forecasting

AI-Driven forecasting helps retailers and manufacturers turn mountains of data into detailed demand forecasts.

1

CREATE A STRONG FOUNDATION BUILT ON DATA

You've spent a small fortune collecting data about every interaction that a customer has with you – online and in-store. Begin by assessing the data, separating demand signal from the noise, taking into account past promotions and other external influences.

2

PREPARE YOUR DATA FOR MODELING

Not all data is useful, and an unknown portion may be incorrect, inconsistent, or missing. Bad data leads to bad forecasts. Automated machine learning algorithms can analyze all of your data to correct the problems that frequently cause inaccurate forecasts.

3

CREATE HIGHLY ACCURATE MACHINE LEARNING MODELS

Automated AI can use a library of hundreds of the most powerful open source machine learning algorithms to create advanced time series models in parallel. The resulting competition between models quickly identifies the best one to drive the forecast required for just-in-time operations.

4

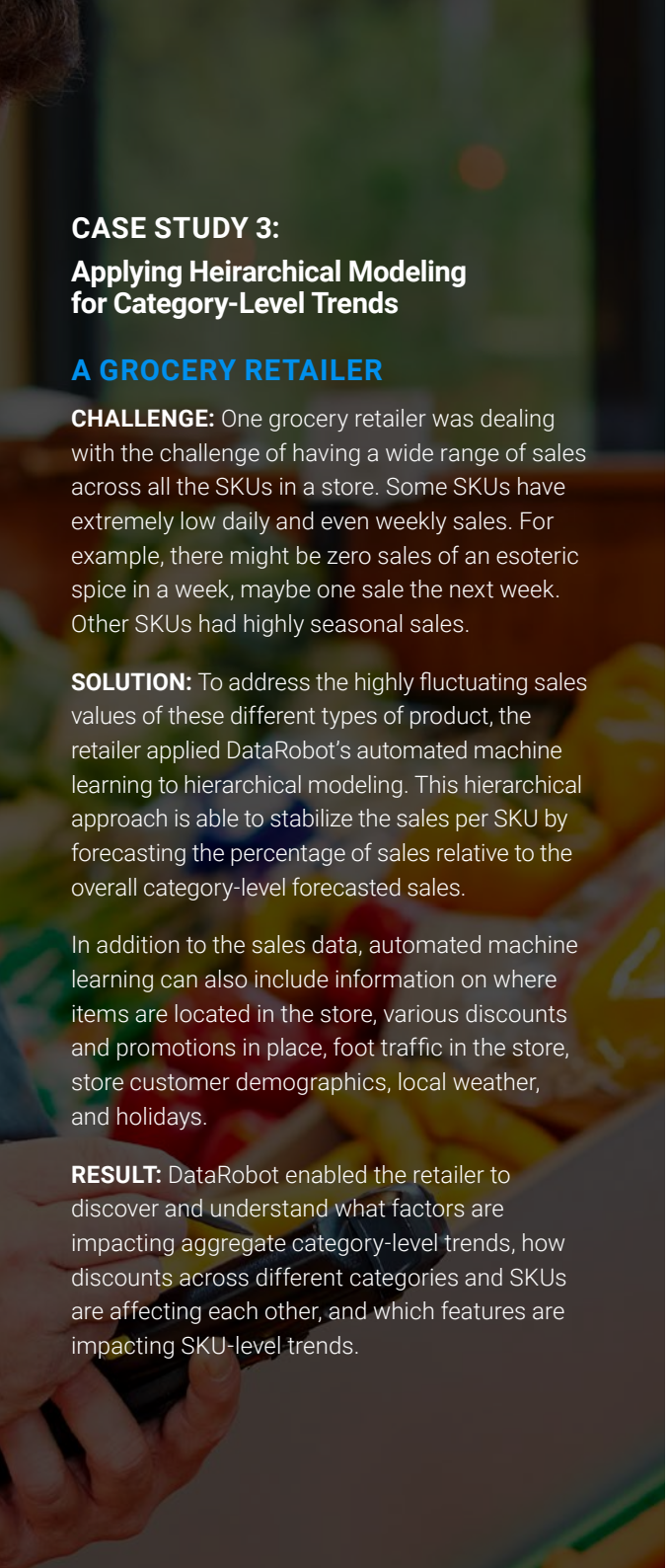
CONNECT DEMAND FORECASTS TO REPLENISHMENT AND ORDERING

Armed with detailed AI-driven demand forecasts and sales projections at the individual SKU level, it then becomes possible to connect the outputs of the models to the inputs that a rules-based planning system needs for efficient ordering and on-time delivery. Operationalize and democratize forecasts in your existing dashboards, such as Tableau, PowerBI, and Qlik.

5

UPDATE AI-DRIVEN FORECASTS AS NEEDED

Demand forecasting models need to be monitored, updated, and replaced regularly in order to account for environmental changes, such as a competitor opening a nearby store, a change in consumer preferences, swings in commodity pricing, or changes in the economy.



CASE STUDY 3:

Applying Heirarchical Modeling for Category-Level Trends

A GROCERY RETAILER

CHALLENGE: One grocery retailer was dealing with the challenge of having a wide range of sales across all the SKUs in a store. Some SKUs have extremely low daily and even weekly sales. For example, there might be zero sales of an esoteric spice in a week, maybe one sale the next week. Other SKUs had highly seasonal sales.

SOLUTION: To address the highly fluctuating sales values of these different types of product, the retailer applied DataRobot's automated machine learning to hierarchical modeling. This hierarchical approach is able to stabilize the sales per SKU by forecasting the percentage of sales relative to the overall category-level forecasted sales.

In addition to the sales data, automated machine learning can also include information on where items are located in the store, various discounts and promotions in place, foot traffic in the store, store customer demographics, local weather, and holidays.

RESULT: DataRobot enabled the retailer to discover and understand what factors are impacting aggregate category-level trends, how discounts across different categories and SKUs are affecting each other, and which features are impacting SKU-level trends.

DataRobot: An AI Demand Forecasting Solution for the Real World, Now

AI can help retailers and manufacturers to improve their entire supply chain and get a better handle on demand forecasting — saving time and money and increasing efficiency.

DataRobot provides retail- and manufacturing-specific forecasting in an imperfect and unpredictable business landscape, along with the ability to implement automated time series capabilities to accommodate even the most detailed, business-related nuances.

Advanced features make it possible to tackle time series challenges by creating competition among different algorithms and quickly identifying the best forecasts required to drive just-in-time operations.

Demand Forecasting Solution Workflow

Start

1. Automatically query SKU-level **data** on sales, events, promotions, and holidays for the period

2. Automatically **predict** the daily demand of each SKU at the store level for the current period

3. Demand planners then **visualize** SKU-level predictions via a human-centric AI dashboard

4. Demand planners can analyze factors impacting product demand through transparent and easy-to-understand **prediction explanations**

5. Demand planners can take action across their respective **business functions**

6. End solution is continuously monitored and **managed** to ensure consistent delivery of accurate predictions and account for drift in the data

Conclusion

In these turbulent times, retailers and manufactures face unprecedented challenges that require best-in-class solutions. By deploying an AI-driven demand forecasting solution, retailers and manufacturers gain an automated means to identify trends, accurately adjust business practices, and drive revenue through better product availability for their customers, regardless of the circumstances.

"As the leader in enterprise AI, we leverage our deep expertise to embed AI into your native supply chain and business processes."

Let our team of retail, consumer products, manufacturing, pharmaceutical, and life sciences industry experts show you how you can achieve your goals and dominate your competition with automated machine learning.

For more information, visit www.datarobot.com/retail

DataRobot

DataRobot is the leader in enterprise AI, delivering trusted AI technology and enablement services to global enterprises competing in today's Intelligence Revolution. DataRobot's enterprise AI platform democratizes data science with end-to-end automation for building, deploying, and managing machine learning models. This platform maximizes business value by delivering AI at scale and continuously optimizing performance over time. The company's proven combination of cutting edge software and world-class AI implementation, training, and support services, empowers any organization – regardless of size, industry, or resources – to drive better business outcomes with AI.

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