

# Transforming Online Retail: The Innovations of Inventory Backcasting in Demand Forecasting



## Online retail operations

Online retail, commonly known as e-commerce, has experienced tremendous growth and transformation in recent years. The COVID-19 pandemic accelerated this trend, making online shopping the go-to option for consumers seeking convenience and safety. This surge can attribute to technological advancements, increased mobile device usage, rising customer trust, and the preference for online shopping.

Online retailers face the challenge of optimizing their inventory to efficiently meet customer demand [1]. Many businesses are adopting omnichannel retailing strategies, integrating physical and online stores to harness the power of digitalization, social media, big data, artificial intelligence (AI), virtual reality (VR), augmented reality (AR), and blockchain to navigate this landscape effective-

ly. In online retail operations, key entities include products, employees, customers, and sometimes delivery partners. Customer interactions, such as purchasing, returns, and substitutions, significantly influence the relationships between these entities. Key performance indicators (KPIs) like order fulfilment are crucial for customer satisfaction, making proper inventory management and demand forecasting essential. Excellent customer service fosters loyalty, which is vital for long-term success [2]. Efficient order processing is essential to maintain customer loyalty. Striking a balance between stocking enough products and avoiding overstocking is crucial, requiring careful demand monitoring and inventory adjustments.

## Forecasting Online Retail Demand

Demand forecasting in the realm of online retail is a critical process that empowers businesses

to anticipate customer demand accurately. This precision, in turn, enables optimization of inventory management, production schedules, and overall supply chain activities. To achieve this, various methods come into play, ranging from statistical models and machine learning algorithms to qualitative analysis. An indispensable component of effective demand forecasting at the Stock Keeping Unit (SKU) level is the integration of a Forecasting Support System (FSS).

To gauge forecast accuracy for SKU demand forecasting, retail companies and academic researchers alike frequently employ accuracy measures such as mean absolute percentage error (MAPE) and median absolute percentage error (MdAPE). Evolving market conditions and shorter product lifecycles have amplified the intricacies of sales forecasting. To tackle this complexity, businesses employ diverse forecasting methodologies, encompassing extrapolation, causal, computer-intensive, and judgmental techniques.

Quantitative models emerge as a preferred choice due to their logical and systematic approach, adeptness at handling vast datasets, and proficiency in generating precise forecasts with minimal errors. These models excel at identifying systematic trends and biases, equipping decision-makers with trustworthy data for informed choices. In the context of grocery stores, harnessing explicit features in regression trees constructed from sales and promotion time series can significantly augment the accuracy of sales forecasting, considering the intricate nature of data and techniques involved.

### Backcasting Online Retail Inventory

In the fast-paced world of online retail, staying ahead of the competition requires more than just historical data analysis. Forward-thinking businesses are increasingly turning to proactive planning techniques like backcasting to envision their ideal future outcomes and pave the way for success. In this article, we delve into the concept of backcasting and explore its potential applications in online retail operations.

Backcasting is a strategic planning method that stands in stark contrast to traditional forecasting

methods. Instead of depending solely on past data for forecasting future trends, backcasting focuses on establishing ambitious future objectives and then reverse-engineering the specific policies, actions, and strategies needed to attain them. In essence, it involves painting a vivid picture of where you want to be and then charting the course to reach that destination. In the realm of online retail, backcasting can be an invaluable tool for crafting a winning strategy. Rather than simply reacting to market shifts, businesses can proactively shape their destinies by employing backcasting for:

*Product Selection-* By envisioning future market demands and consumer preferences, online retailers can carefully curate their product offerings. This helps in reducing excess inventory of unpopular items while ensuring that popular products are readily available when needed.

*Promotions and Marketing-* Backcasting allows businesses to anticipate the most effective promotional strategies for upcoming seasons or events. Whether it's holiday sales, back-to-school campaigns, or seasonal discounts, backcasting helps in fine-tuning promotional efforts for maximum impact.

*Pricing Strategies-* With a clear vision of the future, retailers can establish dynamic pricing models that adapt to changing market conditions. This ensures competitiveness while maximizing profit margins.

*Inventory Optimization-* Backcasting aids in inventory management by projecting future demand. Retailers can avoid overstocking or understocking issues, reducing carrying costs and minimizing the risk of stockouts.

*Supply Chain Efficiency-* By aligning supply chain operations with future goals, businesses can streamline their processes and reduce lead times, ensuring that products reach customers efficiently.

“ Our research highlights the pivotal role of precise inventory management and optimized replenishment policies in retail success. Emphasis on order fulfillment rates and the impact of promotions enriches industry understanding. ”

Backcasting also finds relevance in time-series modelling, particularly in cases where historical data may be incomplete or unavailable. By extrapolating current data and variables, backcasting can help create more accurate models, aiding in decision-making and resource allocation. While backcasting has seen substantial application in urban sustainability, its potential in retail supply chains remains largely unexplored [3]. Further research in this area holds promise for online retailers seeking to stay ahead in an ever-evolving industry.

### Bridging the Gap: Integrating Forecasting and Backcasting in Inventory Policy Decisions

Inventory management is a pivotal aspect of success for retail stores, especially during promotional periods. Our research has highlighted the critical importance of maintaining accurate inventory levels and connecting backroom inventory to store shelves. This approach has proven highly effective in minimizing stockouts, streamlining restocking processes, and enhancing overall inventory control. To delve deeper into these issues, our study employed statistical methods, including the Phi coefficient and Pearson's correlation, to identify potential problem areas. One notable finding was the absence of a significant relationship between inventory levels and promotional activities in the current retail landscape.

A central focus of the study was the measurement of the order fulfilment rate, a crucial KPI that evaluates service levels in retail stores. We adopted a rigorous methodology, aiming to measure the order fulfilment rate for selected SKUs after determining the optimal forecasting period. Findings revealed a positive impact on service levels in a prominent Asian retail supermarket, with order fulfilment rates experiencing a significant increase as a result of optimizing the forecasting period. This outcome underscores the paramount importance of precise demand forecasting and adept inventory management in enhancing order fulfilment rates, ultimately leading to heightened service levels and increased customer satisfaction. Furthermore, the study underscores the relevance of the order fulfilment rate as a key metric in retail operations. It demonstrates the tangible benefits of employing an optimized forecasting period to bolster service levels in retail stores.

Effective inventory replenishment policies are pivotal for managing stock levels while meeting customer demands and minimizing costs. We focused on refining the continuous replenishment method to identify the most effective inventory levels for specific SKUs. By closely monitoring real-time demand data, retailers can establish reorder points and implement efficient replenishment policies. This approach streamlines operations, elevates customer satisfaction, and maximizes profitability. The study includes detailed calculations that offer insights into the establishment of reorder points and replenishment policies for each product. By adopting continuous replenishment, retailers can strike a delicate balance between maintaining sufficient inventory levels and avoiding overstock situations.

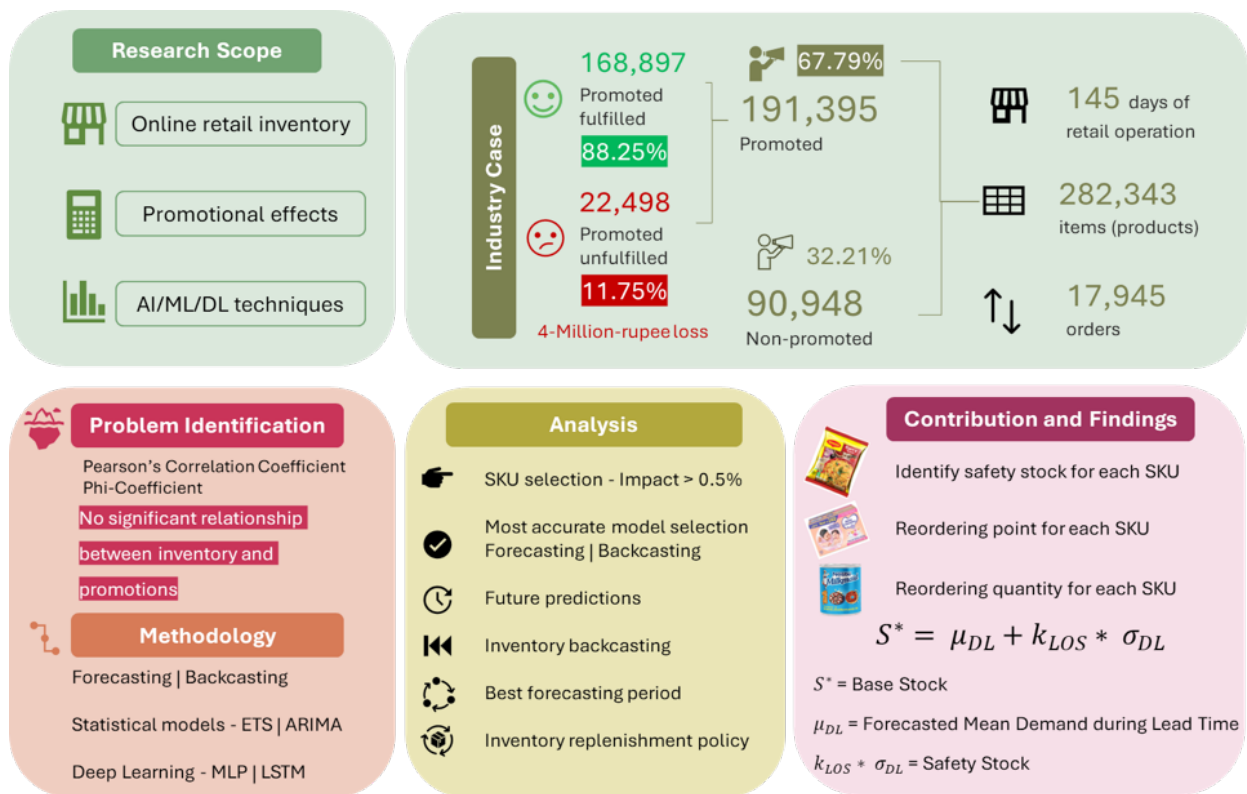


Figure 1: Summary of the study

In summary, the new approach contributes to a deeper understanding of effective inventory replenishment strategies and provides a comprehensive framework for retailers to optimize their inventory management practices. These findings are instrumental in helping online retail businesses stay competitive and deliver exceptional service to their customers.

**References:**

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