QuantSpark

Solving clearance stock build-up

Developing a custom clearance tool to transform retailer operations, unlocking a £3.5m profit uplift opportunity

Executive Summary

A key factor in the success of many retailers is the ability to supply to customers while keeping unsold stock to a minimum. Too much stock impacts production and storage costs, too little stock affects customer loyalty.

The Client Clearance Tool was developed by QuantSpark to solve a major business problem for a retail client - ineffective clearance of marked-down stock resulting in excess inventory.

The solution involved two key innovations:
(1) a workflow optimisation tool to streamline clearance list execution.
(2) A predictive model to recommend optimal markdown strategies at the Stock Keeping Unit (SKU) level.

The Client Clearance Tool delivered major benefits, unlocking an addressable £3.5m annual profit uplift opportunity, dramatic labour reduction through workflow improvements, and a foundation for long-term product development.

The success of the Client Clearance Tool demonstrates the power of advanced analytics and predictive modelling to drive smarter, more profitable decisions in for clearing discontinued stock. This type of solution can enable other retailers to optimise their clearance operations and increase their bottom line.

Introduction

To thrive in retail's fast-paced environment, companies must relentlessly reinvent themselves through bold innovation and unwavering dedication to understanding and fulfilling the changing priorities of customers and the business.

Here at QuantSpark, we relish the opportunity to apply advanced analytics and new technology in a commercial setting regardless of the size of the challenge.

One crucial aspect of retail management is the efficient clearance of discontinued stock – a task that, until recently, lacked the right tools and strategies.

Enter the Client Clearance Tool, a revolutionary solution developed by QuantSpark for our retail client, designed to transform the way clearance operations are conducted.

Unveiling the big idea

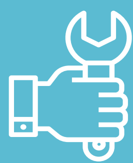
The journey towards creating the Client Clearance Tool began with a simple yet profound question during the discovery phase: *"Why is there a build-up of General merchandise clearance stock in our warehouse?"*

In response, we identified two areas of immense value where we could craft innovative solutions to address this problem.

The first of these areas was the quick win. This involved delivering a workflow tool aimed at enhancing the execution of general merchandise clearance stock. The goal was to streamline this process, making it both more efficient and accurate by automating manual processes and reducing the dependency on Excel macro tools.

The second, and perhaps more far-reaching, high-value solution involved the development of a sophisticated predictive model. This model was designed to generate recommendations for the most optimal markdown strategy at the individual Stock Keeping Unit (SKU) level. It would guide decisions on aspects such as the appropriate timing and the discounts to apply to each SKU, ultimately maximising profitability and ensuring that all stock is sold within the clearance window.

Addressing the business problem



Before the Client Clearance Tool came into play, our retail client faced a significant business problem. Teams struggled with the lack of suitable tools to effectively and accurately execute clearance operations for marked-down stock.

Furthermore, they lacked the means to leverage data-driven insights for crafting an efficient markdown strategy. The result was a build up of stock in stores and back-of-store warehouses due to ineffective markdowns and un-realised profit through stock not being sold.

The power of predictive modelling

To tackle these challenges head-on, the Client Clearance Tool harnessed the power of predictive modelling. Historical SKU sales data played a pivotal role in crafting the optimal markdown strategy. What did *"optimal"* mean in this context? It meant ensuring that all stock was sold within the given clearance window while retaining the maximum possible profit. This innovative approach transformed clearance operations, making them more precise and profitable than ever before.

We conducted a thorough Pareto analysis revealing that a significant percentage of the challenges in making effective markdown decisions stemmed from a specific subset of SKUs. These SKUs fell into categories such as home ware and furniture, and others with minimal seasonal impact.

Interestingly, the analysis also highlighted that seasonal SKUs enjoyed a more straightforward process of being discontinued, exited, and sold. This was due to the inherent nature of seasonal goods, which come with clear clearance deadlines. Take Halloween, for example.

The external factors, including additional marketing and the seasonal demand for Halloween products, created a sense of urgency that propelled effective strategies by Merchandising teams for clearing this stock.

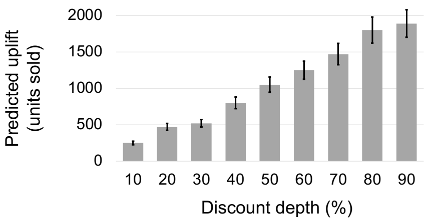
Model Methodology

Calculating SKU-level markdown strategies

To understand how we calculate markdown strategies at the SKU level, it's essential to delve into the Model Methodology behind this innovative approach. The process encompasses sales prediction, optimisation, and achieving the optimal strategy.

Let's explore each step in detail:

1. Sales prediction



Our journey begins with predicting how changes in discount levels impact SKU sales. To achieve this, we employ a linear regression model. This model predicts the percentage change in volume sold (uplift) for a specific SKU at a given discount amount (%).

To enhance the model's accuracy and its ability to generalise to new SKUs, we group SKUs into segments. This segmentation aids in capturing underlying patterns and behaviour's within SKU categories.

Historical sales data, particularly data related to promotional and clearance events, serves as the bedrock for training our model. By analysing past performance, we create a foundation for predicting future sales uplift.

The model's output consists of a predicted sales uplift for each SKU at all potential discount depths, allowing us to gauge how discounts impact sales.

2. Optimisation

First discount	Second discount	Weeks to apply second discount	Average clearance profit margin
10%	40%	5	42%
10%	50%	4	45%
20%	20%	4	39%
20%	30%	5	50%
20%	40%	6	45%
20%	40%	5	42%
30%	40%	7	43%
30%	40%	6	44%

Armed with the predicted uplifts from our regression model, we move on to the optimisation phase. Here, we fine-tune the markdown strategy based on specific parameters, such as the proportion of stock to clear and a defined clearance deadline.

The optimisation process involves varying parameters like discount depth, duration, and frequency.
These variations are essential to identify the markdown strategy that yields the best results.

The output of this phase provides an overview of the margin and stock implications associated with applying a particular discount depth, ensuring a balanced approach to clearance operations.

3. Optimal strategy

First discount	Second discount	Weeks to apply second discount	Average clearance profit margin
10%	40%	5	42%
10%	50%	4	45%
20%	20%	4	39%
20%	**30%**	**5**	**50%**
20%	40%	6	45%
20%	40%	5	42%
30%	40%	7	43%
30%	40%	6	44%

The culmination of our model methodology lies in calculating all possible markdown strategies. These strategies are then filtered based on profit margin and stock thresholds.

The primary goal is to maximise both profit margin and the amount of stock cleared while considering specific constraints.

Our markdown strategy is inherently dynamic and customised for each SKU across the retail estate. This customisation allows us to effectively balance the dual objectives of stock clearance and margin maintenance.

The ultimate output of this process is the optimal discount strategy, one that clears stock within the defined deadline while preserving the highest possible profit margin.

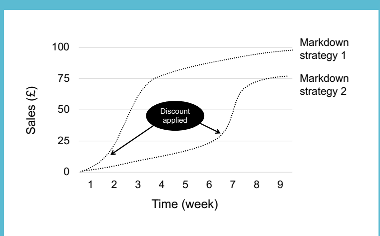
What is an SKU?

A Stock Keeping Unit (SKU) is a number (usually eight alphanumeric digits) that retailers assign to products to keep track of stock internally, once it arrives from a warehouse or distributor.

A stock-keeping unit (SKU) is a scannable code (though not a bar code) to help vendors automatically track the movement of inventory.

Each product will have its own unique SKU, helping retailers determine which products require reordering and provide sales data.

Different strategies have different impacts on clearance time and revenue



In summary, the SKU-level markdown strategy calculation is a multifaceted process that leverages predictive modelling, optimisation techniques, and customisation to enhance the efficiency and profitability of clearance operations. This methodology represents the cutting edge of retail analytics, enabling businesses to make data-driven decisions that maximise their bottom line while meeting clearance goals.

Streamlit

Leveraging Streamlit for efficient development

One of the key factors in the success of the Client Clearance Tool was the technology stack chosen for its development.

We selected a Python-based front-end components package called Streamlit.
This technology choice significantly reduced the time required to deliver a productionised solution that end users could use.

The decision to use Streamlit was driven by its pre-built Python components.
These pre-built components allowed our development to focus on the core model logic, enhancing the workflow for executing stock clearance operations. By leveraging Streamlit, we accelerated the development process, ensuring a quicker time-to-market for this innovative retail solution.

Key innovations achieved

Automated data cleaning
diagnosed and guided resolution of data quality issues

£3.5m profit uplift opportunity
through data-driven markdown strategies

Sales uplift forecasting
predicted impact of discounts on sales volume

Long-term product roadmap
laid the foundation for ongoing innovation

Building the client clearance tool

Workflow optimisation

The final solution was a fully productionised web application hosted on the client's AWS infrastructure that allowed end users to log in using their secure single sign-on credentials.

The tool allowed end users to drag and drop their excel clearance list into the web application using an easy to use, clean user interface.

The application would then clean the excel file, diagnosing data quality issues and the advising on resolution steps. Following end user resolution, the app would generate a final clearance list, allowing end users to action the markdown with full confidence in the accuracy of the list.

Markdown strategy model

The model was delivered as a proof of concept ready to be fully productionised into the workflow Streamlit web application. The model proved the efficacy of the methodology and the ability to generate recommendations across all of the in scope SKUs, proving out the potential return on investment through making data driven decision for SKU level markdown strategies.

Outcomes and benefits

Dramatic workflow improvement

The workflow tool introduced as part of the Client Clearance Tool significantly reduced the time it took for merchandisers to execute clearances.

What used to be a cumbersome process taking up to 90 minutes per clearance list was streamlined to 5 minutes. This efficiency not only saved time but also enhanced accuracy in executing clearance operations.

Substantial profit uplift

The power of data-driven decision-making became evident as we identified a £3.5 million profit uplift opportunity annually.

By leveraging historical sales data to model the optimal markdown strategy for each SKU, we enabled our client to maximise profitability while ensuring that all stock was sold within the specified clearance window.

This potential profit uplift is a testament to the effectiveness of the Client Clearance Tool in driving financial success.

Foundation for long-term development

Beyond its immediate benefits, the Client Clearance Tool laid the foundations for a long-term product development roadmap. This roadmap is poised to address broader areas of Return on Investment (ROI) by optimising not only clothing but also further GM (General Merchandise) categories.

The tool has opened doors to ongoing innovation, allowing our client to continually adapt and thrive in the dynamic retail industry.

Conclusion

How our Client Clearance Tool can work for other retailers

In conclusion, the Client Clearance Tool represents a pivotal moment in the retail industry's evolution. It was born from the desire to solve complex business problems, enhance decision-making through predictive modelling, and optimise clearance operations by leveraging data and insights.

As the retail landscape continues to shift, tools like the Client Clearance Tool will remain indispensable, empowering retailers to make smarter, more profitable decisions.

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