

MANAGING STOCKOUT AND OVERSTOCK OF IMPORTED GROCERY PRODUCTS IN A SUPERMARKET CHAIN

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Introduction

The profitability of the supermarket business is dependent on its sales revenue and efforts to keep operating costs low. It is important for supermarkets to maintain a high level of customer satisfaction by ensuring that the products are made available to customers at the right place, at the right time, at the right quantity and at the right price. Supermarket chains are often concerned with managing out-of-stock (or stockout) and over-ordering of grocery products as demand forecasting for such products can be very challenging.

The costs of stockout (when goods are unavailable) and overstock (when excess goods are accumulated) for a supermarket business can be high. Stockouts lead to immediate loss of sales as customers shop for products or alternatives elsewhere, loss of follow-on business, and loss of goodwill and reputation in the longer term. Overstocking leads to higher holding costs as more storage space is needed, locks up scarce resources as the capital cannot be used elsewhere, contributes to ageing inventory (e.g. inventory held for more than 90 days), and leads to higher disposal costs when the product shelf life expires. Both stockout and overstock situations can adversely impact the profitability of the supermarket business.

This paper examines the stockout and overstock of imported grocery products in a supermarket chain in Singapore. The supermarket chain has over 120 outlets providing a wide range of grocery products sourced from all over the world. The chain has a fresh food distribution facility and a distribution centre (or centralised warehouse) for efficient logistics support. It proactively seeks new supply chain relationships with overseas grocery suppliers to provide more product variety for its customers and keep prices competitive. Products with good saleability in overseas markets are often introduced to the local market despite the potential uncertainty of customer demand for these products. The supermarket chain also diversifies its supply sources to manage the risks involved in bringing in these products into the market.

Finding the right balance of inventory levels for imported grocery products is not easy. Competition in the supermarket industry in Singapore is very intense and supermarket chains have to source for products world-wide to secure competitive prices through bulk purchases. Various promotions and festive occasions throughout the year require imported grocery products to be brought in larger bulk to cater to increased demand. Festive season products tend to be expensive, non-returnable and usually cannot be sold after the festive period.

Therefore, it is important for inventory planners to manage the inventory levels well and strive to make good order forecasts so as to cater to demand during normal and promotional periods. This study attempts to find answers to the following research questions:

- What are the main causes of stockout and overstock of imported grocery products?
- How can the order forecasting of these products be improved to minimise stockout and overstock situations?

Literature Review

According to Gruen et al. (2002), about 47% of stockout incidents can be attributed to store order and forecasting, while 28% is due to upstream causes and 25% is due to store replenishment. Other contributing factors can include container delays and late replenishment order from supermarkets. Gruen et al. (2002) reported that about 31% of consumers would purchase an item from another store when the item is unavailable at the store. Besides the direct or indirect loss of potential sales at the supermarket outlet, there is the issue of customer dissatisfaction.

Aburto and Weber (2007) noted that improving the forecasting accuracy of a supermarket can help to reduce stockout incidents while allowing the supermarket to keep its inventory level low. They advocate that solving the stockout problem requires a reliable prediction of the stock's demand. However, they iterated that this is not easily achieved as sales can be dependent on various factors such as past sales, prices, advertising campaigns, seasonality, holidays, weather, sales of similar products, and competitors' promotions.

Overstocking can be a result of poor management of stock demand where inaccurate inventory data cascades from the warehouse to the stores (Hooi, 2013). It also occurs when a product has a stipulated selling period with unknown demand, where supermarkets deliberately overstock to hedge against uncertainty in the stock's demand (Tsay, 2001). This can happen at the level of the warehouse or retail outlet. When overstocking occurs at the warehouse, stocks are likely to be "pushed" to the supermarket outlets. If the outlet staff has poor management of its shelf spaces, these excess stocks have to be shifted to the storage room. Over time, this leads to high stock returns to the suppliers or stock disposal when products reach their expiry dates. All of these create higher logistical and administrative costs.

Many studies have looked at improving order forecasting, yet it is still a challenge for many supermarkets to make accurate forecasts on orders. This is because order forecasting is highly contextual and is easily affected by various ordering processes and replenishment policies specific to the supermarket business (Chopra and Meindl, 2016). There is never a 100% accurate forecast, but many are striving to obtain an order forecast as accurate as possible.

Methodology and Data

We used the case study method (Saunders et al., 2012) to investigate the stockout and overstock situation at this particular supermarket chain. Qualitative and quantitative data was obtained to address the research questions. To understand the main factors that caused stockout and overstock, we had discussion with the procurement and inventory managers. The cause-and-effect analysis was applied to identify the root causes. We examined the current process for ordering imported grocery products and then attempted to improve the order forecasting process.

Figure 1 shows the current process for ordering imported grocery products. For a new product, the procurement manager gathers necessary information (e.g. price and profit margin) and presents to the ranging committee that meets on a weekly basis for approval. The committee makes a comparison of the new product with existing items. If the product is rejected, no follow-up action is required and the supplier is informed of the reasons for the rejection. If the product is approved, the procurement manager informs the inventory planner to add the new approved items with the existing ones under the same supplier (where applicable) to obtain updated order quantities for the next order. Once the order quantities have been approved, the inventory planner triggers a new order to the supplier.

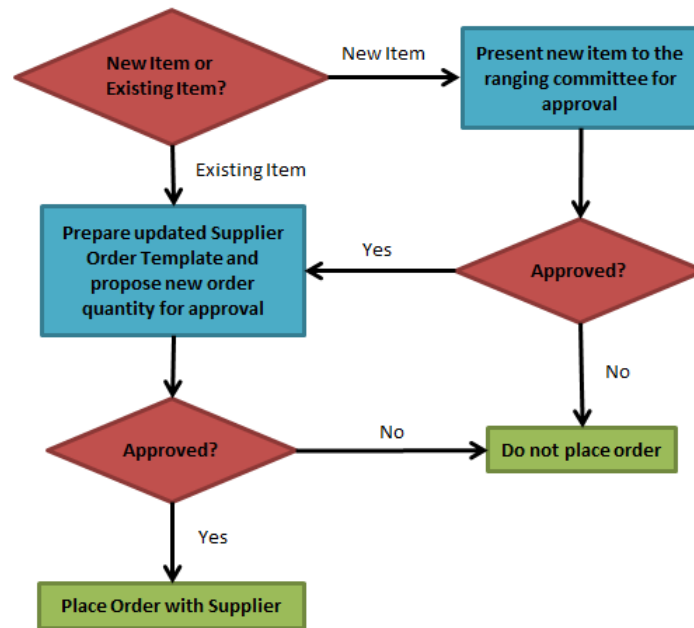


Figure 1: Current process for ordering imported grocery products

The following information was examined to provide a better insight into the ordering process:

- *Monthly Write-Off Report*: This report is used by inventory managers to monitor the monthly write-offs at the warehouse level. Write-offs can be due to damaged products, seasonal products that cannot be sold after the festive period, and stocks past their expiry date.
- *Point-of-Sales (POS) Data*: Data is extracted from the intranet based on various specifications such as by individual store, individual supplier, and items by the respective retail formats.
- *Supplier Ordering Template*: Available on a daily basis, this Excel-based spreadsheet is used by the inventory planner (imports) to help make important decisions on ordering. It consists of up-to-date descriptions and specifications of products under a particular supplier.
- *Temporary Not Available (TNA) Report*: Available on a weekly basis, this report informs the supermarket outlets on products currently unavailable and arrival date of the next shipment.
- *Warehouse Stock Expiry Report*: This report consists of all the items current made available in the warehouse sorted from the earliest expiry date to the latest. This report is useful for monitoring product shelf life and gives the inventory planners time to react.
- *Supplier Product Quotation List*: This list contains product specification and pricing information from suppliers when there are new item proposals for procurement managers to consider.
- *Warehouse Stock Inventory Report*: This report provides an overview of products in the warehouse and supermarket outlets. It includes detailed information on product listing, classifications and inventory level.

Table 1 shows an example of the supplier ordering template for seven different flavours of instant noodles from a certain supplier based on average monthly sales from December 2014 to February 2015. The supermarket wants to place a new order SL003/15 to arrive in Singapore on 16 April 2015. It is important to ensure up-to-date and correct data provided by the suppliers is reflected in the spreadsheet. Table 2 describes the various columns of the spreadsheet.

PURCHASE ORDER & INVENTORY

Supplier: ABC PTE LTD (71300)

Proposed Date: 16-Mar-15

													INCOMING ORDER				
													16-Apr-15				
													SL003/15				
													L	M	N	O	P
S/NO.	SKU	PRODUCT DESCRIPTION	P/S	DC	SHELF LIFE UPON ETA (MTHS)	WH88 SOH (CTNS)	STORE SOH (CTNS)	TOTAL WH & STORE SOH (CTNS)	AVG MONTHLY SALES (Dec - Feb '15) / MTHS (CTNS)	MOS BASED ON WH SOH (MTHS)	MOS BASED ON WH + STORE SOH (MTHS)	PROPOSED ORDER QUANTITY (CTNS)	ESTIMATED AVAILABLE STOCKS IN WH @ POINT OF ETA (CTNS)	MOS BASED ON WH + NEW SHIPMENT (MTHS)	ESTIMATED AVAILABLE STOCKS IN WH & STORE @ POINT OF ETA (CTNS)	MOS BASED ON WH + STORE + NEW SHIPMENT (MTHS)	
1	13010470	ABC INST NDL-RST BEEF 55 100G	6	88	5	993	153.8	1146.8	1684.4	0.6	0.7		0	0.0	0	0.0	
2	13010471	ABC INST NDL-HOT BEEF 55 101G	6	88	5	869	171.0	1040.0	1445.3	0.6	0.7		0	0.0	0	0.0	
3	13010473	ABC INST NDL-CHK MUSH 55 98G	6	88	5	370	140.5	510.5	931.7	0.4	0.5		0	0.0	0	0.0	
4	13028845	ABC INST PRWN NOODLES 55 96G	6	88	5	156	62.3	218.3	361.2	0.4	0.6		0	0.0	0	0.0	
5	13055590	ABC P.VEG PORK RIBS 55 119G	6	88	5	0	140.7	140.7	363.2	0.0	0.4		0	0.0	0	0.0	
6	13028841	ABC INST B/NDL MROOM CHK 103G	12	88	5	109	46.5	155.5	293.8	0.4	0.5		0	0.0	0	0.0	
7	13042403	ABC INST B/NDL-RST BEEF 105G	12	88	5	83	42.9	125.9	307.4	0.3	0.4		0	0.0	0	0.0	
													0				
PREPARED BY:													ADDITIONAL INFO:				
LAU KIAT HONG / DATE													Order lead time : 1 month				

Table 1: Sample input from the supplier ordering template

Col	Description	Spreadsheet Computation	Source / Remarks
A	Stock Keeping Unit (SKU)	-	-
B	Product Description	-	Supplier product quotation list
C	Carton Pack Size	-	Supplier product quotation list
D	Distribution Centre/Warehouse	-	-
E	Product Shelf Life (months)	-	Supplier product quotation list
F	Warehouse Stock-on-Hand or WH SOH (cartons)	-	Stock inventory report
G	Store Stock-on-Hand or Store SOH (cartons)	-	Stock inventory report
H	Total Stock-on-Hand or Total SOH (cartons)	= (Column F + Column G)	-
I	Average Monthly Sales (cartons)	-	Point-of-Sales (POS) data
J	WH SOH Months of Supply (months)	= (Column F / Column I)	-
K	Total SOH Months of Supply (months)	= (Column H / Column I)	-
L	Proposed New Order Quantity (cartons)		Input from inventory planner
M	Estimated Available Stocks in WH (cartons)	=IF((Column F) - (((Column L - Start Date) / 30days)*Column I) > 0, (Column H + Column L) - (((Column L - Start Date) / 30days)* Column I), Column L)	-
N	WH SOH + New Shipment MOS (months)	= (Column M / Column I)	-
O	Estimated Available Stocks in WH & Store (cartons)	=IF((Column H) - (((Column L - Start Date) / 30days)*Column I) > 0, (Column H + Column L) - (((Column L - Start Date) / 30days)* Column I), Column L)	-
P	WH SOH + Store SOH + New Shipment MOS (months)	= (Column O / Column I)	-

Table 2: Description of supplier ordering template

Results and Discussion

Causes of stockout and overstock

Figure 2 shows the cause-and-effect diagram for identifying possible factors that contribute to stockout and overstocking situations. The fishbone diagram was grouped into six categories, namely: HQ, Suppliers, Stores, Warehouse, Procedures and Customers. For each category, potential causes leading to stockout and overstocking were surfaced. After discussion with the procurement and inventory managers, the root causes were identified as:

- *Suppliers - Long Lead Time - Distance*: Lead times for imported products sourced overseas vary greatly. An order for a US-based supplier requires a lead time between 2.5 to 3 months, while an order for an Asia-based supplier needs a lead time of 1 to 1.5 months. Any delays in placing new orders or a shipment delay would affect downstream replenishment at the stores.
- *Stores - Displays - Fail to Replenish Timely*: Failure to replenish products onto the store shelves while products sit idle in storage room is another cause. Products must be replenished timely and checked at regular intervals to ensure as many products are made available to customers.
- *Customers - High Demand - Promotion*: Goods are likely to move faster due to special pricing given during promotions for a particular product. Before a promotion, sufficient stocks need be placed to cater to high customer demand. Inventory levels at the store are likely to be low or out-of-stock after the promotion. In the event of a last-minute cancellation of a promotion, the store would be flooded with stocks and leading to insufficient space for sales display.

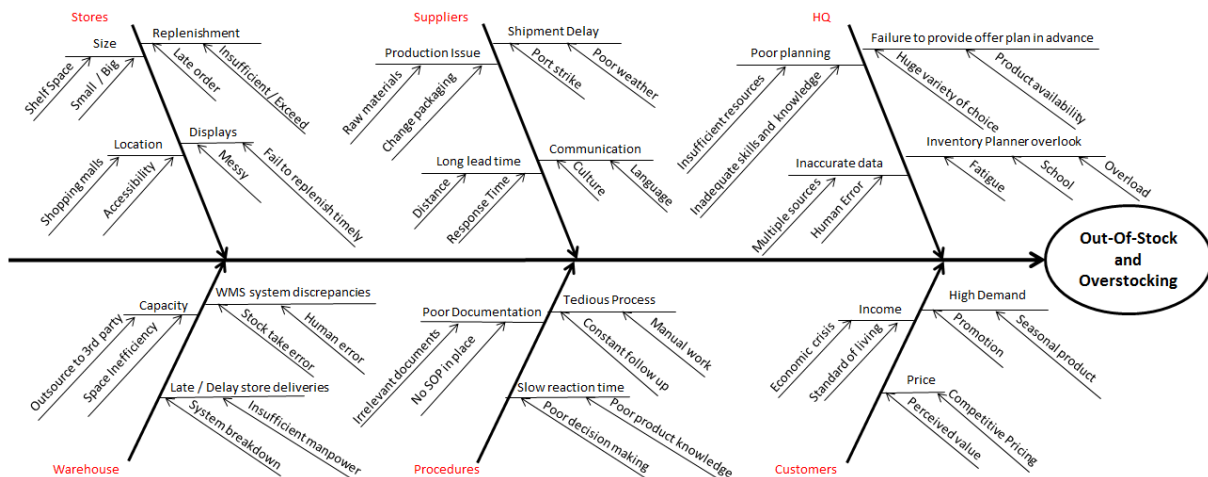


Figure 2: Cause-and-effect diagram for stockout and overstock

Effect of the supplier ordering template on write-offs

We used data from the monthly write-off reports to determine whether the supplier ordering template was an effective tool to minimise write-offs of unsold goods after the festive season and products past their expiry dates. Write-off amounts tend to be higher after festive seasons as well as after the year-end stock takes at the stores and warehouses. The supplier ordering template was implemented at the supermarket at the end of 2013.

Figure 3 shows the monthly write-off value of imported grocery products for FY2013 to FY2015. Comparing the figures for FY2013 and FY2014, it can be seen that there was a marked reduction in annual write-off value, i.e. a savings of about \$405,000. We reckon that the supplier ordering template could have played an important role in providing as timely and accurate information as possible for inventory planners to place their orders to suppliers.

Between FY2014 and FY2015, there was an increase in the annual write-off value of about \$80,000. We attributed this to the expansion of the import business with an increase in new products introduced to the market and the corresponding increase in write-offs.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
FY2013	\$304,890.42	\$ 88,275.64	\$206,103.17	\$ 65,036.52	\$110,584.05	\$76,387.82	\$65,414.88	\$43,433.85	\$61,561.35	\$33,583.98	\$ 54,536.09	\$79,493.80	\$ 1,189,301.57
FY2014	\$ 62,540.67	\$105,086.76	\$106,829.41	\$ 83,228.57	\$ 56,708.96	\$72,981.82	\$36,712.43	\$62,768.13	\$79,745.56	\$62,524.44	\$ 28,347.99	\$26,337.31	\$ 783,812.05
FY2015	\$ 70,445.21	\$ 73,160.17	\$131,429.99	\$115,631.53	\$ 67,216.52	\$42,060.14	\$37,417.55	\$63,503.85	\$50,472.27	\$47,715.79	\$101,244.20	\$63,729.91	\$ 864,027.12

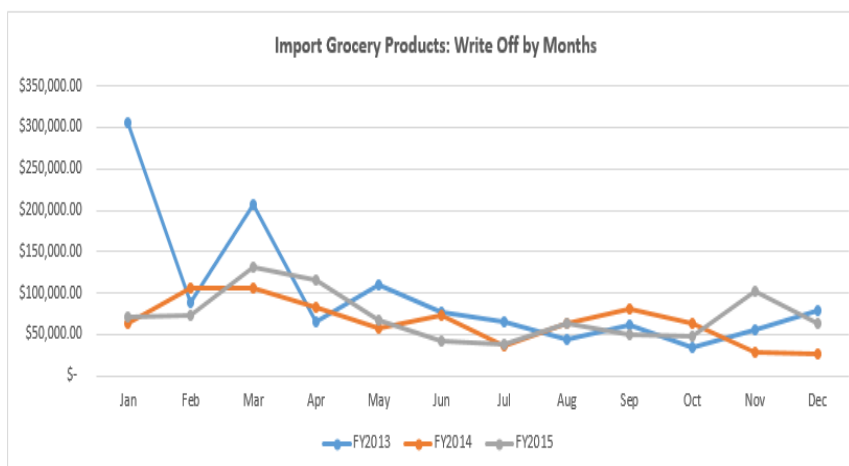


Figure 3: Monthly write-off value of imported grocery products, 2013-2015

Improving the order forecasting process

Microsoft Excel Solver was incorporated into the supplier ordering template in an attempt to improve the ordering forecasting process by optimising the order taking into account the average monthly sales, Months of Supply (MOS) and current inventory levels. The following settings in Solver were used (Figure 4):

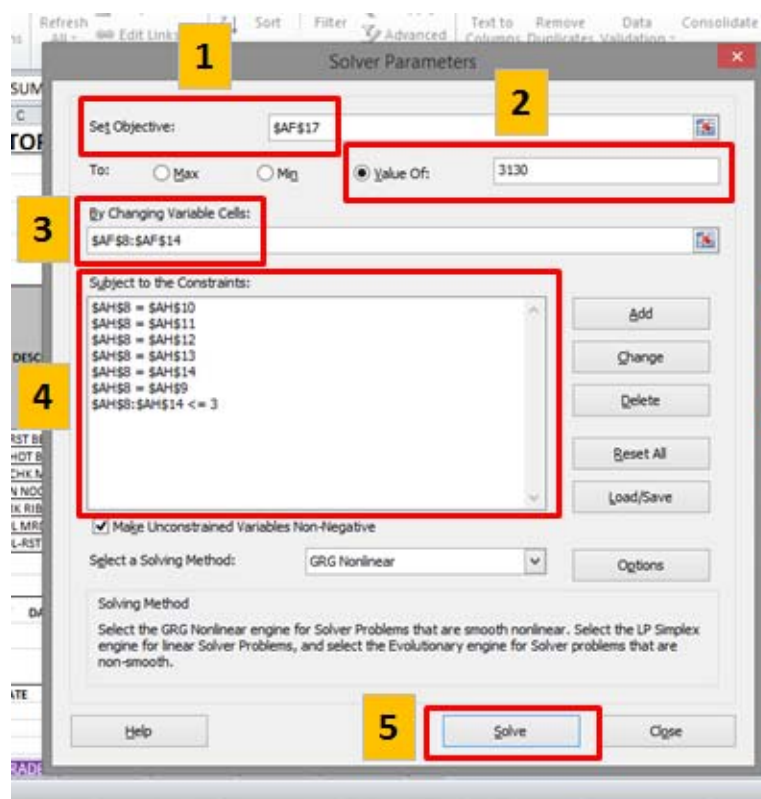


Figure 4: Excel Solver Parameters

- Using the example input of Table 1, Solver was applied to derive the order quantities for the new order SL003/15. Figure 5 shows the sample output. The MOS (based on Warehouse + Store + New Shipment) of 0.6 months (column P) was optimised across all the items. The proposed order quantities are shown in column L.

Figure 5: Sample output showing the order quantities obtained using Solver

Conclusions and Recommendations

Out-of-stock and overstock of goods are major issues of concern for supermarkets that provide a large variety of products to customers. This is especially so for imported products where lead time and accurate order forecasts are needed to ensure products arrive in time whenever customer wants it to ensure high customer service standards. The objectives of this study were to investigate the factors that cause stockout and overstocking of imported grocery products for the case of a supermarket chain in Singapore as well as to find ways to improve the order forecasting process.

Overstocking can lead to increased write-off costs and ageing inventory. We reported the use of an Excel-based supplier ordering template to help the inventory planner make important decisions on ordering. There was a marked reduction in the total write-off value the year after the supplier ordering template was implemented. We explored the use of Solver to perform order forecasting in a more efficient instead of manual input of the order quantities. However, achieving an optimum inventory level is a challenging task. It is important to ensure the ordering processes are handled with well to build customer loyalty and increase customer satisfaction through quality products and services.

Due to time and resource constraints, it was not possible to gather more detailed for an extensive investigation. Further work can look at conducting surveys with end customers at the supermarket outlet level to gather their response when they encounter out-of-stock situations rather than obtaining information from secondary sources. More studies can also be done to explore ways of increasing the frequency of stock replenishment and improving shelf displays to maximise the space utilisation so as to improve stockout situations.

Another area for future work can be to explore the use of auto-replenishment systems for imported grocery products using sophisticated technologies and software where orders are auto-generated by the system and sent to suppliers. This can provide the supermarket chain a competitive advantage by reducing the order lead time and increasing work productivity.

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