12 Ship as Soon as You Can: Don’t Wait Till You Have To![1]

Piet van der Vlist, Eindhoven University of Technology, pvlist@rsm.nl

Ton de Kok, Eindhoven University of Technology, A.G.d.Kok@tm.tue.nl

Tom van Woensel, Eindhoven University of Technology, tvwoensel@tue.nl

12.1 Introduction

In food retail, the supermarket’s bargaining power is the strongest one. So, the supermarket organizations have been able to reduce their supply own chain costs considerably, introducing frequent reordering in small quantities (daily or even more often). At the same time they have forced their suppliers to increase service levels and shorten lead times, in order to maintain adequate client service levels in the supermarket stores.

A simple cost analysis reveals that the increase in costs at the supplier’s side of the supply chain is considerably higher than the decrease in costs at the supermarket’s side. This means that the overall food supply chain ranging from the factory gate down to the supermarket’s shelves can be improved upon by taking an integral approach.

One such an integral approach is the Supply Chain Synchronization policy (SCS), as described in Van der Vlist (2007). With SCS the supplier bases his production schedule on downstream inventory levels and demand forecasts. This production schedule then drives the heartbeat of the entire downstream supply chain, as every order and shipment is synchronized to the production schedule. Based on extensive calculations, simulations and case studies, SCS claims a considerable decrease in overall logistics costs.

In this article we (1) discuss the current retail supply chain practice, (2) model the retail supply chain as a value network under SBS polices in order to evaluate the current practice from a cost and service perspective and (3) verify the effectiveness of the synchronized supply chain using SCS policies to parameterize SBS policies according to SCS principles. The model developed can be considered as a micro model of the retail chain, as it is based on demand, lead time and cost characteristics of 5 representative products, together mimicking the retail supply chain from the factory to the shelves in the retailer stores. The micro model is developed such that it is consistent with macro data about costs and service as presented in Van der Vlist (2007).

The main conclusion resulting from the modeling exercise is that the SCS principles lead to more efficient supply chains while ensuring lower or equal overall costs. The efficiency derives from the lower shipment frequencies between manufacturer DC and retailer DC, as well as lower shipment frequencies between retail DC and retail store. As we did not model the exploitation of these efficiencies by logistics service providers to ensure less empty truck kilometers and better utilized trucks overall, the costs determined by our micro model are in fact upper bounds on the costs resulting from SCS principles. Another finding is that current practice is both highly inefficient and highly ineffective. The optimal SBS policies under both current shipment frequencies and the SCS principles yield a cost reduction of 5% while maintaining the current shelf availability of 85%. Even with a shelf availability of 95% the optimal SBS policies both under current shipment frequencies and under the SCS principles yield a cost reduction of close to 3%.

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[1] This article has been written in honor of our dear friend and colleague Jo van Nunen, who passed away so untimely. Jo was deeply involved in our research project on Synchronizing the Retail Supply Chain. The title of this article was one of his sayings to summarize the project principles.

The paper is organized as follows. In section 12.2 we describe the current supply chain from factory to store. In section 12.3 we discuss the store operations, as these operations drive effectively the current supply chain by shelf replenishment orders. We propose an ideal supply chain design in section 12.4. This ideal design is tested and confirmed by a micro model described in section 12.5. In section 12.6 we summarize our main findings.

12.2 The current Pull supply chain from factory to store

Based on the inventory levels in their own warehouses, food manufacturers decide when which products will be produced and packed on what fill lines in order to raise the inventory in their warehouses to adequate levels. The goods are filled and packed in the consumer packages that appear on the shelves in the supermarkets' stores. At the final stage of the production lines the goods are assembled in carton boxes, on trays in a plastic sleeve, or in reusable crates, in supply chain lingo called collo (plural: colli.) Theses colli then are automatically stacked on pallets. Each time a pallet is full, it is transported to the manufacturer's warehouses, together with pallets produced at about the same time on other production lines, consolidated into full truckloads (FTL). This current supply chain is shown in figure 1

In order to work efficiently, manufacturers produce large batches of identical products. As a consequence these manufacturers maintain relatively large levels of cycle stock. In case of a product that is being produced once a week, the manufacturer's warehouses in any case on average stock half a week of cycle stock.

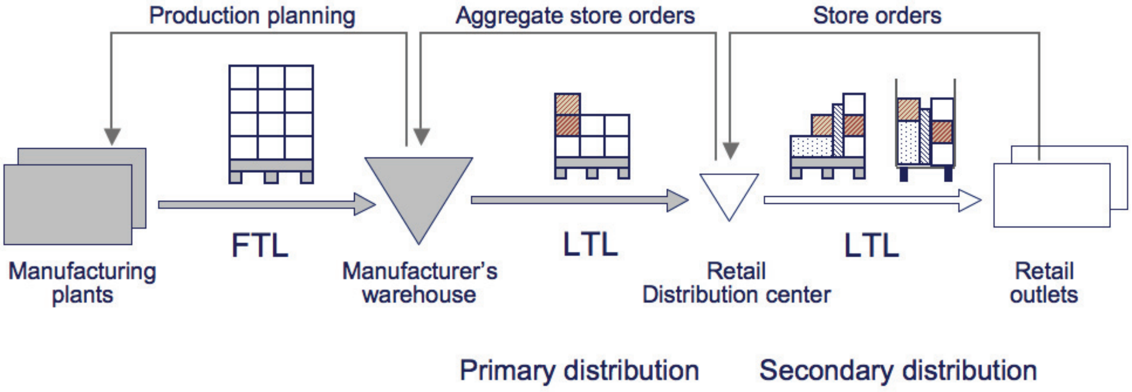

Figure 1 The current supply chain

The manufacturer's warehouses each are located centrally in the area they serve, that is the area where they replenish the supermarket's distribution centers. This primary distribution from manufacturer's warehouses to the supermarket's distribution centers normally is managed by the manufacturers.

Supermarket organizations order frequently and in small quantities in order to keep their inventory levels low. This means that in the manufacturer's warehouses the full homogeneous pallets, containing only one product type, need to be disassembled and reassembled into mixed pallets containing different product types, so as to exactly reflect the supermarket organization's orders.

To that end the manufacturers in their warehouses have arranged an order pick area at collo level, mostly hand based.

As a consequence of their own ordering behavior, the supermarket organization's regional distribution centers receive mixed pallets, mostly assembled by hand and not full. These pallets are being delivered by trucks that are not fully loaded either (less than truckload LTL), not in the least because the supermarket organizations are not aware of the manufacturer's truck planning. The supermarket's regional distribution centers need to disassemble the mixed pallets to fill their own order pick areas, again mostly hand operated and at collo level.

Supermarket organizations in general do own more than one regional distribution center, e.g. three to five, each positioned centrally in the regional area where they serve the supermarket stores. The secondary distribution from regional distribution centers to the supermarket stores in general is managed by the respective supermarket organization and the trucks display the supermarket logo.

12.3 Store operations

The supermarket stores typically order daily or more often. A delivery schedule determines for each store the days of the week a product can be ordered and will be delivered. The stores receive the goods on mixed pallets or roll cages, containing goods from several manufacturers, grouped per product family so as to ease filling the shelves. Orders that are placed in the morning typically are delivered in the afternoon of the same day and usually are stacked on the shelves in the evening. The lead-time is therefore one sales day.

As the power is with the retailers, it is important to better understand what drives retail operations nowadays. Supermarkets differ in customer service, both in the amount of in-store inventory and in the way they present the goods to the consumer, varying from hard discounters that just stack the colli as they were received and leave it to the client to open up boxes and trays, to retailers that fill the shelves by hand, carefully aligning the products. Typical tactical and operational decisions retailers face in managing their stores refer to product assortment and variety (which products to store), location and shelf-space allocation in the store (where and how much space should be assigned to each product type) and product replenishment (when and how much to reorder of each product). An essential objective for most retailers is to provide a high availability of their products at low operational costs. This ultimately challenges retailers to have good plans, well executed (Fisher, 2009).

Effective management of store operations is crucial to the retailer's own success (Pal and Byron, 2003) and often critical for the performance of the entire supply chain. It is frequently pointed out that "the last 100 feet" of the supply chain from store receipt to the shelf represent both the highest supply chain cost and the biggest customer service risk (Supply Chain Effectiveness Survey, 2002). There exists limited published evidence on store level processes (Falck, 2005, Samros et al. 2004) and even more limited research exists on models of in-store processes (Kotzab and Teller, 2005). For most retailers, store handling operations are not only labor-intensive, but also very costly. It is suggested that labor is accounting for around 75% of of the in-store logistical costs, compaired to 25% related to store inventory.

An empirical study of Broekmeulen et al. (2004) shows that the handling costs at the store level clearly dominate the other operational cost components in the retail part of the supply chain consisting of the retail DC and the store. Based on this outcome and on figures found elsewhere in literature, in this article we assume that the in store logistics costs account for 50% of the supermarket’s logistics costs. In other words, the supermarket’s in-store logistics costs are as high as the supermarket’s supply chain costs outside the store (see Figure 2). But we are well aware, these figures to vary per retailer.

Traditional store-based retailing heavily relies on two operations: inventory replenishment and inventory handling. Many opportunities for improvement in these operations exist, once their most important characteristics and drivers are well understood.

Because of the fixed order and delivery schedules, the replenishment policies are based on periodic review. The system generated ordering advice is based on a reorder inventory policy under lost sales and substitution.

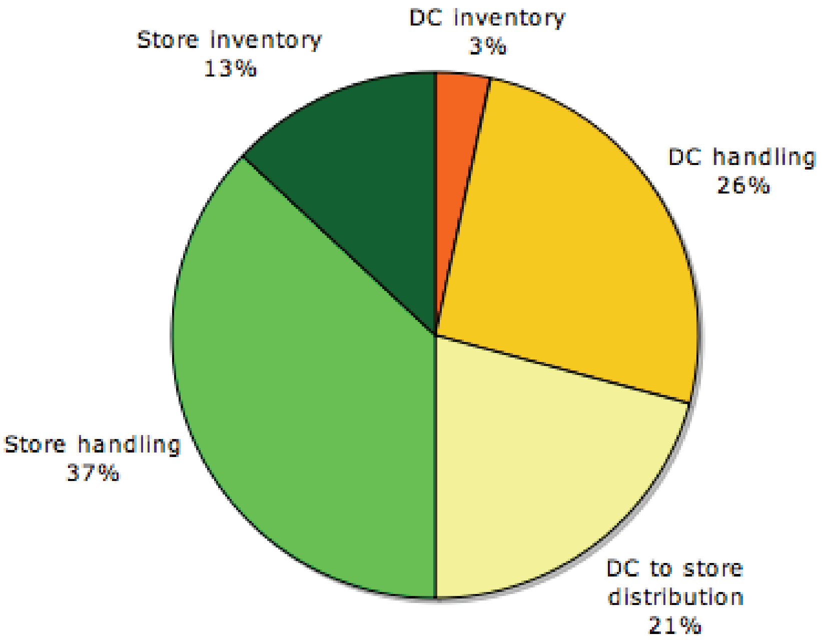

Figure 2 Retailer's logistics cost distribution

Curseu et al. (2009) estimate the handling time per product type required to execute the shelf-stacking operation depending on the number of batches and the number of consumer units stacked. Based on the insights from a time and motion study, a prediction model is developed that allows estimating the total stacking time per order line. The model is tested and validated using real-life data from two European grocery retailers and allows for evaluating the workload required for the shelf-stacking operations. The analysis leads to a handling cost structure in which each replenishment is associated with costs of the following structure: $K+K_1\ n+K_2nq$, where q is the fixed batch size, orders are nonnegative integers (n) multiple of these q consumer units. Ignoring the specific product category, i.e. for a random product the parameters are estimated in Curseu et al. (2009) to be $K=10$, $K_1=20$, $K_2=1$. We use these parameters in our micro model developed in section 1.5.

12.4 The ideal replenishment supply chain

Frequent reordering and just-in-time delivery was invented in the automotive industry, where parts are expensive, upstream lead times are long and every point in the supply chain adds value by combining parts into subassemblies. Those subassemblies hit the final assembly-line as specific complex components synchronously with other components. And together with these other components they constitute the final assembly, without any downstream inventory (zero inventory). These concepts are totally inadequate to replenish food supermarkets.

Analysis of the logistics costs in the current food supply chain typically shows a cost breakdown as presented in Table 3

	Manufacturer	**Retailer DC**	**Total supply chain**
Inventory	7%	4%	11%
Handling	18%	31%	49%
Distribution	15%	25%	40%
Total	40%	60%	100%

Table 3 Typical logistics goods cost distribution[2] (from factory gate to supermarket back door)

It is striking, that the costs of inventory amount to only 11% of the logistics costs, namely 7% at the manufacturer's warehouses and just a tiny 4% at the supermarket's distribution centers. To prevent clients to be confronted with empty shelves, replenishment lead times should be short. The nearest location able to replenish the shelves are the supermarket distribution centres. With inventory costs as low as only 4%, there will hardly be enough inventory to replenish the supermarkets if demand exceeds expectations.

A fundamentally better supply chain with lower total costs cannot be realized by further reducing the already extremely low costs of inventory (4%) at the supermarket distribution centers. Reducing the inventory levels even further means escalating the delivery time requirements posed upon the manufacturers resulting in higher order picking costs and distribution costs on the manufacturer's sife of the supply chain.

In fact the opposite is true. The replenishment supply chain costs can be reduced significantly, when inventory is not kept upstream at the manufacturer's warehouses, but instead downstream in the supermarket's regional distribution centers. If the supermarket organizations would be prepared to keep higher inventory levels, the manufacturers would be able to save on their logistics handling costs more than the increase in inventory costs at the supermarket’s side of the supply chain. That way the costs of the supply chain as a whole will go down.

From this perspective it is relatively easy to draft the ideal replenishment supply chain for food supermarkets. There are no fundamental reasons to keep inventory upstream in the supply chain at the manufacturer's warehouses because: [3]

- production lead-times are short,
- the factory produces consumer ready products
- subsequent stages do not add value to the product,
- goods are cheap
- handling is costly.

The ideal food replenishment supply chain is shown in figure 4. In the ideal supply chain the manufacturer does not keep any inventory at all. The manufacturer's warehouses are being reduced to stockless cross docking platforms. At these cross docking platforms the full homogeneous pallets arrive straight from production in full truckloads.

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[2] In store logistics not included.

[3] Beware: These characteristics are true in the food replenishment supply chain, but may often not be valid in many another supply chains.

The pallets are being cross docked as they are, without any hand operated repacking. Synchronously to their arrival the pallets are being shipped to the various supermarket distribution centers consolidated into full truckloads. The costly hand operated order picking process at the manufacturer's warehouses doesn't exist anymore. Equally, goods reception at the supermarket's distribution centers is simplified and less costly. And last but not least the higher inventory levels at the supermarket's distribution centers guarantee a better service to the supermarket outlets and ultimately to the clients.

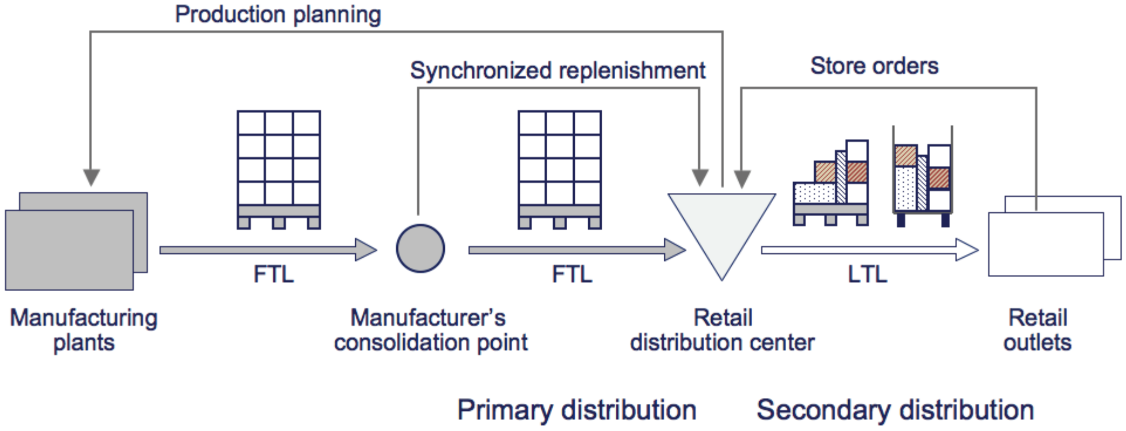

Figure 4 The synchronized replenishment supply chain

In the ideal supply chain the manufacturers relate their production schedule to the inventory levels in the supermarket's distribution centers and the aggregate sales forecasts from the supermarkets, which implies that production is based on information far more downstream the supply chain, making the supply chain more responsive. The production schedule drives the whole supply chain as delivery to the supermarket's regional distribution centers is fully synchronized to production.

Following the above line of thought, Van der Vlist (2007) shows that inventory currently at the manufacturer's warehouses moves to the supermarket's regional distribution centers. Keeping more inventory at the supermarket's regional distribution centers by no means requires the supermarkets to own these goods. It is perfectly adequate if the ownership would remain with the manufacturers (Vendor Managed Inventory VMI). It can be shown that total supply chain inventory levels will be lower than current inventory levels already at the manufacturers' warehouses alone.

With Supply Chain Synchronization the supply chain clearly orders in a PUSH mode, with production pushing the goods down the supply chain.

As our micro model developed in section 1.5 also includes the supermarket stores, we have been able to show that inventory at the supermarket's regional distribution center is less effective than shelf stock at the store. Hence we must extend the SCS principles into the store. Clearly, this may be hindered by the limited shelf space availability.

12.5 Micromodeling

In section 12.2 and 12.3 we discussed the main characteristics of the current retail supply chain and in section 12.4 we described the ideal retail supply chain under Supply Chain Synchronization. In order to get more insight and support concerning our ideal supply chain design we have developed a micro model of the retail supply chain, starting from the manufacturer scheduling production orders in the factory all the way down till the store shelves, taking into account the operational characteristics that drive costs for inventory, handling and transport at the factory, the manufacturer's warehouses, the supermarket's regional distribution centers, up to and including the supermarket's in-store logistics costs. The model is driven by the in-store demand characteristics.

The results are calculated for a product sample of 5 private label products, as presented in table 5 with their relevant characteristics. We use the following abbreviations:

FTY	Factory producing the product
MDC	Manufacturer's warehouse
RDC	Retailer's regional distribution centre
Store	Supermarket store
E[D]	Average daily demand for a product in an arbitrary store
c_D	Coefficient of variation for a product in an arbitrary store

Item	Costs ex FTY	# / pallet	# / collo	E[D]	c_D
Detergents	2.50	120	6	20.8	0.4
Spreads	0.95	1120	20	83.3	0.2
Ice cream	1.25	400	10	8.3	1.5
Toothpaste	1.50	4000	60	6.7	0.5
Aftershave	5.00	480	12	1.7	1.0

Table 5 Product characteristics with current production and order frequencies

The order and production frequencies shown in table 6 drive the handling costs.

Item	FTY runs /week	MDC orders /week	RDC orders /week	Store orders /week
Detergents	1	2	2	4
Spreads	1	2	2	4
Ice cream	0.5	0.5	0.5	1
Toothpaste	0.25	0.5	0.5	1
Aftershave	0.25	0.25	0.25	0.5

Table 6 Current production and order frequencies

With respect to handling costs we use the costs in Eurocent presented in table 7

Costs in Eurocent	MDC	RDC	Store
Fixed costs per order line	NA	300	1.677
Handling costs/collo	10	10	3.333
Handling costs/unit	NA	NA	0.167

Table 7 Handling costs in Eurocent

We note here that the fixed order handling costs in the RDC are primarily due to quality and quantity control. The handling costs in the store are split in a fixed part, a per collo part and a per unit part. We assume that the FTY and MDC primarily handle pallets.

Finally, transport costs per Euro are shown in table 8

Trucking per kilometer	0.83
# pallets per full truck load	25
Transport cost per pallet per km	0.03

Table 8 Transport cost in Euro

We have used the transport cost per pallet per km assuming that this can be translated into cost per collo and cost per unit by using the data in table 1.5.1. In order to compute the Transport costs per unit on each of the Transport legs we assumed the distances as shown in table 9

Item	FTY-MDC	MDC-RDC	RDC-store
Detergents	150	50	50
Spreads	75	50	50
Ice cream	450	50	50
Toothpaste	50	50	50
Aftershave	450	50	50

Table 9 Distances in kilometers

We determine the supply chain cost breakdown, separating the logistics costs in inventory costs, handling cost and transport cost. For the inventory costs we assume a 20% interest rate, reflecting the opportunity cost of capital. We also consider the cost breakdown between retailer and manufacturer.

From the data in tables 5-9 we build a multi-echelon inventory system with linear holding costs and fixed release costs. The linear holding costs are determined by subsequently adding the cost of the item ex factory and variable costs for handling and transport up to each stock point. The fixed release costs are determined by the fixed handling costs given in table 7. We assume that the manufacturer must provide a 98% fill rate to the retailer, due to the retailer's power. The retail distribution center also provides 98% fill rate to the stores, to reflect that the one-day-lead time from RDC to store must be respected.

We assume an 85% fill rate on the shelf. This may seem very low, but one should take into account that retailers often sell two or three comparable items at similar price points, thereby allowing for substitution. If one item has a stockout probability of 15%, then the probability of three substitutable items being out of stocks equals $(15\%)^3=0.34\%$, or equivalently, the probability of satisfying customer needs equals 99.66%! Clearly, while the retailer hardly misses turnover, the manufacturer does have a 15% probability of missing a sale, due to the retailer's performance.

De Kok and Fransoo (2003) have introduced so-called Synchronized Base Stock policies (SBS), that enable control of arbitrary value networks, of which the retail supply chain is a special case. In De Kok et al. (2005) a case study at Philips Semiconductors is described, where SBS policies have been effectively implemented.

Subsequently a series of projects has shown the validity of multi-item multi-echelon inventory models under SBS policies as a means to determine the relationship between actual inventory capital investments across the value network and the operational customer service achieved towards the client. We build our model using Synchronized Base Stock (SBS) policies.

The first scenario models the current Pull situation. In this first scenario, we determine the inventory levels at MDC, RDC and stores for each item needed to meet the required (local) fill rates. This reflects the item-by-item single echelon approach that is mostly applied currently. The scenario is called **Current**.

In the second scenario we take a retail supply chain wide perspective: we minimize the total inventory investment subject to the shelf availability constraint of 85% using Synchronized Base Stock control or SBS-policies. The scenario is called **Pull optimal 85%**.

In the third scenario we implement the Supply Chain Synchronization Push policies. The supply chain is synchronized to production and follows the rhythm of the manufacturer's production operation. As the production frequency is much lower than the frequency at e.g. the retailer, we expect an increase in inventory at the retailer, but this should yield a reduction in handling costs, that more than compensates the inventory increase. Again we would like to assess the cost breakdown. In the fourth (SBS) and fifth (SCS) scenario, we increase the shelf availability requirements to 95% to reflect the importance of a high shelf availability for the manufacturer. This will increase the shelf inventory and we want to know at what expense and at what increase in volume. The scenario is called **Push optimal 85%**

Let us first consider the current situation. Using our micro model, we find the cost incurred by the five different products across the retail supply chain as presented in figure 1.5.1.

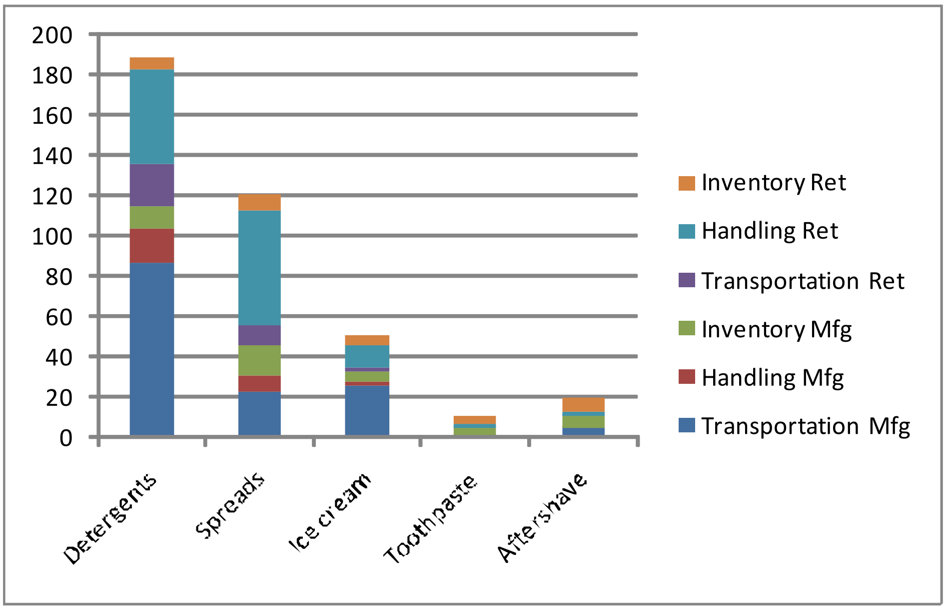

Figure 10 Cost incurred under the Current scenario

Clearly, the majority of costs are incurred by the fast moving products. To get a better insight into the cost allocation among transportation, handling and inventory costs, as well as the cost allocation between retailer and manufacturer, we consider the results presented in figure 11.

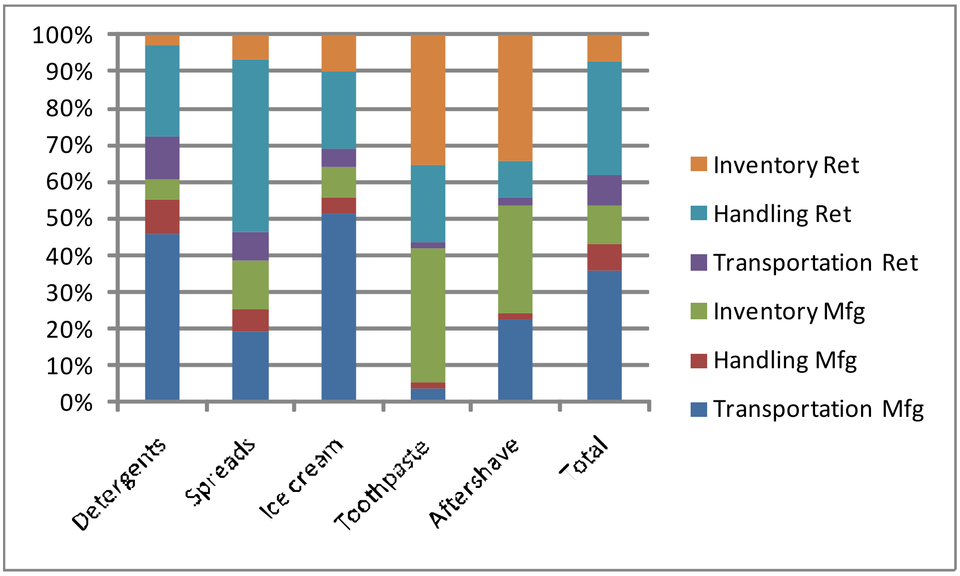

Figure 11 Cost allocation in the Current situation

We find that for the voluminous detergents the transportation costs are dominating, whereas for the high value density products, aftershave and toothpaste, the inventory costs are dominating. The fast moving spreads incur primarily handling costs.

In figure 12 we validate our micro model. The micro model covers the supply chain from release of production orders to supermarket shelf. By considering only the cost from factory door to store door, we can compare our costs to the actual costs determined in Van der Vlist (2007). As follows from figure 12 the micro model cost breakdown is very close to the cost breakdown in practice.

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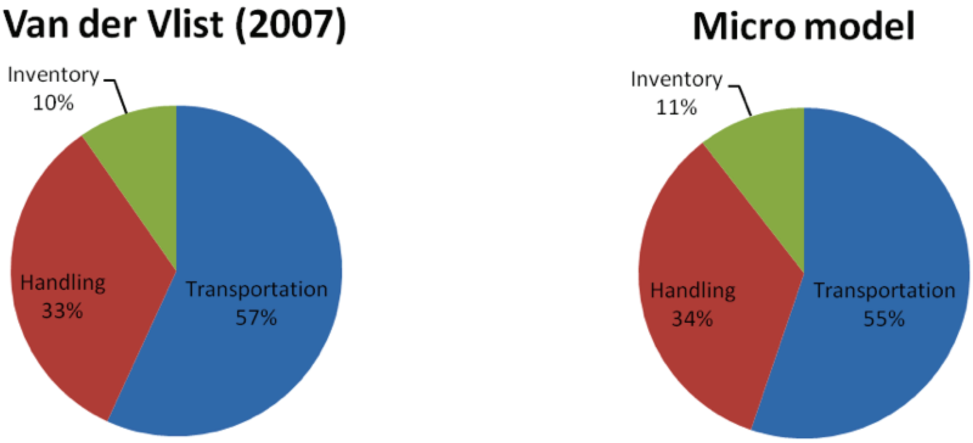

Figure 12. Validation of the cost breakdown of the micro model

Having validated the micro model, we now can use it to analyze the scenario's defined above. In figure 13 we present the total costs for each scenario. From figure 13 it is clear to see that the current scenario is truly suboptimal. By optimizing under the same shelf availability of 85% we can save about 5% in costs, which offers a substantial profit contribution, given the low margins in supermarket retailing. But even increasing the shelf availability to 95% leaves room for a cost reduction of close to 3%. At the same to this will substantially increase the manufacturer's turnover.

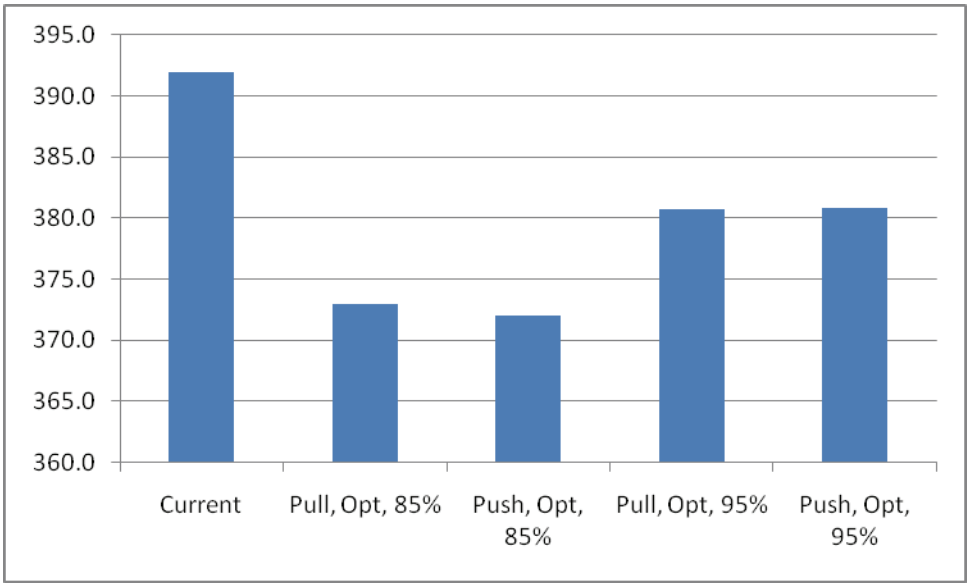

Figure 13 Comparing scenarios' total costs

Having a closer look at the optimized scenarios, we find that under 85% shelf availability, the SCS approach outperforms the optimized scenario under the original shipment frequencies, while at 95% shelf availability this is no longer the case. Here we see the impact of high shelf availability. Together with the reduced shipment frequency to the store this requires such an increase in shelf stock that cost reduction in handling are offset by a cost increase for holding inventory. This is further confirmed by the cost breakdown in absolute figures and relative figures as presented in figures 14 and 15, respectively.

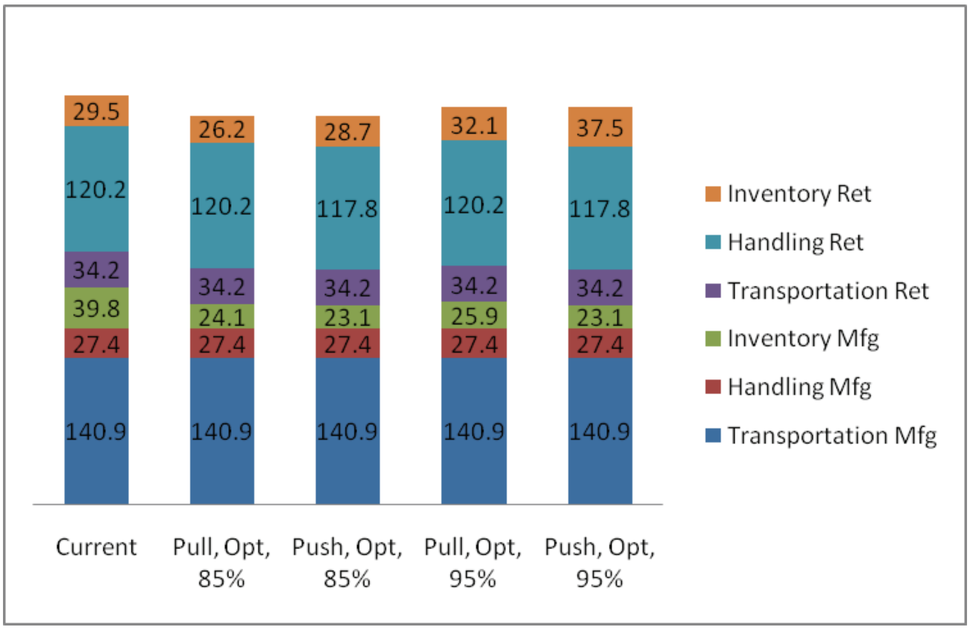

Figure 14 Absolute cost breakdown

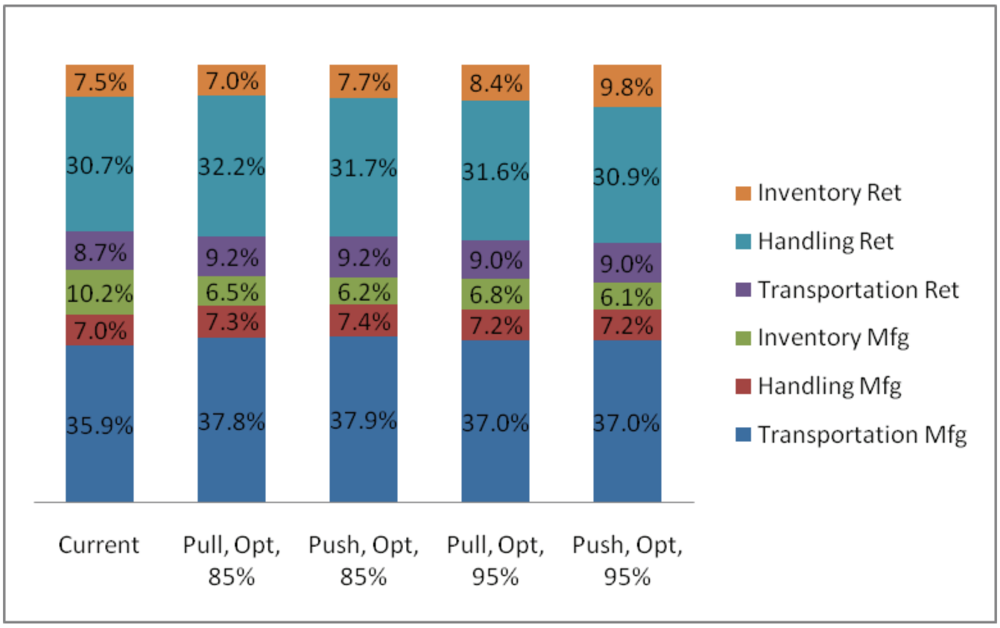

Figure 15 Relative cost breakdown

The scenarios differ significantly in inventory positioning. This is shown in figure 16 in days covered at each stage, including de factory and the stores.

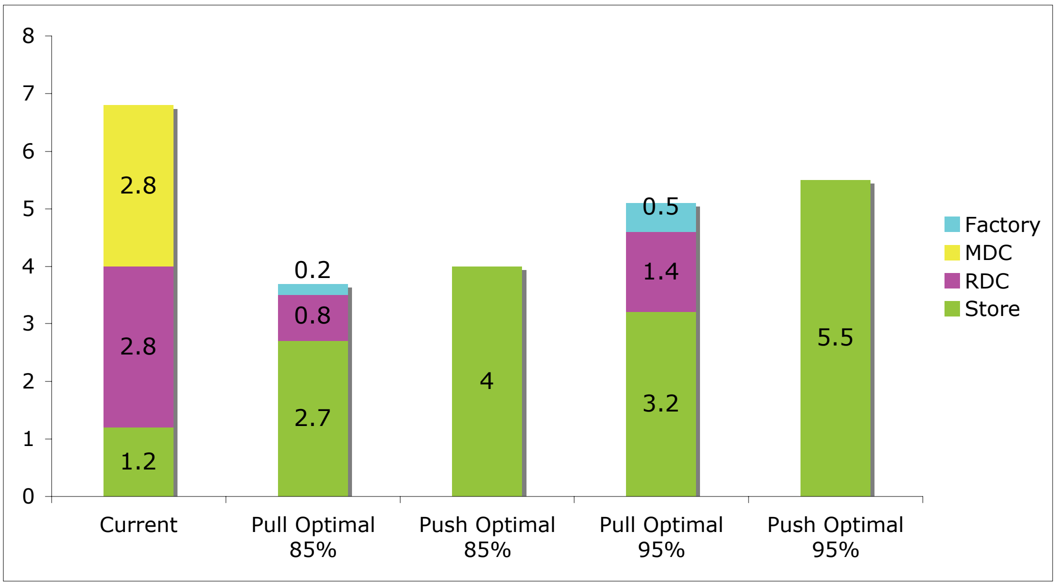

Figure 16 Inventory positioning in days covered

Table 15 shows that substantial increases in shelf stock are required to achieve the potential cost reduction. In particular for the fast movers this is necessary. In case the required space is not available, the next best location is the supermarket's distribution center. This shows the potential of larger supermarkets as they have relatively more space available. The results in table 15 reveal the need for sophisticated shelf space optimization, where subject to an aggregate space constraint, one can look for the optimal allocation of shelf space among the product assortment.

As mentioned earlier, the above analysis shows the potential of the SCS Push principles. Notice that we have used the same variable cost data, both for transportation and for handling.

It is to be expected that with reduced shipment frequencies and handling frequencies, further economies are possible that allow further reduction of transportation and handling costs. This implies that retail supply chains under SCS Push principles are the most effective ones.

Our model only implements the Push characteristics of Supply Chain Synchronization and neglects any potential savings stemming from other aspects of synchronizing the supply chain. Such aspects are e.g. simplifications that inherent to shipping goods in larger volumes: full boxes, full pallets and full truck loads. Likewise the model neglects the savings due to the associated reduction in orders. The savings of SCS shown in this section may be considered to be a safe lower bound.

Studying the other aspects of Supply Chain Synchronization (SCS) above the mere Push operation needs refinement of the current SBS-model. One might expect this to show that the performance of SCS can be even improved upon.

12.6 Conclusions

In this paper we have developed a micro model of the retail supply chain to provide further insights into the retail supply chain blue print developed in Van der Vlist (2007). We extended the analysis of Van der Vlist in two ways. Firstly we considered the retail supply chain from order release in production to the shelves in the stores. Secondly, we applied synchronized base stock (SBS) policies to determine the optimal allocation of inventory capital under this class of policies. Despite the fact that SBS policies are not optimal, earlier research has revealed that they outperform currently used rolling schedule approaches and that they are close-to-optimal for all systems for which the optimal policy is known, i.e. pure assembly systems and pure divergent systems under the balance assumption (cf. De Kok and Graves, chapters 10-12). We note here that the determination of the optimal SBS policies is based on solving a set of recursive equations and is extremely efficient, thereby enabling optimization of supply chains with thousands of items.

Our analysis is based on a micro model that is consistent with the empirical data presented and discussed in Van der Vlist (2007). The main conclusions are that current practices based on pull systems and high frequency of replenishment are highly ineffective. Cost savings of at least 5% are possible under the same service level targets. Increasing this target from 85% to 95% allows still for 3% cost reduction. As margins are wafer thin in retail, such cost reductions are substantial. Our analysis shows that applying the push concept as formulated with the Supply Chain Synchronization (SCS) principles formulated in Van der Vlist (2007) leads to similar cost reductions when applying optimal SBS policies as in the case of optimization while maintaining the present frequencies. This implies that further cost reductions are possible, as we can exploit the lower shipment frequencies for better coordination in transport, warehousing and cross-docking. Under the push concept shelf stocks in the stores need to be increased substantially, which may require to push back some stocks to the retailer distribution centers. Both exploitation of lower frequencies and push back of stocks to retailer DC's are topics for further research.

References

Bisschop, J., 2007, *Supply chain performance evaluation*: application of the synchronised base stock policy in a high-tech complex equipment supply chain with contract manufacturers, TUE.

Curşeu A., T. Van Woensel, J.C. Fransoo, K.H. Van Donselaar and R.A.C.M. Broekmeulen (2009) *Modeling Handling Operations in Retail Stores*: an empirical analysis, Journal of the Operational Research Society, 60, 200-214

Falck, C. M. 2005. *Efficient store ordering*. Masters thesis, Department of Industrial Engineering and Management, Helsinki University of Technology, Helsinki, Finland

Fisher, M. 2009. *Rocket Science Retailing*: The 2006 Philip McCord Morse Lecture, Oper. Res. 57(3) 527540.

Kok, A.G. de and Fransoo, J.C., 2003, *Planning Supply Chain Operations*; Handbooks in Operations Research and Management Science, Volume 11, Chapter 12.

Kok, A.G. de and Graves, S.C., 2003, Supply Chain Management: Design, Coordination and Operation, Handbooks in Operations Research and Management Science, Volume 11.

Kotzab, H. and C. Teller, 2005, *Development and empirical test of a grocery retail instore logistics model*, British Food Journal 107(8) 594-605

Pal, J.W. and Byron., J.W. 2003. *The five Ss of retail operations*: a model and tool for improvement, International Journal of Retail & Distribution Management, 31(10):518-528.

Smaros, J., Angerer, A., Fernie, J., Toktay, L. B., and Zotteri, G. (2004), *Logistics Processes of European Grocery Retailers*, Working paper, Helsinki University of Technology. http://knowledge.insead.edu/abstract.cfm?ct=14061.

Van der Vlist, P., 2007, *Synchronizing the Retail Supply Chain*, Erasmus University, Rotterdam School of Management; ERIM Ph.D. Series Research in Management no. 110, http://hdl.handle.net/1765/1, ISBN 90-5892-142-0; Rotterdam.

Van Zelst S., K. Van Donselaar, T. Van Woensel, R. Broekmeulen and J. Fransoo (2009), *Logistics drivers for shelf stacking in grocery retail stores*: Potential for efficiency improvement, to appear in: International Journal of Production Economics, 121, pp. 620-632

Survey of Supply Chain Effectiveness. 2002. Prepared by Kurt Salmon Associates