Optimizing the Distribution Network of Perishable Products to Small Format Stores

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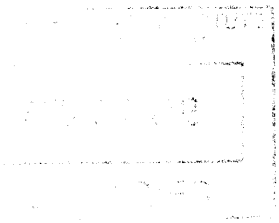

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Abstract

FoodCo is a leading foods company that has reputed brands and global operations with revenues in excess of USD 5Bn. Although FoodCo's sales to Small Format Stores (SFS) customers are a small part of the overall sales, it is a fast growing segment where FoodCo sees future. However, distribution to the SFS channel is a challenge – FoodCo needs to ship refrigerated and frozen products to over 40,000 stores through multiple distributors. Furthermore, such stores are characterized by low sales velocity relative to traditional retailers. The transactional nature of FoodCo's supply chain relationship with channel partners creates challenges for FoodCo in influencing key decisions in the supply chain.

To tackle the problem, the authors reviewed the literature and interviewed experts and practitioners to understand best practices in Consumer Packaged Goods (CPG) companies across the world serving SFS. Although there were few direct parallels, collaboration was found to be a practice that successful companies employed.

The authors also analyzed data including store sales, orders to FoodCo, promotions and supply chain costs, etc. They created a quantitative model that suggested that fees paid out to distributors for their full service are not proportional to the costs. They also concluded that FoodCo's lack of visibility into the sell-through demand made it subject to a strong bullwhip effect, leading to large amounts of inventories and shrinkage. Further, they identified that store sales were scattered geographically and that direct shipments to high selling stores were not possible.

Based on the analysis, the authors recommend that FoodCo start collaborating with their channel partners. First, FoodCo could communicate the value of collaboration to its channel partners in order to gain their support. Then, FoodCo and the retailers can share their demand plan with each other, foster collaboration and elevate the manufacturer-retailer relationships to a strategic level. Further, FoodCo could build scale by consolidating volumes through a single re-distributor for channels where the sales volumes are very low.

Thesis Supervisor: Dr. Edgar Blanco
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- Dr. Bruce Arntzen, Executive Director, Supply Chain Management Program, Senior Research Director, MIT
- Former practitioners at global food and non-food CPG companies

[1] Identity of the sponsor company and its executives have been withheld on request.

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List of Acronyms

BOH	Beginning On Hand (inventory)
CPFR	Collaborative Planning Forecasting and Replenishment
CPG	Consumer Packaged Goods
CV	Coefficient of Variation (Standard Deviation/Mean)
DC	Distribution Center
DSD	Direct Store Delivery
EOH	Ending On Hand (inventory)
FG	Finished Goods
FTL	Full Truck Load
LTL	Less than Truck Load
POS	Point of Sale
SCM	Supply Chain Management
SFS	Small Format Stores

1 Introduction

1.1 About FoodCo

FoodCo[2] is one of world's largest food companies with revenues of multiple billions in FY2011[3]. With an employee base in the thousands, and strong brands, it serves its customers in more than 100 countries. FoodCo reaches its customers through big-box retailers, convenience stores, dollar stores, drug stores and through smaller independent convenience stores.

Big-box retailers have traditionally been the largest customers for FoodCo. Such retailers usually have sophisticated distribution and supply chain processes that are integrated with their suppliers. With large business volumes, FoodCo ships directly to the retailer's warehouses in full truckloads to minimize the transportation costs.

1.2 Small Format Stores Business Context

As we can see from Figure 1, the population above the age of 65 in the US has shown a rapid growth[4] in the past. It is expected to show such growth in future as well. This demographic trend of aging population suggests that the importance of small format stores is going to increase in the future, as proximity of this type of stores becomes a critical factor for convenience of senior shoppers.

[2] Identities of the sponsoring company and its channel partners have been withheld on request.
[3] Source: Corporate portal of FoodCo, accessed Mar 30 2012.
[4] Source: http://www.aoa.gov/aoaroot/aging_statistics/future_growth/future_growth.aspx accessed Mar 30, 2012

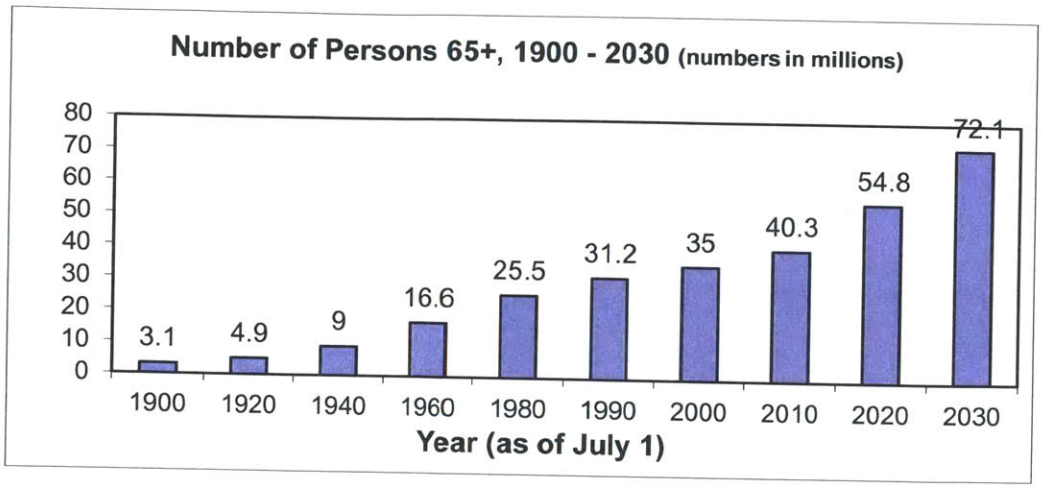

Figure 1: US Population above the age of 65 – history and forecast

A report by Nielsen[5] shows that the number of convenience stores in the US has been increasing over the years.

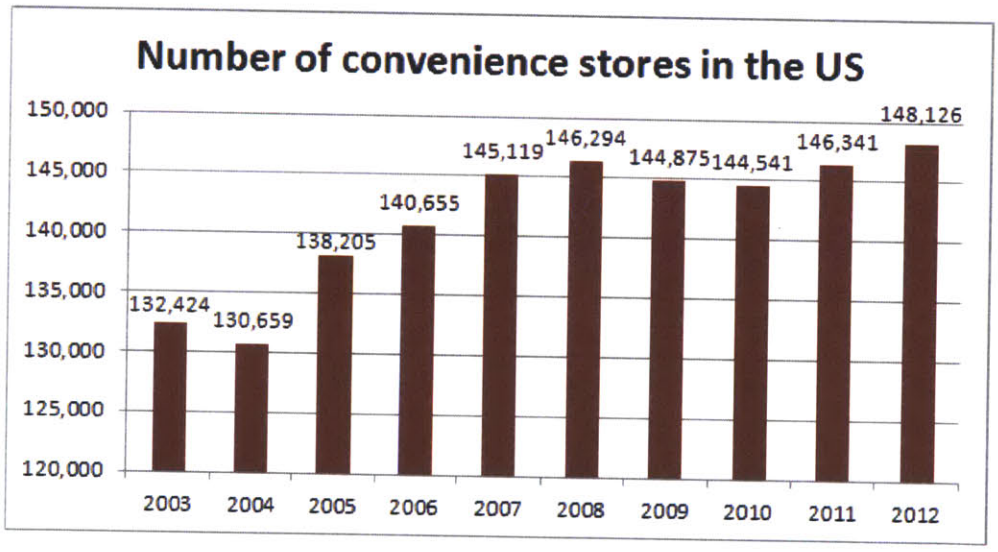

Figure 2: Number of convenience stores in the US

Continued growth in convenience store count is representative of the fact that small format stores are gaining importance in general. Consumers prefer to shop within a mile or two from their homes rather than drive to big-box supermarkets located outside of town. This

[5] Source: http://www.nacsonline.com/NACS/NEWS/FACTSHEETS/SCOPEOFINDUSTRY/Pages/IndustryStoreCount.aspx accessed Mar 30, 2012

trend makes small format stores like convenience, drug and dollar stores the preferred shopping location. Big-box retailers, such as Wal-Mart and Target, entering the small format stores segment themselves[6], exemplify this trend. Within FoodCo, small format store channel is also growing at a high rate, as shown in Table 1.

Table 1: 5-year CAGR sales by channel[7]

Channels	5-year CAGR
All Channels	4.4%
Grocery	3.3%
Wal-Mart	4.6%
Target	10.4%
Club	6.3%
Small Format	8.8%
A/O	1.0%

1.3 Research Problem

Our research focuses on the Small Format Store (SFS) channels. Currently, FoodCo predominantly sells 3 frozen SKUs to the SFS channel. These products require temperature controlled transportation (commonly referred to as "reefers") and storage infrastructure. Such a distribution chain entails higher costs compared to dry products infrastructure. Despite the fact that these products are classified as perishable, their perishability can be ignored as long as the cold chain is not broken.

FoodCo is exploring opportunities to improve ways of how it is supplying frozen and perishable products to the SFS channel. First, individual stores are geographically dispersed as such store chains have broad national coverage. Second, the distribution network is complex (has multiple distribution layers) and has higher end-to-end delivery costs and higher price levels compared to big-box supermarkets, because small format retailers use a

[6] Source: http://www.nytimes.com/2011/06/03/business/03walmart.html and http://pressroom.target.com/pr/news/target-to-open-small-format-store-chicago.aspx both accessed on 03/30/2012

[7] Source: Kantar

variety of third party specialized distributors to deliver their perishable products. Third, sales velocity at SFS stores is low, however, less than truckload (LTL) shipments that can match such velocity are economically infeasible. Hence, it is necessary to aggregate shipments into full truckloads (FTL) at the beginning of distribution process. Fourth, it is challenging to monitor shelf inventory and ensure that the product is available in the store all the time, as there is low visibility into distributor's inventory and shipments to end retailers, as well as into Point of Sale (POS) data. While IT systems at some SFSs do not enable demand visibility at all, some other SFSs charge money to the manufacturer for sharing POS and inventory data.

What makes it more complicated is the fact that SFS stores such as CupCo and GloCo have no storage infrastructure, including freezer storage, and no staff trained to manage the shelf. All products have to be delivered not just to the store, but placed directly on the shelf, thus needing additional labor for shelf management. We would like to mention that PlaCo has practices and resources that are different from GloCo and CupCo, and are very similar to convenience stores: PlaCo manages the shelf itself, does not use distributors to place orders, but aggregates orders from individual stores in central PlaCo office.

These challenges limit the distribution of FoodCo products to these retailers and present difficulties for the FoodCo distribution network. In addition, there are challenges from the perspective of who controls the chain from manufacturer to retailer. Generally, manufacturers prefer having a handful of distributors across all retailers to build volume scale. This allows them to maximize the utilization of transportation resources and reduce per unit total costs. Manufacturers tend to control the shelf through vendor-managed inventory (VMI), category management and shelf management when distributing to large format retail stores. On the other hand, retailers want to build scales from the perspective of reducing the complexity of their store operations. Hence, retailers prefer to control the

supply chain from higher upstream, consolidate multiple suppliers' products in distribution centers and deliver FTL shipments of products to the stores. The boundary point of control over distribution network can be different depending on a retailer's or manufacturer's power, distribution infrastructure or type of product. Figures 3 and 4 show examples of different boundary points in the distribution network between different players. In the context of FoodCo's business of frozen products with SFS channel, distributors and redistributors control the most of distribution network, including managing the shelf at stores.

Basic supply chain/distribution network and notation are presented below:

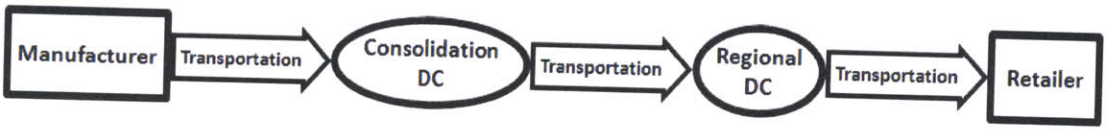

Figure 3: Supply chain/distribution network basic scheme

Notation for supply chain decision control over distribution network:

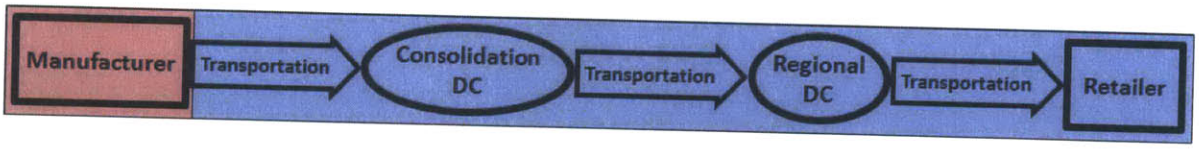

Figure 4a: Example of a global convenience store chain

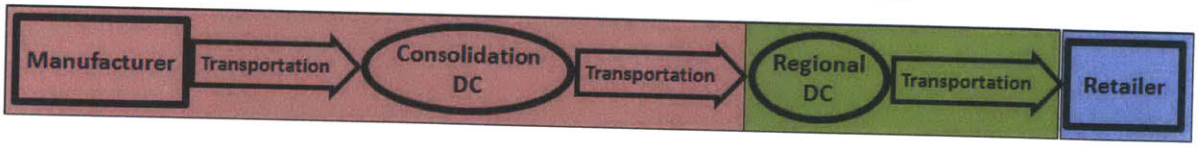

Figure 4b: Example of a CPG company in Latin America

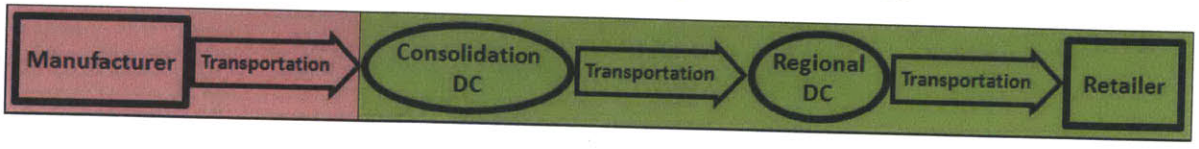

Figure 4c: Example of FoodCo's SFS refrigerated & frozen stores distribution network

In summary, there are multiple operational challenges in the current SFS distribution system: lack of shelf management capabilities at the stores with limited merchandise space (except PlaCo), lack of backroom storage, low visibility into sell-through demand, and variation in the retail prices due to distributor markup and margin expectations.

Strategic challenges follow from the need to move away from transactional, one-direction communication to a collaborative mode of engagement with channel partners and the need to be able to monitor performance of the distribution chain.

1.4 Thesis Scope and Methodology

This thesis aims to present possible strategic designs of distribution network, depict best practices in distribution of perishables and in non-food industry distribution, summarize relevant literature and its application, and provide framework to improve cost effectiveness with key small-format retailers. The main research questions we plan to answer are the following:

1. What are the alternatives to FoodCo's existing SFS distribution network of frozen products?
2. How can elements of those novel alternative network configurations be added to increase the efficiency of the current FoodCo distribution network?

We adopted a two-pronged approach for our research methodology – a quantitative and a qualitative analysis of the current state of the distribution network to small format stores. Then, we explored possible improvements and cost reductions in the supply chain, validated the scenarios with our thesis sponsors from FoodCo and selected the two most feasible scenarios – fostering collaboration with channel partners, and consolidating volumes to create scales.

The qualitative analysis included interviewing key executives at FoodCo in such functions as Sales, Marketing, Trade and Pricing Analytics. In addition, we interviewed experts and industry practitioners and performing academic literature review on related topics. We also visited retail stores and warehouses to observe their practices in marketing, storage, sorting and distribution.

The quantitative analysis studied the sales patterns and volatility at the store level and FoodCo level (sales from FoodCo to distributors or redistributor), identifying the bullwhip effect, the price structure including the product margins at all layers in the distribution network, and, where known, transportation, storage and handling costs.

The rest of the thesis is structured is as follows: in the next section we describe main actors in FoodCo's distribution network and activities performed by each of them; we then present our literature review divided into four topics (supply chain and distribution network frameworks, distribution practices, perishable products distribution research, bullwhip effect research); then we introduce case studies from our interviews with experts/former industry practitioners to understand the up-to-date business practices in distribution; we further describe our research methodology and show the results of our analysis; in the subsequent sections, we make our recommendations and draw conclusions from our research; we conclude with recommending further research and suggest additional activities that can be undertaken by the company.

All names and identities of FoodCo's channel partners have been disguised. Any information not available in the public domain has been withheld on request.

2 Path to Shelf: Current Distribution Network to Small Format Stores

There are four big retail chains in SFS segment – GloCo, CupCo, PlaCo and MitCo. Table 2 below summarizes key operating and financial statistics about these players[8].

Table 2: Key statistics of GloCo, CupCo, PlaCo and MitCo

Customer Name	Number of Stores (approx.)	Number of States	Revenue, USD Bn (approx.)	Operating Profit, USD Bn (approx.)
GloCo	9,500	35	$13	$1.2
CupCo	7,300	43	$57	$4.4
PlaCo	7,800	52	$72	$4.3
MitCo	7,000	45	$8	$0.6

For our analysis, we are using three frozen stock-keeping units (SKUs) with the highest sales volumes in this segment: SKU-1, SKU-2, and SKU-3. We note that FoodCo is not the largest player in the segment, and that industry-standard case pack size of 12 units is relatively large compared to average sales in this retail format which is about 2-3 units a week.

Our thesis focuses on the distribution network serving two retailers: one each from the Drug & Dollar segment – CupCo and GloCo. We further describe operations of these two SFS chains in more detail.

2.1 GloCo

As of February 25, 2011, GloCo had approximately 9,500 stores in 35 states and 9 distribution centers. Stores are located in eastern and central part of the US.

[8] Source: Corporate portals of GloCo, MitCo, CupCo and PlaCo.

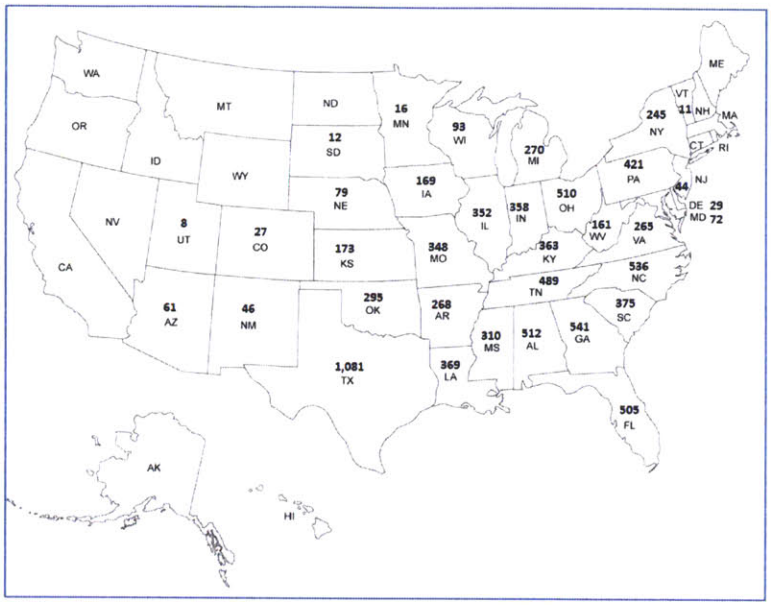

Figure 5: GloCo store map[9]

Eight states account for 50% of the total number of GloCo stores, with Texas being home to over one thousand stores, as shown in the table 3 below.

Table 3: States with highest number of GloCo stores

State	Number of stores (approx.)
Texas	1,000
Georgia	550
North Carolina	550
Alabama	500
Ohio	500
Florida	500
Tennessee	450
Pennsylvania	400

[9] Source: GloCo corporate website accessed Mar 30, 2012

Table 4: GloCo distribution center locations

State with DC	Number of stores served (approx.)
Kentucky	1,000
Oklahoma	1,400
Virginia	1,000
Mississippi	1,000
Missouri	1,300
Florida	100
Ohio	1,300
South Carolina	1,000
Indiana	1,000

GloCo has an "Every Day Low Price" (EDLP) strategy, and the chain has minimal promotional activity throughout the year. GloCo's strategy is to ensure product availability in the stores to promote sales as opposed to using pricing and promotions to stimulate sales. This strategy also extends to the distribution network.

2.2 CupCo

As of September 30, 2011, CupCo had approximately 7,300 stores in 43 states[10].

[10] Source: CupCo corporate portal

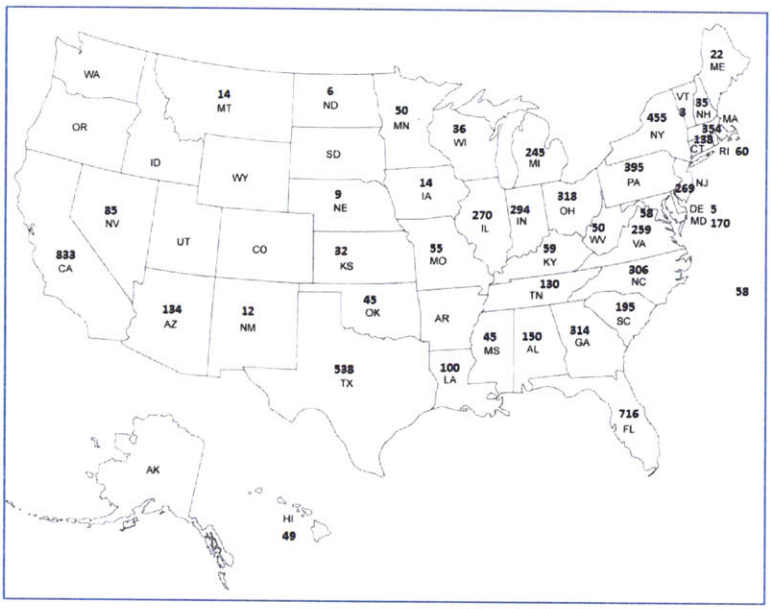

Figure 6: CupCo store map

Seven states account for 50% of the total number of CupCo stores, as shown in the table 5 below.

Table 5: States with highest number of CupCo stores

State	Number of stores (approx.)
California	850
Florida	700
Texas	550
New York	450
Pennsylvania	400
Massachusetts	350
Ohio	300

2.3 Distributors

The graph below summarizes distribution network details and product flow by retailer. We then describe operation of the distributors employed by GloCo and CupCo.

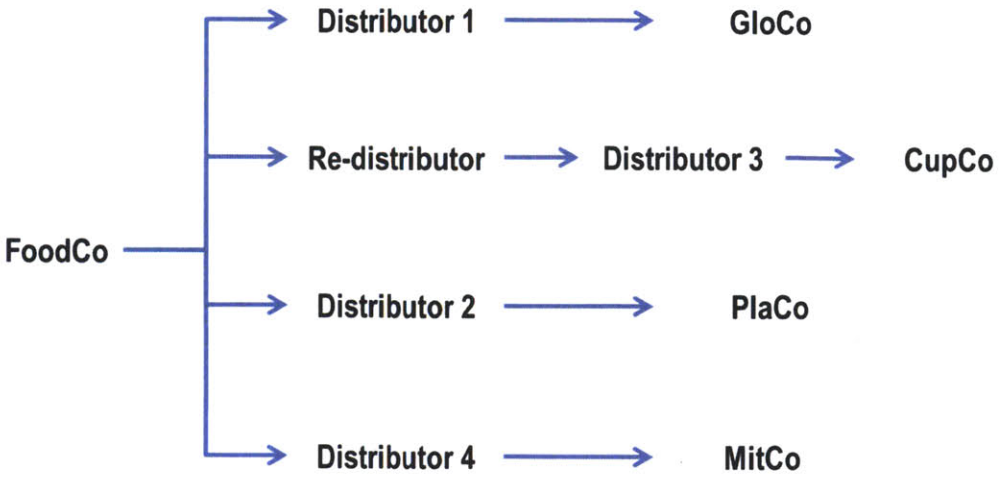

Figure 7: Current distribution network to small format stores

2.3.1 Distributor 1

Currently, the GloCo account is served through multiple distributors, with Distributor 1 being the largest one.

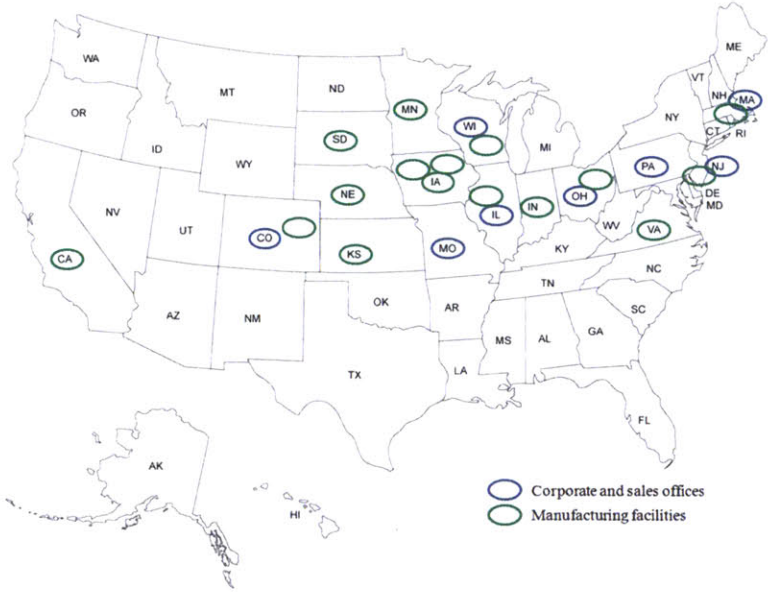

Figure 8: Distributor 1 locations

Distributor 1 offers direct store delivery and has national distribution resources. Distributor 1 has 8 sales offices and 16 manufacturing facilities across the country[11].

[11] Source: Distributor 1's corporate portal accessed Mar 30, 2012

2.3.2 Re-distributor 1 & Distributor 3

CupCo account is served through Redistributor 1 and Distributor 3. Redistributor 1 aggregates LTL orders from Distributor 3.

Redistributor 1 is a nationwide food redistributor, delivering to 3,800 distributors in LTLs. [12] Redistributor 1 owns a transportation system of more than 800 temperature-controlled trucks and can ship a combination of frozen, refrigerated and dry products in a single load. The distribution center locations operated by Redistributor 1 are shown in the figure 9.

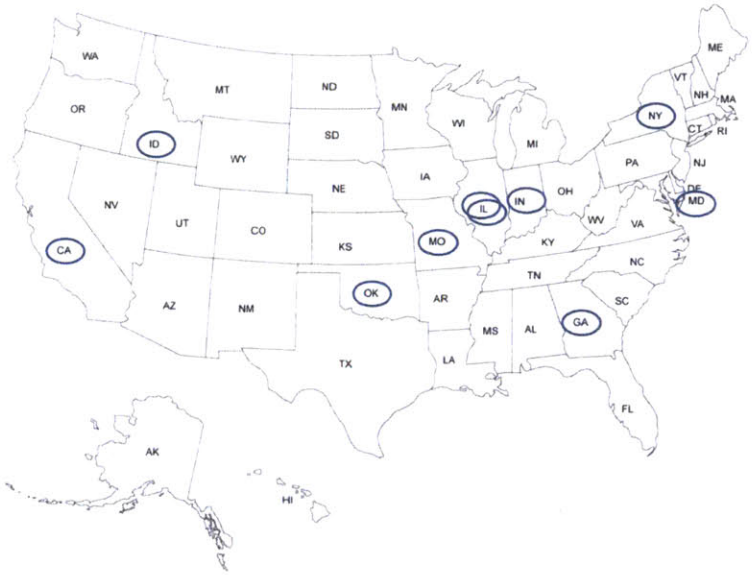

Figure 9: Redistributor 1 distribution center locations

After buying the frozen products from FoodCo, Re-distributor 1 then sells the products to Distributor 3 and Distributor 4. Re-distributor 1 places orders with FoodCo on a weekly basis. A typical CupCo store receives two deliveries from Distributor 3 per week, while higher velocity stores receive 3-4 deliveries per week.

Distributor 4 serves the shelves of FoodCo's perishable products at CupCo stores. They have access to the POS data of CupCo to manage the replenishment to stores. Distributor 4

[12] Source: Redistributor 1's corporate portal accessed Mar 30, 2012

manages the unsaleables and is responsible for pulling out dated or damaged products from CupCo shelves.

2.4 Distribution Network Structure

As described in previous sections, there are different distributors and re-distributors in the current SFS distribution network. Figure 10 summarizes the current distribution network structure of shipping frozen products from FoodCo to small format stores.

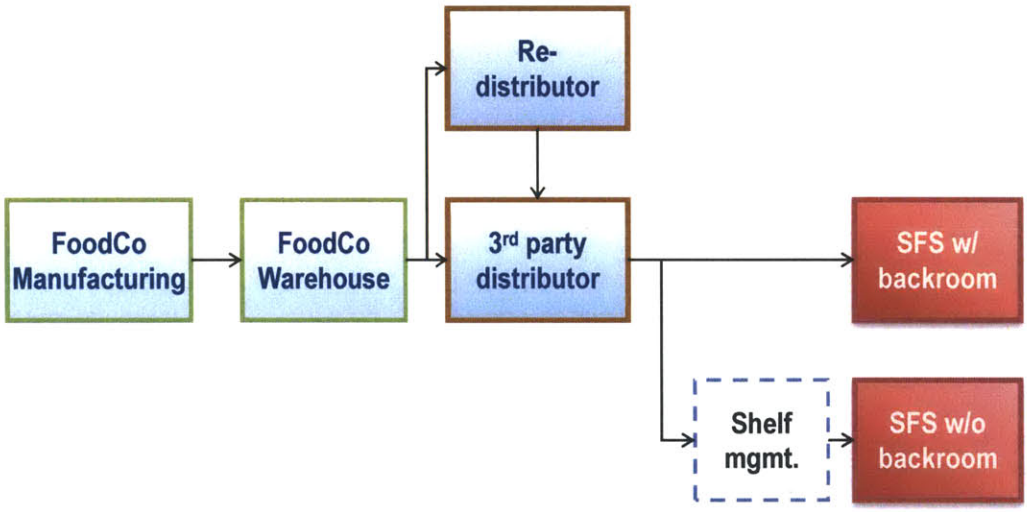

Figure 10: Distribution network of FoodCo

CupCo's distribution network is highly complex. Products are shipped to a redistributor's central warehouse (Re-distributor 1) and then to the redistributor's regional warehouses. From there, products go through two layers of Distributor 4 warehouses. The two layers at Distributor 4 represent the original Distributor 4 ice cream distribution network, into which FoodCo's frozen products merge in relatively small quantities.

In contrast with CupCo's complex distribution network, GloCo does not use a re-distributor. For GloCo, FoodCo ships to the Distributor 1's, two central warehouses. From there, FoodCo's products flow into the distributor's network. The distributors manage the shelf for CupCo and GloCo. As described earlier, in contrast to GloCo and CupCo, PlaCo manages the shelf itself without relying on distributors.

CupCo and GloCo. As described earlier, in contrast to GloCo and CupCo, PlaCo manages the shelf itself without relying on distributors.

One of characteristics of FoodCo's SFS channel is low sales velocity that we talked about earlier. While this is indeed true for both GloCo and CupCo, there is difference in relative sales volumes between these two accounts. For the three SKUs in the frozen category (SKU-2, SKU-3 and SKU-1), CupCo sales volume is approximately one-tenth of GloCo volume.

The reason for the different networks can be not only the varying sales volumes at GloCo and CupCo, but also the balance of power in the supply chain. When it comes to the crucial decision of appointing distributors, FoodCo has no influence. The retailer appoints the distributor. Even in the current operating model, FoodCo receives orders from distributors, and not retailers. This contrasts with the practice of convenience stores and one drug store, which aggregate orders from individual stores at the central office and place orders directly to suppliers.

It is important to note that retailers like CupCo and GloCo do not have refrigerated storage and transport capabilities. Hence, CupCo and GloCo use an external third party distributor to replenish the stores with frozen and refrigerated products.

Because of this additional supply chain participant, and the lack of IT systems capabilities at some of the retailers that we mentioned earlier, FoodCo has no visibility into the store inventory. True data about the actual weeks of supply of inventory or of expired products in the stores is not shared with FoodCo. Distributors handle expired products on shelf, with FoodCo paying a distributor an unsaleable allowance.

FoodCo uses an industry standard case pack size of 12 units per case. Based on the low sales velocity in the stores, this case pack leads to multiple weeks of inventory.

2.5 Summary

We have described the main actors in FoodCo's distribution network to small format stores, such as end retailers, redistributor and distributors. We saw the differences in distribution structure in case of GloCo and CupCo network structure and outlined the main factors for such differences to exist.

In the next section, we provide relevant literature for analyzing the FoodCo's small format stores distribution network.

3 Literature Review

Based on the characteristics of the currrent FoodCo SFS distribution network, we have identified four main topics in the academic literature that are relevant to the focus of our thesis. We first review supply chain and distribution network frameworks. We then summarize academic literature on supply chain practices in small format retail. We then continue with an overview of research in perishable products distribution and conclue this section with relevant literature about the bullwhip effect.

3.1 Supply chain and distribution network frameworks

Fisher (1997) introduces a supply chain framework based on the nature of the demand for the product. Functional products (stable, predictable demand, long life cycle, slow ''clockspeed'') need the supply chain to be cost-efficient. On the other hand, innovative products (volatile demand, short life cycle, fast ''clockspeed'') require a responsive supply chain. We consider this framework relevant to FoodCo, as the products we focus on in our thesis can be classified as functional, with stable predictable demand, long life cycle (have been on the market for a long time) and unchanging characteristics, therefore requiring a cost-efficient supply chain.

Spekman & Farris (2009) define a channel of distribution as "a set of interdependent firms that collaborate to make a product or service available for end-use consumption." They call the distribution channel design a "key strategic marketing decision" and describe costs and benefits that influence this decision. In particular, the authors emphasize that using third-party resellers in a multi-stage distribution network is a frequent practice, due to high costs of a manufacturer's captive distribution system, ability of the manufacturer to use investment capital more efficiently elsewhere, and the ability of a reseller to aggregate products from many suppliers and to provide better service to end retailers. They further state that "The objective of channel management is to identify the combination of channel members that best supports the business strategy, balancing responsiveness to customers

with total incurred channel cost while retaining enough control to ensure adequate network cooperation." Spekman & Farris (2009) identify five types of distribution channels that can be summarized in the table 6 below.

Table 6: Types of distribution channels

Distributors	Business that sell to other businesses. They create value through the movement of goods by providing activities such as providing assortment, breaking bulk, financing and managing inventory. These channel members usually take ownership of the goods.
Master Distributors	These channel intermediaries often sit between the manufacturer and other middlemen and hold inventory of hard-to-get parts. They often have sub-distributors who work with them doing more traditional distribution and logistics functions.
Value-added resellers (VARS)	Designers, engineers, or consultants who partner with manufacturers of products that are used in their designs. They typically buy at a discount and then resell the product as part of their solution.
Manufacturer Reps	Independent sales agents who carry different manufacturer's lines of product and serve as a third-party sales force for these firms. They carry multiple lines (often noncompeting) and specialize in different end-user applications. They are usually paid a commission on the sale.
Brokers	These are a form of manufacturer's rep and associated with the retail trade serving less complex products. They will work at the store level merchandising the shelves on behalf of the manufacturer they represent.

In addition, Spekman & Farris (2009) list the benefits of wholesalers, or distributors, both for the manufacturer and the retailer. In the case of the manufacturer, the wholesalers deliver stock to other locations, do bulk-breaking and provide the variaty of other products that enables one-stop shopping. For retailers, wholesalers handle inventory, provide credit and financing, customer service and advice and technical support.

The authors stress the importance of incentives (distributor's margins) in the distribution channel, saying that "without a well-designed system of incentives, manufacturer may find

that distributor interests do not coincide sufficiently with with their own and that tensions over preferences become exacebrated. A distributor may wish to take on a competitive line or devote more sales effort to a different product to a detriment of the established manufacturer."

Finally, the authors name corporate reputation and brand image as another factor in designing distribution channels. The give the examples of Coca Cola with a very intensive hands-on distribution strategy aimed at making the product universally available, and Hewlett Packard and Cisco that rely heavily on channel partners not only to distribute the product, but also to provide other services the manufacturers can not provide.

Using Speckman's framework, we observe that FoodCo's current network structure matches the description of the multi-stage network that uses the distributor channels, as FoodCo needs third-party distributors to move LTL quantities of products, do bulk-breaking and manage inventory.

3.2 Distribution practices

Fernie (1995) presents an interesting historical perspective on the development of grocery retail and its distribution practices. His paper summarizes the literature on how geographical spread, labor costs, culture, cost of capital and other factors impacted supply chains, encouraged warehouse automation, supplier-retailer collaboration, inventory reduction and construction of regional Distribution Centers (DC). In the US in the early 90s, grocery supply chains had a large inventory, standing at 104 days of sales for dry products and 75-80 days including perishable products. This could be explained by supply chain fragmentation: stock was pulled through the supply chain by replenishment orders for stores but inventory tended to be pushed through the warehouse network because of trade promotions and forward buying. This corresponds to the situation observed at FoodCo where a complex

network of redistribtors and distributors requires a large amount of inventory in the supply chain.

Garza-Ramirez (2011) describes distribution strategies in emerging markets, specifically in Latin America. There are many similarities between traditional retail in Latin America, which accounts for over 80% of the number of stores and consists of small independent convenience stores (mom & pop stores), and the drug & dollar small format store segment that we analyze in our thesis. These similarities include proximity to end customers, limited number of personnel, impulse purchase goods and store size. Based on surveys of workshops with industry practitioners in Latin America, the author finds that companies are more likely to make the decision to use a distributor model as opposed to direct store delivery when the company's strategy is to achieve high market coverage and low cost. Below is a table with main distribution and sales practices in Latin America that the author summarized by studying companies in various inductries.

Table 7: Sales and distribution schemes, adopted from Garza-Ramirez (2011)

Type	Scheme	Sales	Distribution
Direct	**Presales with Scheduled Delivery**	A seller visits customer's premise (i.e. point of sale), establishes relationship with customer, captures the order, and executes merchandising activities	Products are delivered to the store within a specified lead-time. (Sale and delivery do not occur at the same time)
Direct	**Onboard**	The seller/driver captures the order and delivers the product in the same visit. Product is stored in the vehicle. In addition, seller/driver executes merchandising activities	
Direct	**Telesales with Scheduled Delivery**	A seller calls the customer (point of sale), establishes relationship with customer, and captures the order.	Products are delivered to the store within a specified lead-time. Merchandising is executed by the driver or

			merchandising figure
Direct	**EDI with Scheduled Delivery**	Customer sends order electronically	Products are delivered to the store with a specified lead-time. Merchandising is executed by the driver or merchandising figure
Indirect	**Wholesalers (Presales and Scheduled Delivery)**	A seller establishes relationship with wholesaler and captures the order (manually or electronically). Wholesaler sends pre-seller to the point of sales	Wholesalers deliver products to point of sale within a specified lead-time.
Indirect	**Wholesalers (Onboard)**	A seller establishes relationship with wholesaler and captures the order (manually or electronically). The wholesaler sends a seller/driver to capture the POS orders and to deliver the product in the same visit.	
Indirect	**Distributors (Exclusive)**	A seller establishes relationship with point of sales and captures the order (manually or electronically). An exclusive distributor delivers the product. In some cases, an exclusive 3PL is responsible for the sale and distribution of the product.	
Indirect	**Distributors (No Exclusive)**	A seller establishes relationship with point of sales and captures the order (manually or electronically). A general distributor, which also sells/delivers product from other companies, delivers the product to the POS. In some cases, a general 3PL is responsible for the sale and distribution of the product.	
Indirect	**Partners**	A seller (from either company) establishes relationship with the POS and captures the order (manually or electronically). Merchandising is executed by the seller/driver.	Products are delivered (jointly) to the store. Merchandising is executed by the seller/driver.

Hybrid	**Hybrid**	Multiple sales schemes are used to manage the relationship with the POS, provide merchandising, as well as to capture the orders.	Multiple distribution schemes are used to deliver products to customers.

A description of other small format stores' distribution network is presented in the paper by Chopra (2003) that analyzes the 7-Eleven's supply chain in Japan. As part of introducing the business model of 7-Eleven Japan Co., the author describes distribution system of this convenience store chain. Products are categorized into frozen foods, chilled foods, room temperature processed foods, and warm foods, and different type of trucks are used for each category of products. The replenishment of all such products from the DCs to the stores is purely bases on the POS data. Suppliers have visibility to this data and use it to plan their production. All products go through 7-Eleven DCs, where 7-Eleven's truck fleet picks them up for store deliveries. Each DC serves a cluster of 50-60 stores. Deliveries are made several times a day, daily, or several times a week depending on sales velocity of a product. This is a good example of a distribution network where the retailer has the bargaining power and uses product consolidation to achieve economies of scale and scope through a controlled distribution network.

Supasansanee and Kasiphongphaisan (2009) present a more detailed description of 7-Eleven's supply chain practices in less developed environments. The authors characterize the retail industry in Thailand as one having poor infrastructure and low supply chain coordination, and analyze the 7-Eleven chain as the largest one in Thailand. They assert that the convenience store (C-store) segment in Thailand has potential to grow, given saturation rates (population served by one store) below USA and Japan. 7-Eleven has built a responsive supply chain in Thailand with the company's seven DCs serving a cluster of stores. Five DCs have chilled storage area where products are stores at a temperature of 4

C^{o}/38 F^{o}. Orders from each store are combined at DCs, using light-directed digital picking. Large case packs are broken down into smaller units at DCs. Stores are replenished up to three times a day. Purchasing is centralized in head office. Each store sends order information to head office, from where order is directed to a DC, and goods are sourced from that DC. Orders from DCs go through the head office, to be sent to suppliers. In case of fresh produce, head office places the orders from stores directly to suppliers without involving DCs. Vendor Managed Inventory (VMI) is used in case of big suppliers. Sales are usually forecasted using a moving average of the previous few weeks sales history. 7-Eleven employs subcontractor to deliver goods from DCs to stores, determining the route by warehouse management system (WMS).

The case study "7-Eleven Stocks Up on Tech Savvy" (2005) gives insights about the store chain operations in the US, where store sales data and data analysis are provided to large suppliers via the 7-Exchange system. This information sharing allows both a better understanding of customer preferences by manufacturers and visibility into store-level inventory so that manufacturers can negotiate with store managers and influence their decision to order particular items.

In summary, we see that FoodCo's SFS distribution network in the case of GloCo and CupCo (with exception of PlaCo) largely contrasts the convenince store practices. With respect to practices in similar retail format in less developed environments such as Latin America, we see that FoodCo's current distribution network follows the model of Indirect Distribution (no exclusive distributor), with current FoodCo's distributors aggregating and delivering products from other manufacturers as well.

3.3 Perishable products distribution

Blackburn and Scudder (2009) provide a useful framework to analyze perishable product distribution. In their paper, a Marginal Value of Time (MVT) model is used to suggest a

supply chain strategy for melons and sweet corn. While distributing perishable products, the MVT deterioriates over time, and the objective is to minimize lost value of these products in the supply chain. Authors suggest a a two-stage combination of a responsive chain from post-harvest to cooling when product deterioration rates are high, and an efficient chain for shipping stage when product value is stabilized once it reaches cold chain. The authors state that if MVT stays stable, one type of distribution strategy (efficient strategy to minimize costs) is appropriate. This matches our conclusion based on Fisher (1997) framework of the appropriateness of the cost-efficient supply chain for FoodCo's frozen products in SFS distribution network.

Bogataj et al (2005) evaluate the performance of the cold chain management (CCM) using net present value (NPV) of the delivered product after subtracting manufacturing, distribution and cooling costs, as well as the deterioration of value. The authors present an input-output model that assesses the impact of changes in transportation or temperature control on the stability of cold chain.

Ahumada & Villalobos (2009) present a tactical planning model for producing and manufacturing fresh agricultural products in Mexico with the objective to maximize revenues. In a mixed integer-programming model, the authors introduce a linear product value decay function on the revenue-maximizing function, also using product value decay as a constraint for product storage in the model. Besides production quantity decision, the model also determines transportation modes taking into account quality deterioration and service level impact. A case study used by the authors to validate the model confirmed that using trucks to transport perishable product is more adequate if compared to rail, because of lead-time requirements.

Bourassa (2006) examines distribution of perishable pharmaceutical products (nuclear medicines) and the choice of transportation to deliver such products with the objective to

minimize distribution costs while balancing factors such as product (radioactive) decay, service level, transportation costs, etc. The product has extremely high decay rates, on average 20% to 30% in one day on average, and delivery times are therefore very short. He concludes that product production and shipping can be re-organized to match the time of demand spikes, whereas for less perishable products (that can be compared to frozen products our thesis focuses on) an existing distribution network of radio pharmacies can be used. This last recommendation of this paper matches the current network of FoodCo who employs the existing distribution network of Distributor 4 or Distributor 1.

Finally, Rau et al (2003) derive an optimal joint total cost in an integrated inventory model for multi-echelon supply chain of a product with deteriorating value, or perishable product. Their model shows that integrated approach to the supply chain results in the lowest total costs (the sum of the order cost, the receiving cost, the holding cost, and the deteriorating cost), which we conclude warrants collaboration in the supply chain in general and in FoodCo's downstream distribution network in particular.

The literature on distribution networks for perishable products drives decision-making using the product value deterioration over time, across a variety of products including fresh crops or radiopharmaceutical drugs. Since frozen products have an extended shelf life when managed in the adequate cold-chain, the proposed methods (e.g., MVT or decay functions) are not directly applicable. Instead, the key decision in FoodCo distribution is the need for a temperature controlled trucks and warehouses. This not only leads to higher distribution costs, which we plan to address in our thesis, but also limits the supply chain partners available.

3.4 Bullwhip effect

Bullwhip effect refers to the amplification of demand volatility as we move upstream to distributors and manufacturers from retailers with relatively steady end-store demand. This

increasing volatility forces the upstream supply chain to carry significantly more safety stock than is required. Amongst the causes of this effect, the most important are the lack of information sharing between the different layers of the supply chain, and the delay in propagating the demand signal to the upstream nodes. The current FoodCo distribution network includes multiple echelons and limited visibility. In this environment, there is a potential for bullwhip effect.

Geary et al. (2006) emphasize that demand amplifications can be as large as 20:1 across the supply chain and cause significant stock-out costs or inventory holding costs depending on whether a demand downturn or upswing occurs. In the end, bullwhip oscillations in supply chains can be the cause of periodicity in the economy in general. This paper describes drivers of the bullwhip effect and presents some good practices. The authors summarize ten supply chain design principles as appeared in the previous literature: control system principle, time compression principle, information transparency principle, echelon elimination principle, synchronization, multiplier principle, demand forecast principle, order batching principle, price fluctuations principle, gaming principle. For the FoodCo distribution network, information transparency and echelon elimination principles are the most relevant and within the scope of this thesis. The authors included a study of 32 trans-European value streams, mostly in the automotive sector, and developed an index of performance ranking companies on their ability to build seamless supply chains and to deal with following unceratinties: process uncertainty, supply uncertainty, demand uncertainty, control uncertainty. Schedule stability is used here to measure bullwhip effect at all levels of supply chain. The authors cite Wikner et al. (1992): "What a ''player'' within the chain needs to know is how his customer orders are constituted. Specifically, knowledge of the ''firm orders from the marketplace'' plus ''buffer store top-ups'' plus ''forecast future demand'' is what is wanted to make an appropriate scheduling decision."

In the next section, we expand the literature review with case studies derived from interviews conducted with experts and practitioners.

4 Case Studies in Small Store Distribution

From the academic literature review, we saw that FoodCo's business problem was unique and not directly addressed by published literature. To supplement our knowledge of the best practices in food and non-food distribution, we also interviewed several former practitioners occupied in supply chain functions regarding the key practices they followed and organized the information into case studies presented in this section. We keep the names of the practitioners and the companies undisclosed on request.

We asked following questions to the practitioners:

1. What is the structure of your supply chain from the company to the end consumer?
2. Who selects the distributors?
3. Who makes the decision on how much to order for end retailers?
4. Who owns transportation and distribution centers across the distribution network?

We interviewed practitioners from the following companies: a food products company in South East Asia, a food products company in Latin America, and a food/non-food products company in South Asia. We chose emerging markets only, as these regions tend to have a higher share of small format retail, such as in Latin American countries researched by Garza-Ramirez (2011).

4.1 Case Study 1: Food products distribution in South East Asia

The first company is a leading CPG company with a global footprint. The company has one factory in a South East Asian country. Products not manufactured in the factory are imported from other regions. A third party logistics company (3PL) handles product distribution to SFS.

The company uses the 3PL firm to move its products from its warehouse to the distributors and other large customer accounts. Distributors send products to retail stores using their own fleet of trucks. In general, the delivery from distributor to retail stores takes one day. The

food products company conducts distributor audits twice a year to check on the actual stock with the distributor and to monitor distributor's operations.

Small and independent stores can order from distributors, or directly from the food products company. The food products company then sends the orders to distributors that deliver to retailers.

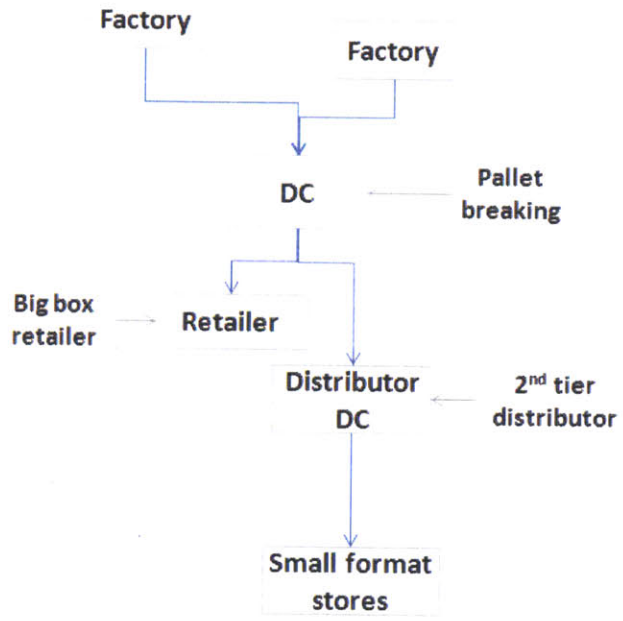

Figure 11: Food products company distribution network in South Asian country

As quantities ordered can be small and reefer trucks are expensive, the food products company contemplated using reefer bikes to deliver frozen products. However, no third party logistics (3PL) company could provide a fleet of reefer bikes for this purpose, and therefore, the company could not implement this initiative.

The company launched a project to use POS sales to recommend order quantities to the distributors. The objective was to better understand the actual demand, synchronize production and reduce inventory in the entire supply chain. The key challenge faced by the company in implementing this project was to convince internal and external stakeholders of the benefits and the right mechanisms of information sharing.

There are two key learning from this case study. First, conducting distributor audits not only gives visibility into inventory levels, but also helps establish closer ties with distributors. This happens as the company become more involved with distributor's operations, and collaborates with the distributors in resolving key operations issues. Second, recommending order quantities to the distributor and providing visibility into demand would shift the manufacturer-distributor relationship to a strategic level, fostering collaboration and coordination. FoodCo should consider providing demand visibility to the channel partners.

4.2 Case Study 2: Food products distribution in Latin America

We now describe operations of a leading food products company with global presence, focusing on a Latin American country. The company's only frozen SKU sold in this country is waffles and consists of four SKUs with different flavors. These SKUs are sold only in supermarkets (a Non-DSD segment as described later in this section). The food products company is a frozen products category leader, and manages the display and shelf space allocation of its own SKUs as well as those of other manufacturers.

The distribution network in the country is divided into two segments, one for Non-DSD customer segment (70-75% of sales) and another for DSD customer segment (30-25% of sales volume).

Figures 11 and 12 show the Non-DSD and DSD customer segmentation structure.

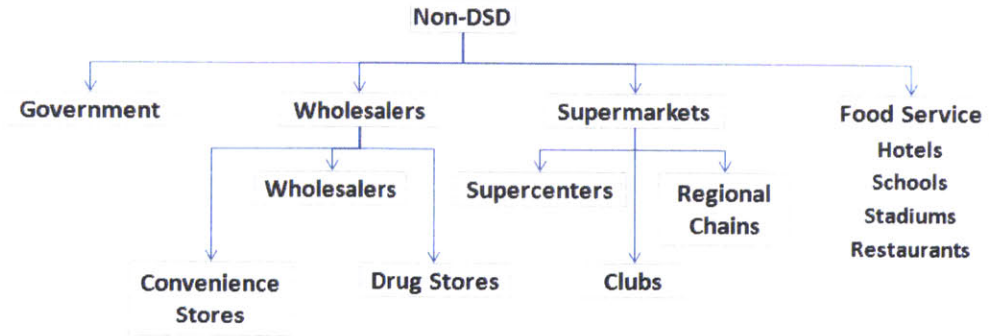

Figure 12: Foods Company's non-DSD customer segmentation

Figure 13: Food Company's DSD customer segmentation

The company has three manufacturing locations in the country, and all of them feed into one Macro Distribution Center (Macro DC).

Non-DSD customers are served from one of the five regional distribution centers (RDCs), with the exception of Key Accounts, which are shipped directly from Macro DC.

The manufacturer controls shelf management and inventory management process at the retail stores in Non-DSD segment through a dedicated replenishment team. It is interesting to note that the replenishers are temporary workers, and are on the payrolls of an external staffing company. Using a flexible labor force allows the company to manage the replenishment process effectively. This practice is made possible by the low labor costs and availability of temporary labor. Although very interesting, this practice may have limited applicability to FoodCo's specific problem as the labor rates in the US are much higher than in the Latin American country.

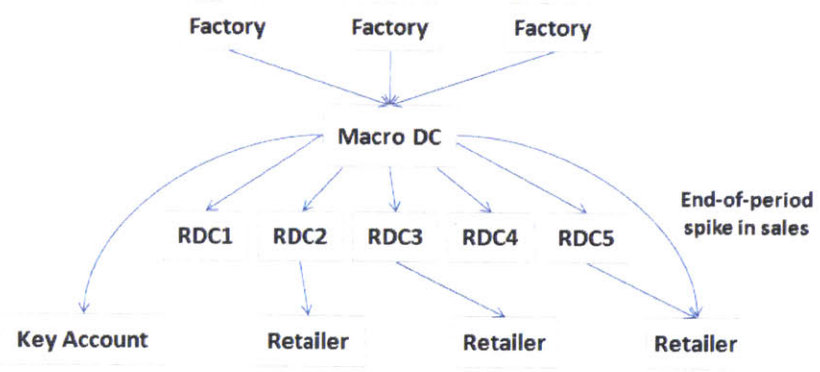

Figure 14: Foods Company non-DSD distribution network

The company has five RDCs, each serving a dedicated region. Each of the regions has 10-15 sales representatives assigned to it. Each sales representative oversees a team of 20-25 replenishers. Generally, every large store has one dedicated replenisher working there full time. In case of smaller stores, one replenisher handles between two and ten stores. Under the sales representative's guidance, the replenishers recommend the orders for a store, which are placed by the retailer.

The DSD customer segment covers small independent convenience stores that wholesalers from Non-DSD segment do not serve. The Macro DC serves about 20 independent regional distribution centers owned by distributors. These distributors break large pallets into cases and serve small independent convenience stores through their fleet of trucks that also serve as mobile warehouses. The distributors own the inventory in their warehouses; however, the company owns some of the trucks that distributors use. These trucks have the distinctive logo of the company painted on them.

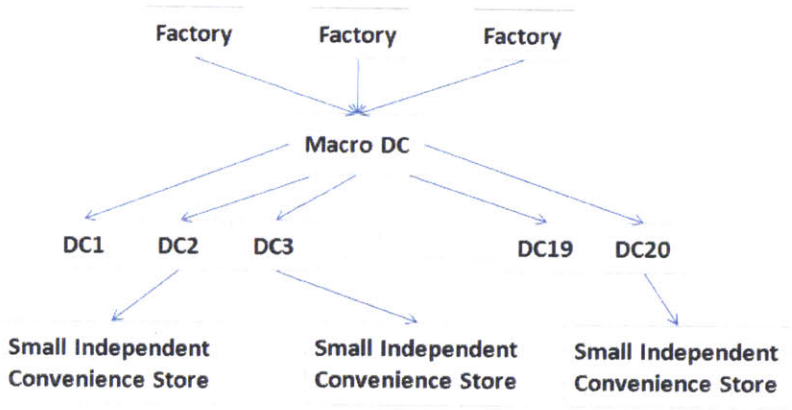

Figure 15: Foods company DSD distribution network

The main learning from this case study is the fact that, in a market with a large number of small format retailers, the manufacturer controls the shelf management and replenishment process, gaining control over the distribution network. However, low labor cost environment is the necessary condition for this network to succeed. The high labor costs in the US therefore, limit the applicability of this learning to the case of FoodCo's SFS channel. We

also see a detailed segmentation of distribution network by multiple retail formats, which is similar to what we observe in the case of FoodCo. This company has more control over the downstream supply chain, compared to retailers in the country.

4.3 Case Study 3: Food and non-food products distribution in South Asia

The firm in this case study is a CPG manufacturer of cigarettes, chips, cookies etc., as well as is engaged in hotel and agriculture business in South Asia. The diagram below shows the general distribution chain.

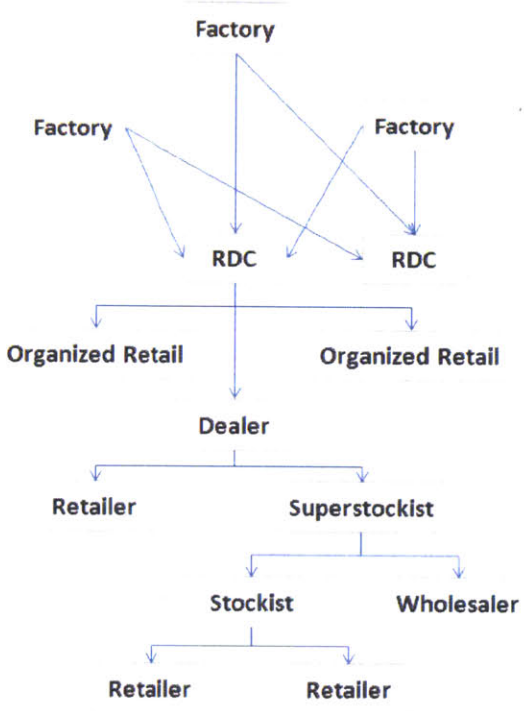

Figure 16: Distribution network of food and non-food products company

A stockist and a superstockist are the terms used to describe a distributor and a redistributor respectively, but on a much smaller scale and are not dedicated to a company. A dealer is usually dedicated to a company whereas the stockist, superstockist and retailer hold SKUs of other companies as well.

The manufacturer manages the distribution network up to the stage of RDC. The RDCs are owned and operated by a third party, but are dedicated to a specific company. The

distribution network is structure in this way because the manufacturer needs to keep presence of its products within the regions, and the manufacturer's ability to do so may be undermined if an RDC is shared with a competitor. Dealers operate within one region in principle, as it is the manufacturer's policy to keep dealerships small and confined within the region, in order to better control them.

In the next diagram, we show the distribution network for slow moving SKUs and comment on it in more detail.

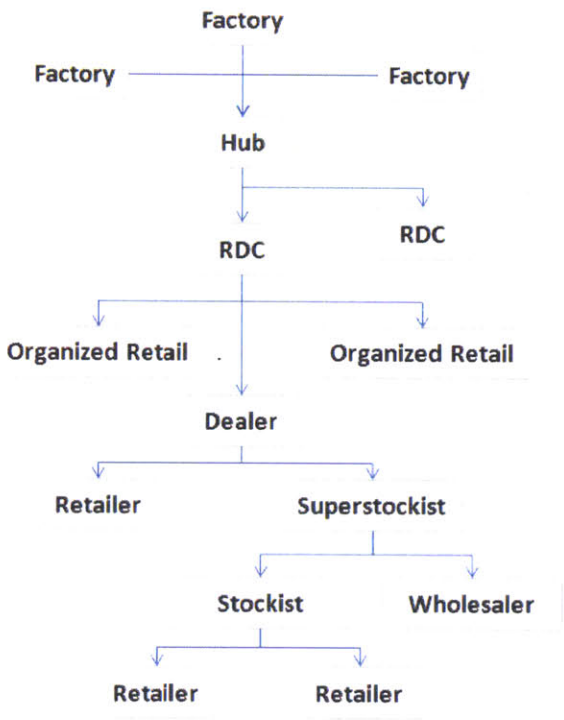

Figure 17: Distribution network for slow-moving products

Slow moving SKUs are transported from factories to a hub where they are consolidated into larger loads and then shipped to regional distribution centers (RDCs). This is in contrast with fast moving SKUs that are directly shipped to RDCs, bypassing the hub.

From RDC, slow moving SKUs are shipped to dealers' warehouses, from where, they are either distributed directly to a retailer, or delivered to a superstockist or a stockist. A

stockist's salesperson will visit about 30 stores a day in the neighborhood, delivering previous orders and collecting new orders. In addition, there is an interesting practice of mailing slow moving SKUs through the postal service from dealers to a stockist. We consider this practice somewhat relevant to FoodCo's SFS channel as both companies deal with the problem of servicing tens of thousands of stores with low sales volumes. However, using the postal service in the US may not be applicable to the SFS distribution network in the US, as postage rates in US are high. The cost becomes even higher when sending frozen products; therefore, we conclude that it is not economically feasible to do it in the case of FoodCo's frozen products distribution to small format retailers.

4.4 Conclusions from Case Studies

None of the case studies described in this section has the exact same channel or product as FoodCo. However, there are important insights on how the profiled case studies deal with servicing a highly fragmented channel as the SFS distribution. Collaboration is viewed as a best practice to influence the supply chain partners. We summarize the main takeaways from the case studies in table 8 below.

Table 8: Summary of distribution practices from case studies

Company & Practice	**Why it works in the Case Study**	**Transferability to FoodCo**	**Reasons for Transferability**
Case Study 1: Food products in South East Asia Manufacturer conducts inventory audits at distributor	• Limited geographic coverage • Helps reconcile distributor's claims • Foster closer ties with distributors	Medium	• Shift from transactional to more strategic relationship with distributors • Increase collaboration with distributors
Case Study 1: Food products in South East Asia Manufacturer	• Proactive stance of the manufacturer to take control of the SC	High	• Use of POS data to achieve cost savings • Challenge: convincing internal teams and

recommends order size & frequency to distributors	• Poor supply chain capabilities of the distributors		distributors of the right mechanisms and benefits of information sharing
Case Study 2: Food products in Latin America Shelf and inventory management done by manufacturer and outsourced to specialized staff	• Retain control on the replenishment • Low labor costs • High availability of temp/low skilled labor	Low	• High labor costs in US • Large distances between stores
Case Study 3: Food and non-food products in South Asia Parcel service for small stores	• Highly scattered demand • Poor infrastructure • Well entrenched postal service	Low	• High postage costs in US • High cost of frozen deliveries (about $20/case)

5 Data Analysis and Results

5.1 Introduction to Data Analysis

To analyze the feasibility of the chosen scenarios that would possibly reduce costs and/or the bullwhip effect, we collected the data on costs and, where the data were not available, made reasonable assumptions with respect to the costs. In addition, we simulated store replenishment patterns. We then calculated the costs for each of the distribution network scenarios and compared those to the costs in the existing distribution network.

We considered the cost of storing inventory and the transportation as the main drivers of the total costs. To calculate the inventory costs, we adopted the following approach:

1. Based on the SKU/week/store wise sales data, we created a time bound DC-to-store replenishment plan. The replenishment plan was created assuming that we needed to keep two weeks of supply in each store and that each store started out by having two weeks of inventory at the beginning of the year. The latter assumption was needed, as we did not have visibility into the store inventory levels.
2. We modeled a zero lead-time (warehouse on wheels concept) and a review period of one week.
3. Weighted average cost of capital was assumed to be at 8%
4. Shrinkage and expiration rate was assumed 5% of the shipments currently in the distribution network.

Fundamentals used in calculating the safety stock (Silver, Pyke, Peterson, 2009):

$$Safety\ Stock = k\sigma_{L+R} \qquad (1)$$

$$Replenishment\ Stock = \frac{DR}{2} \qquad (2)$$

$$In - Transit\ Stock = LD \qquad (3)$$

5.2 *Regional Clusters of Demand*

One of the challenges faced by the SFS channel is the low ordering volumes. In order to explore opportunities to align the supply network with the demand, we tried to identify geographic demand clusters to see if FoodCo can ship directly to key markets or clusters of stores. The combined sales of CupCo and GloCo appear relatively smooth throughout the year as shown below:

Figure 18: Sales profile of CupCo and GloCo

A Pareto analysis of the retailer sales (GloCo and CupCo stores combined) by state showed that 45% of stores contribute to 80% of the total demand. Although there is some concentration of demand, the total number of stores in the top Pareto volume is still large (5000+ store locations); therefore, we could not identify any clear pockets of demand. Moreover, no single store contributes to more than 0.09% of demand.

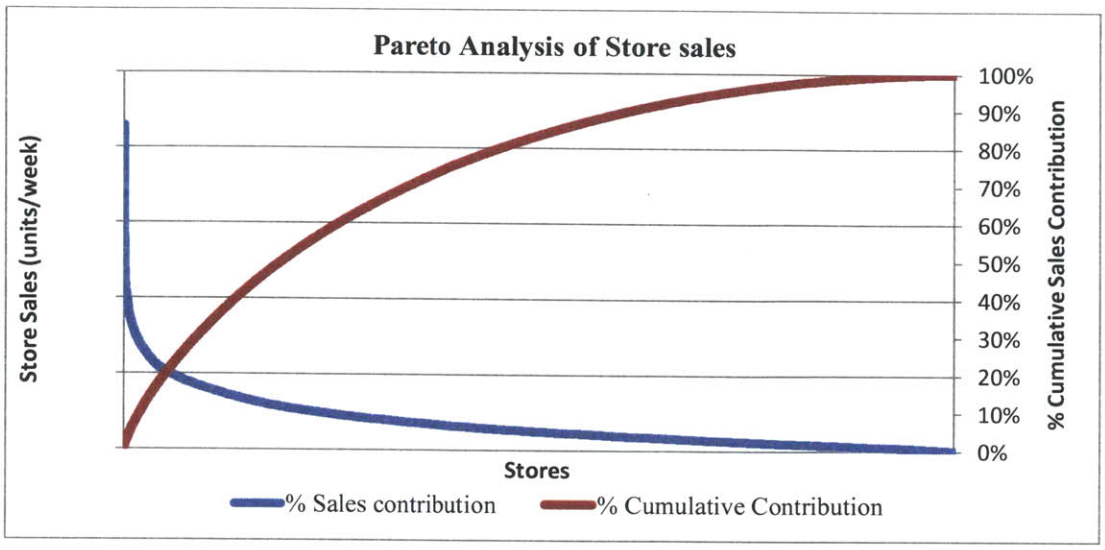

Figure 19: Pareto analysis of store sales

Given the national footprint, we analyzed store sales by state. The same Pareto analysis done by store sales by state reveals that 17 states contribute to about 80% of the CupCo and GloCo sales.

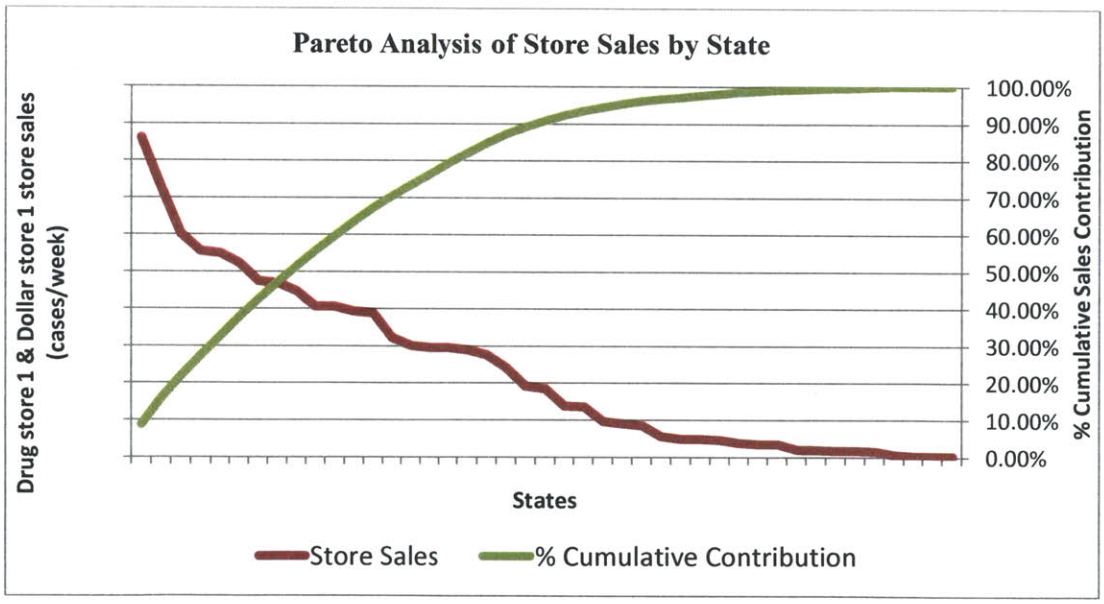

Figure 20: Pareto analysis of store sales by state

Figures 21 and 22 show the breakdown of low and high volume store[13] by state. We notice that there is no state with significantly large share of high-volume stores that would make a state-level Direct-Store-Delivery economically feasible.

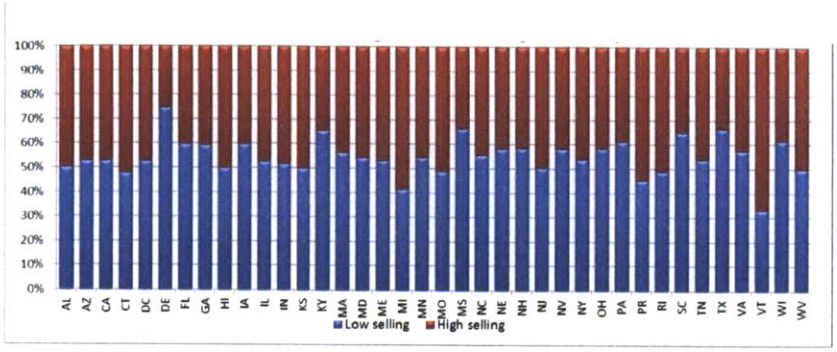

Figure 21: Dispersion of CupCo store sales across different states

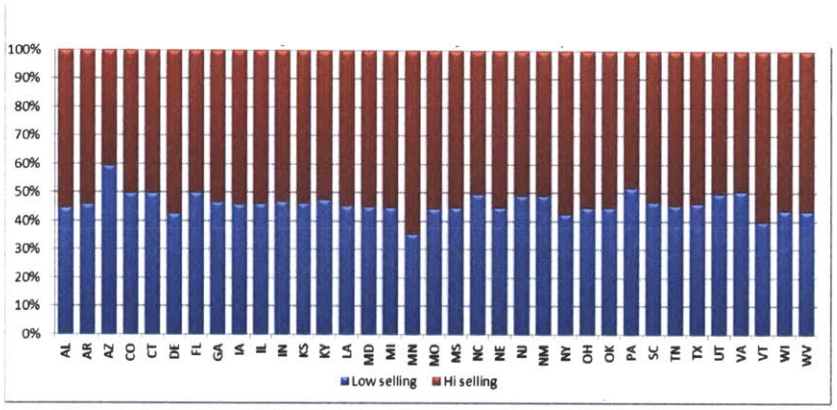

Figure 22: Dispersion of GloCo store sales across different states

The logistics team at FoodCo had created a model[14] to calculate the cost of Direct-Store-Delivery (DSD) network. From the DSD model, the minimum volume required for DSD to be economically feasible would be much higher than the current volumes. Thus, we conclude that DSD to stores or a group of stores is not economically feasible.

5.2.1 Conclusion

FoodCo's store sales are geographically scattered with no concentrated pockets of demand. Direct store shipments are not feasible at current volumes.

[13] High volume stores are the ones that contribute to 80% of the sales
[14] Source: FoodCo Internal Documents

5.3 *Bullwhip Effect Analysis*

As described in Section 3.4, the increased variability created by lack of visibility and extra echelons in the supply chain, translates into higher levels of safety stock across the supply chain. In this section, we will quantify the bullwhip effect in FoodCo SFS distribution network.

We analyzed the store sales by calculating their coefficients of variation (CV) and contrasted them with the CV of orders that the distributors placed with FoodCo. Figure 23 shows our findings:

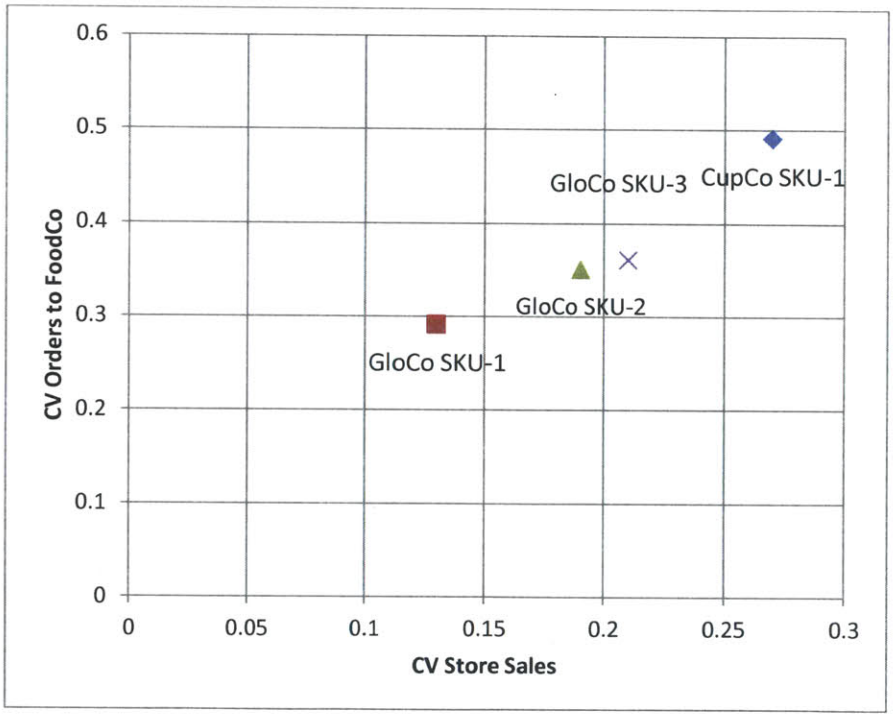

Figure 23: CV of store sales v/s CV of orders to FoodCo

A higher CV denotes higher volatility. CupCo shows higher volatility than GloCo. This is consistent with the fact that the distribution network has additional echelons. However, across both retailers, distributor's orders are more volatile than the store sales. As described in Section 3.4, this is caused by the lack of demand visibility of store demand. To estimate whether visibility of store sales can help FoodCo reduce the volatility of orders, we created

simulation model of orders flowing from the stores to FoodCo with the following assumptions:

- Order policy (R, S): order up to S every period R=1 (weekly replenishment)
- Lead time from distributor to store = 0 (instant replenishment once the review is done)
- All stores start with beginning inventory to suffice 3 weeks of demand
- Stores aim to keep an inventory that will suffice next 2 weeks of demand
- Future demand is accurately known (this gives us the boundary condition, or the maximum amount of savings possible)

The table below shows the basic methodology of simulating store orders:

	week 1	week 2	week 3	week 4	week 5	...	week n
BOH Inv	65	45	52	42	45		0
Demand	20	20	25	27	15		23
Replenishment	0	27	15	30	40		30
EOH Inv	45	52	42	45	70		7

1. We collated the store/week sales for GloCo and CupCo
2. We assumed that at the beginning of the simulation, every store starts with 3 weeks of inventory
3. The replenishment for every week is calculated so that the ending on hand inventory suffices the next two weeks of demand.
4. This calculation is repeated for every week and store.

The table 9 below summarizes our simulation results:

Table 9: Comparison of actual volatility with simulated volatility

	Volatility of Store Sales	Volatility of Orders to FoodCo	Volatility of Simulated Orders
CupCo SKU-2	0.27	0.49	0.28
GloCo SKU-2	0.13	0.29	0.11
GloCo SKU-1	0.19	0.35	0.18
GloCo SKU-3	0.21	0.36	0.22

Across every SKU, we can see that the volatility in the simulated case was lower than the actual volatility. Although, the simulation model assumed perfect forecast capabilities and that all information was shared with FoodCo, it still provides us with the minimum value of the volatility (i.e. best-case scenario). Our analysis of retail store sales and distributor/redistributor orders of the three SKUs clearly identified a bullwhip effect. Figures 24, 25, and 26 compare the store sales with simulated orders and the actual orders. In summary, the store sales are relatively smooth and predictable whereas the orders placed to FoodCo are significantly more volatile.

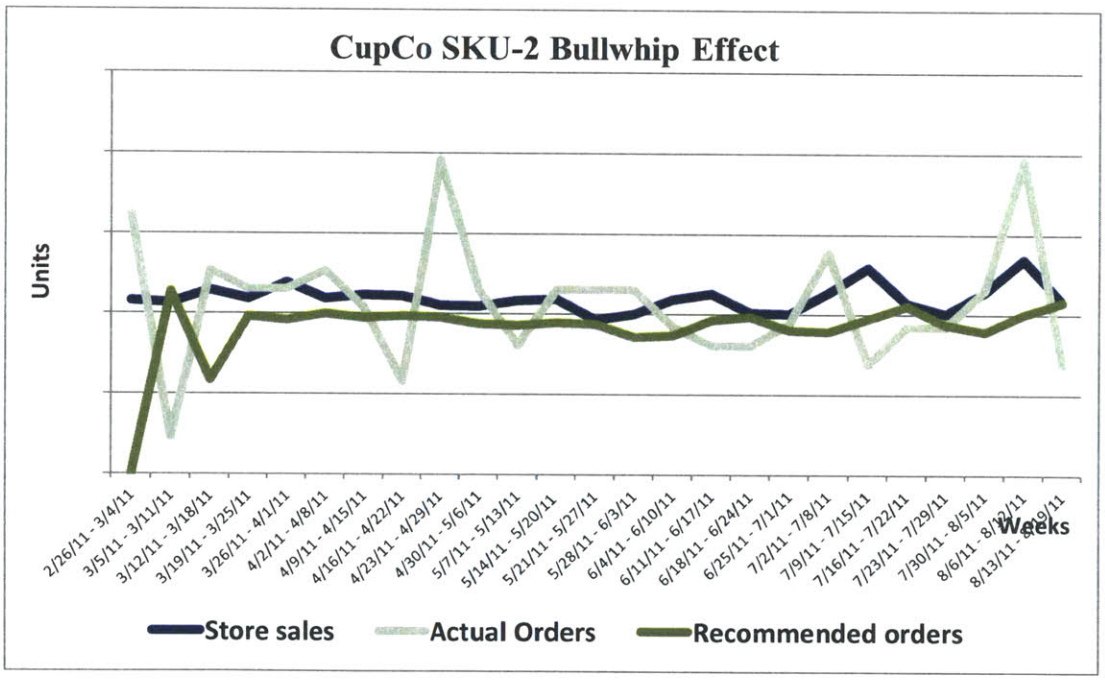

Figure 24: CupCo SKU-2 bullwhip effect

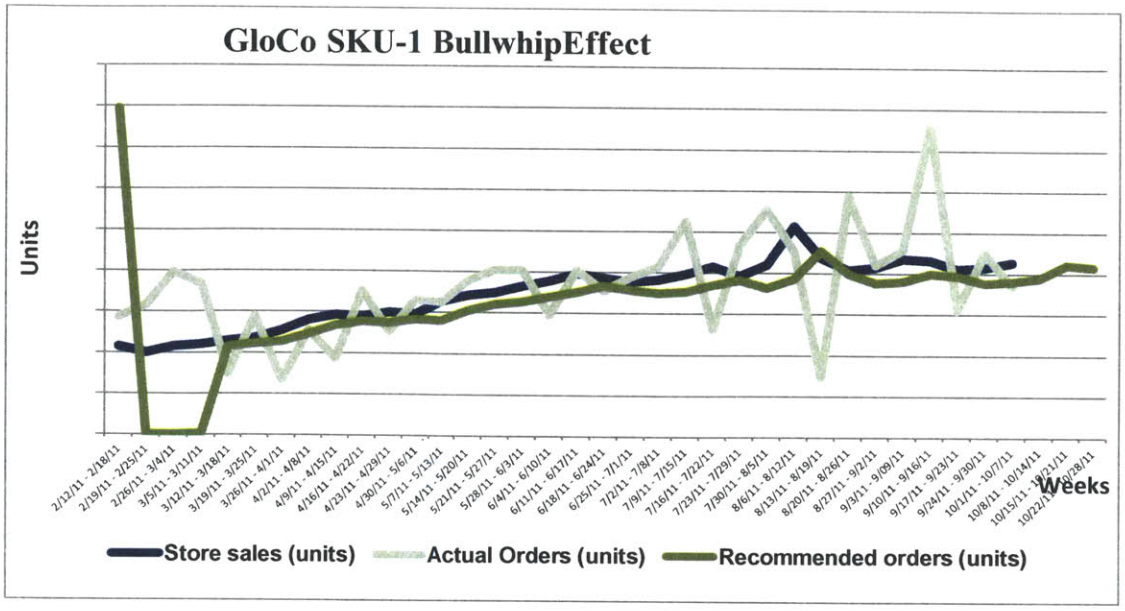

Figure 25: GloCo SKU-1 bullwhip effect

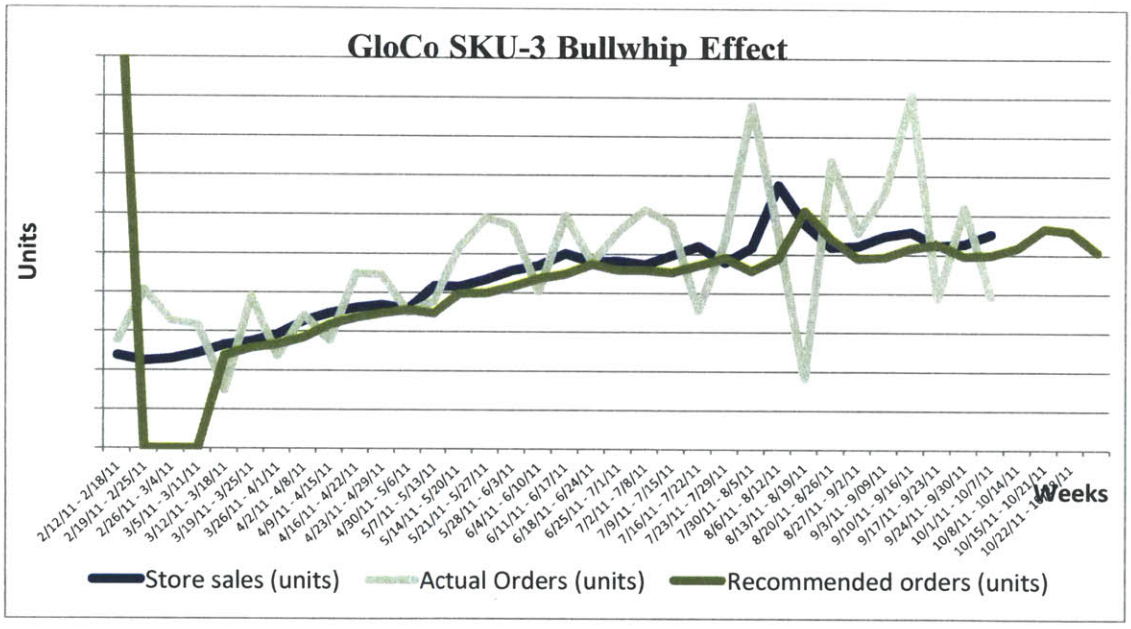

Figure 26: GloCo SKU-3 bullwhip effect

We attribute the differences in the range between GloCo and CupCo to more layers of distribution in the case of CupCo (redistributor, distributor and retail stores), which increases the bullwhip effect.

To quantify the benefits of perfect information sharing, we attempted to answer the following questions –

- How much inventory would FoodCo save?
- How much inventory would the distributor save?
- How much can FoodCo and the distributor save through reduced shrinkage?

The savings calculated for FoodCo were the total of the value created by inventory reduction and the reduction in shrinkage. Section 5.1 contains the assumptions we have used in our calculations of savings. The detailed calculations of the cost savings have been withheld on request.

The results show that FoodCo has potential to reduce the channel inventory and operating costs.

5.3.1 Conclusion

Lack of visibility into the store sales and channel inventory creates a bullwhip effect for FoodCo. If FoodCo were to have this visibility, it can save on inventory and shrinkage costs.

5.4 Distributor's Cost Model

Data provided by FoodCo showed that distributors were charging premiums for services beyond the basic transportation. Such shelf management services, include replenishing the shelf, ensuring proper product placement on the shelf, and managing unsalaeables. To determine if these premiums may be reduced, we developed a Distributor Cost Model. FoodCo had conducted a study of the costs of a direct store delivery (DSD) costing model in 2010 with internal as well as external inputs. While the DSD costing model delved into the details of the transportation costs, we were interested in per case cost of transportation. Our model builds upon the DSD costing model that FoodCo had developed internally. The DSD costing model was updated to get a cost number that resembles what the distributor would have spent to transport FoodCo's products to the stores. It is important to note that the DSD

costing model does not consider the inventory costs, warehousing costs or the gross margin requirements of the distributor. The distributor's transportation costs and estimated shelf management costs with the markups charged by distributors to FoodCo. The shelf management premium was estimated using the following assumptions:

1. The distributor serves about 12 stores per day when they do not need to service the shelf. However, shelf management requires additional time and hence the distributors can serve only 8 stores per day.
2. A distributor that services the shelf would charge an additional markup over the one who does not service the shelf. We concluded this based on the markup charged by Distributor 1 and Distributor 3 and compared it with the markup charged by Distributor 2.

Using different assumptions of stores served per day with and without shelf management and using the transportation cost model developed by FoodCo, we estimated the distributor's cost for shelf management:

Table 10: Shelf management premium calculations

Shelf Management?	# Stores Served/Day	Transportation Cost/Case
Yes	8	A
No	12	B
Shelf Management Premium		**C=A-B**

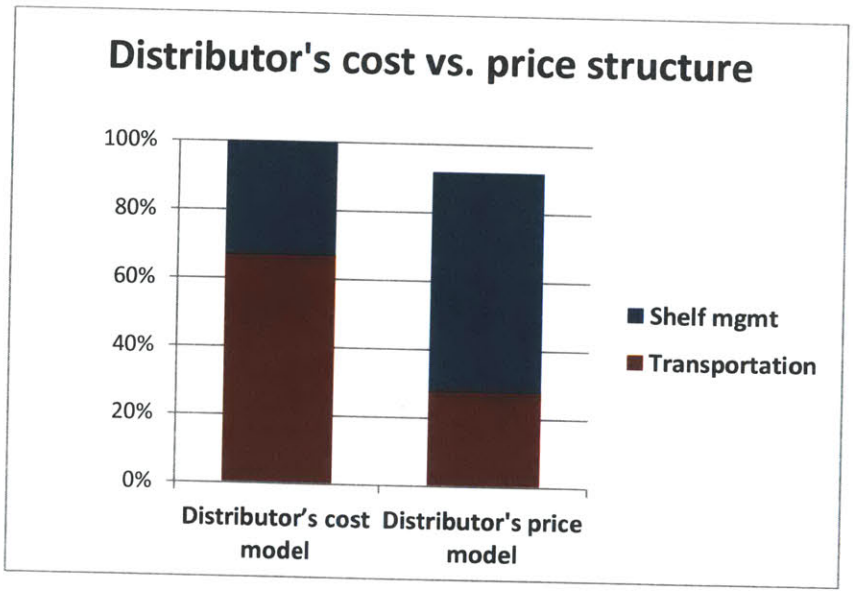

Figure 27: Distributor's cost and premium structure

Figure 27 summarizes the cost and price of basic services and shelf management.

- Based on the distributor's model, we conclude that the shelf management premium that FoodCo pays to the distributor is not proportional to the actual cost of shelf management.
- The distributors are covering the losses on the basic services with the shelf management premium charged to FoodCo.

During our discussions with FoodCo officials, we understand that distributors make low margins. This is consistent with the distributor's cost model that shows that the distributors may be making an operating loss on SKU-2. While the SKU-2 financials may not be representative of the distributor's overall margins, it does provide an important insight that the price of a service may be different from the actual cost of it.

There are two main cost drivers in the distributor cost model:

1. Number of stores we assumed a driver is able to serve in one day
2. FoodCo's share of volume that a distributor is handling in small format stores

The graphs below show the sensitivity of the distributor's costs to these assumptions:

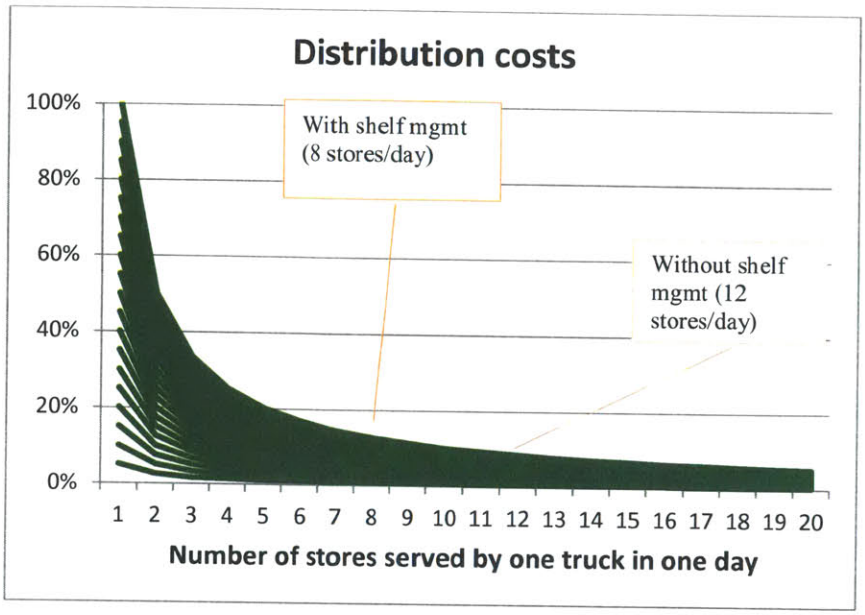

Figure 28: Distribution costs as a function of number of stores served

Figure 28 shows the distributor's costs as a function of the number of stores served by a truck in a day. The different lines represent scenarios with different assumptions of FoodCo's share of distributor's volume. Figure 28 shows that more the number of stores served in a day, less the total costs as fixed costs of the truck are allocated to a larger number of stores. Figure 28 implies that the distributor can break even by serving additional stores in a day.

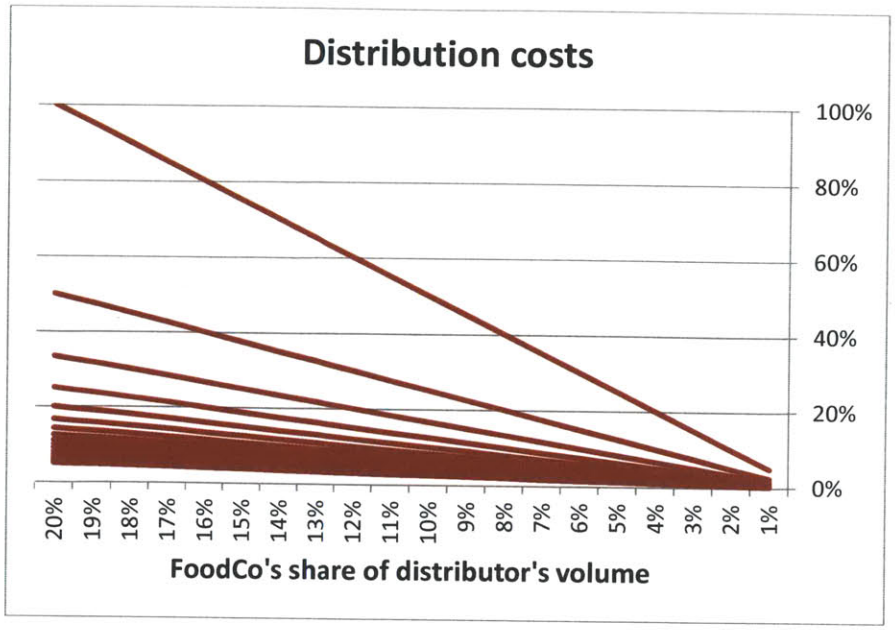

Figure 29: Distribution costs as a function of FoodCo's share of distributor's volume

The assumption of FoodCo's share of the distributor's business directly affects the percentage of costs allocated to FoodCo. The distributor would consolidate shipments from multiple manufacturers and FoodCo would need to pay only a fraction of the total costs in proportion to its shipments. Figure 29 depicts the relation between the distribution costs and FoodCo's share of the distributor's volumes. The different lines in the chart represent different scenarios, each with a different assumption of the number of stores served per day.

5.4.1 Conclusion

Based on the distributor cost model, FoodCo's distributors may have a pricing model that is not proportional to the underlying costs. Distributors may charge higher for the basic services if they do not get the shelf management premiums. FoodCo could use the model in future discussions with retailers to discuss supply chain opportunity areas.

5.5 Conclusions from the Data Analysis

Based on sections 5.2 through 5.4, we conclude that FoodCo sees a high degree of volatility in the orders placed by its channel partners. This is due to the volatility of the store sales and the lack of information sharing between the supply chain teams of FoodCo and its channel

partners. In addition, the store sales volumes are low and lack of any geographic concentration, making direct store deliveries financially unfeasible. In addition, the cost structure of the distributors providing full shelf service is not proportional to the margins charged to FoodCo.

6 Recommendations

This section outlines our recommendations based on the analysis presented in Section 5 and the case studies provided in Section 4.

6.1 Leveraging collaboration

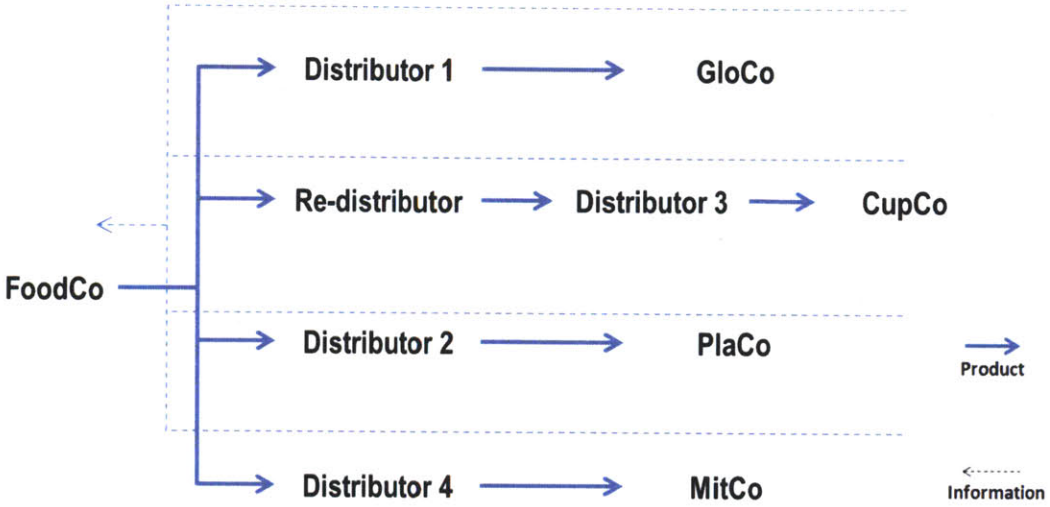

Figure 30: Information and product flow in the distribution network

Our analysis of the bullwhip effect clearly showed the impact of the volatility of the demand as it propagated through the distribution chain (see Section 5.3). Based on the interviews with key FoodCo executives, there is almost no information shared between the supply chain teams of FoodCo and the distributors. Our interviews with a key redistributor also unveiled the fact that any forward visibility into the demand will help them immensely in scheduling labor and assets. Further, FoodCo's supply chain team is not involved in regular calls with the retailer – only the sales team is.

As illustrated by Case Study 1 (Section 4.1), there was significant value in collaboration with distributors serving SFS. We recommend FoodCo share information with its channel partners. The information that can be shared includes tactical and operational data such as:

- Rolling demand plan
- Merchandise plans

- New product introduction plans
- Desired store roll-out plans or planograms

FoodCo can collect information from the distributors and retailers including:

- Master data such as store and DC locations
- Temporary DC capacity constraints that may impact store replenishment
- Product feedback from store managers and end consumers

In addition, over the long term, FoodCo can involve the retailers in key decisions such as product design, pricing, promotions and merchandizing. Since this is an expensive and long-term process, it could be rolled out in multiple phases as shown in Figure 31 below:

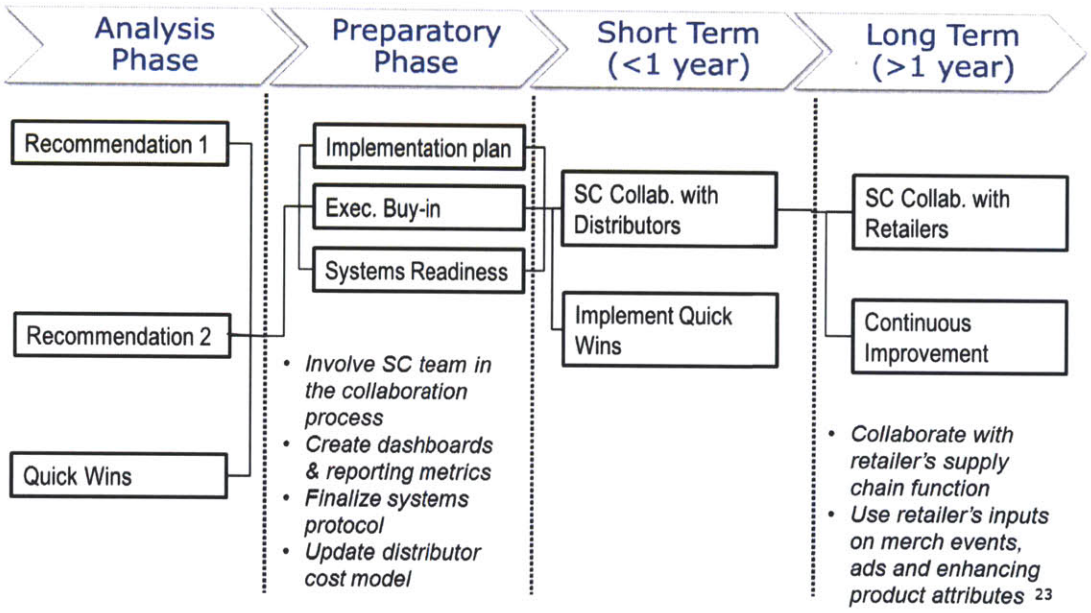

Figure 31: Proposed implementation plan of collaboration

Below, we identify quick wins and the long-term recommendations.

1. In the preparatory phase, FoodCo involves the extended team consisting of Supply Chain, Sales and Finance teams in creating a detailed implementation plan with specific milestones. This phase also marks the creation of detailed dashboards and

metrics to monitor the performance of the stakeholders. In addition, FoodCo should update the DSD model with the latest inputs to update the quantifications of the benefits. Having approval and absolute support of the key leadership at FoodCo as well as the channel partners is a must and FoodCo could use this time for creating the awareness and getting commitment to long term plans both, internally as well as externally.

2. FoodCo can begin by collaborating with the distributors. Getting closer to the distributors will help FoodCo get a good hold of the business. This can be a good foundation to collaborating with the retailers. Collaboration here refers to, but is not limited to the following:
    a. Getting on a regular monthly call with the distributors
    b. Sharing forward looking forecasts by SKU/location/week
    c. Sharing promo and merchandize plans
    d. Involving distributors in logistics decisions of new product launches
    e. Measuring the distributors for their performance
    f. Soliciting feedback from the distributors for specific improvement opportunities
3. After gaining experience of collaborating with the distributors, the supply chain teams of FoodCo can then start collaborating with the retailers. Key points to be discussed in every collaboration meeting could include:
    a. Forward looking demand plan
    b. Promo/merchandize plans
    c. New product launches
    d. Discussion on metrics of performance
    e. Customer feedback about existing products

6.2 *Achieving Volume Scales*

From section 2.1, we see that it is a common practice for manufacturers to consolidate shipments through distributors to achieve lower transportation costs. We recommend the use of a central redistributor to consolidate shipments and provide volume scales that can reduce transportation costs. In addition, this central redistributor can also hold the inventory, relieving FoodCo of its inventory holding costs. The figure 31 shows the proposed network configuration.

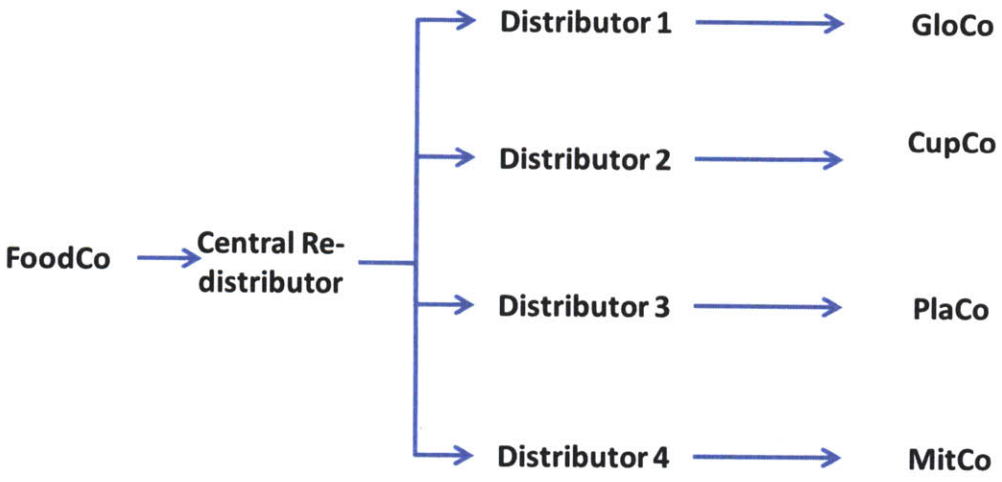

Figure 32: Proposed distribution network with central re-distributor

FoodCo stands to reduce the inventory of the finished goods on its books and gets to save on warehousing costs. There are few things to consider in this model, however:

1. The consolidation adds a layer to the distribution network. This has the potential of aggravating the bullwhip effect, if information is not shared efficiently.
2. To ensure that the redistributor breaks even, FoodCo needs to take a holistic perspective of the margins of all the channel partners.
3. FoodCo could start out implementing consolidation for the channels that have low volumes.

4. Once the volume of business increases, FoodCo should revisit this consolidation strategy. At a critical mass, the SFS channel may create enough volumes by itself if it shows strong growth in future.

6.3 Using distributors for basic services

The distributors cost model suggests that distributors may be charging higher premiums for full service compared to the estimated costs. The distributors make relatively low margins and removing shelf management premium may increase their per unit distribution cost. Still, there are benefits of using distributors for basic services:

1. Collaborating with the retailers and leveraging POS sales information for an integrated demand planning may enable FoodCo to prescribe store wise replenishments for each SKU every week. This may enable FoodCo to use the distributor only for the basic services of dropping the case to the backroom of the store.
2. Considering the average sales volumes, we would recommend creating a smaller case pack. This will allow FoodCo to replenish the store without overloading it with inventory. A typical store sells only a portion of a 12-units case and reducing the case pack size to 6 units per case would not add to the replenishments made to the store.
3. The retailer also stands to gain from doing shelf management itself, as the savings would be shared between FoodCo and the retailer. While the store employees may not spend a lot of time in managing the shelf, the retailer would need to invest in backroom infrastructure and spend some time and resources in training the store employees on shelf management. In addition, it is unclear whether shelf management would require specialized and more expensive labor.
4. Collaboration and information sharing would benefit the distributors by reducing their inventory, transportation costs and their operating costs, in general.

7 Conclusions and recommended future research

Our thesis focused on evaluating design options for the distribution network of frozen products from FoodCo to the small format store (SFS) channel. Currently, this channel is serviced through distributors and a redistributor. This structure creates multiple challenges such as bullwhip effect and high shelf management premiums. These issues become all the more critical since the SFS channel is expected to grow.

By analyzing historic SFS data and by developing analytical models, we identified three important characteristics: lack of geographic demand concentration, bullwhip effect due to channel intermediation and a mismatch between calculated Full Service costs and distributor's premiums charged for shelf management. We estimated potential savings from using a central redistributor and from collaboration and improved information flow.

Due to the low sales volume and store fragmentation, we have concluded that a direct DSD model is not viable. Instead, we propose that FoodCo improve the current distribution network by achieving scale and employing one central redistributor, enhancing collaboration with distribution partners and retailers and improving information flow. We observed these practices in a series of case studies in other SFS environments.

During the course of our research and from interviews with supply chain experts, we realized that there are other aspects worth evaluating as FoodCo increases the overall business with the SFS channel. Figure 33 shows a broader set of activities FoodCo should consider as part of their strategic view of the SFS channel.

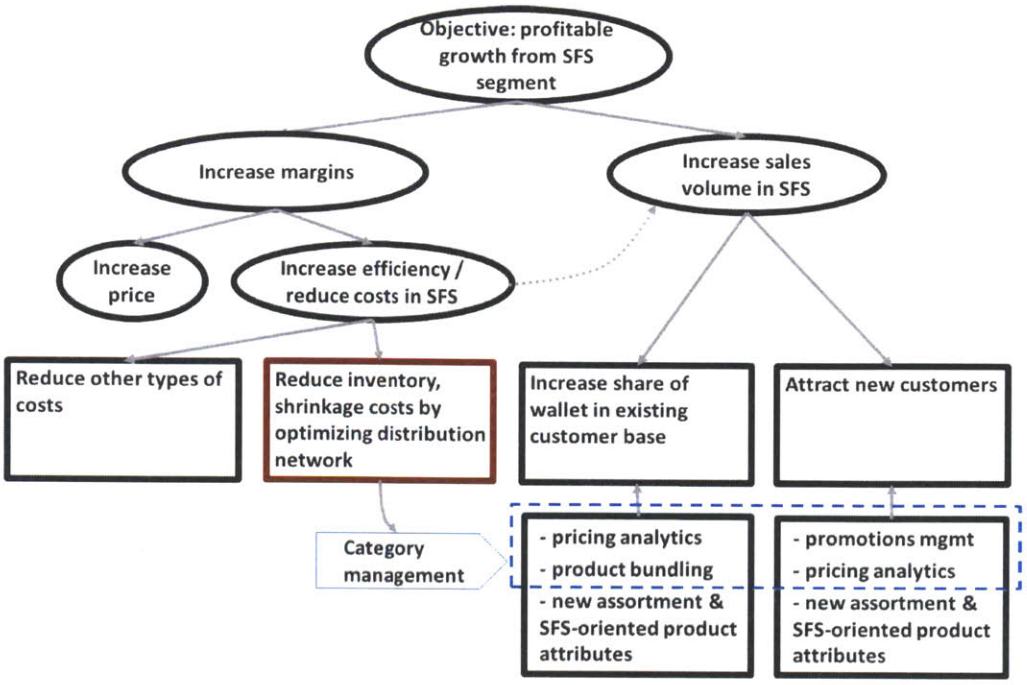

Figure 33: Holistic thought process to SFS management. Thesis scope highlighted in red

We start with the overall objective of profitable growth for both the retailer and the manufacturer. This can be done through better manufacturer's and retailer's margins or through more sales.

- FoodCo's margins can be increased through increasing selling prices to distributors or a redistributor, or by making the supply chain more cost-efficient
    - FoodCo's Prices to distributors or a redistributor – Currently decided by the Marketing team
    - Efficiency – this is the focus of our thesis project
- Increasing sales volumes was an issue that was highlighted during various interviews with FoodCo executives and partners. The low sales volumes lead to high per unit distribution costs and make the distributors very important. Higher sales volumes would allow distributor and retailer to take advantage of supply chain efficiency and volume-based pricing programs and explore the option of shipping directly to the stores. This increase in sales can be brought about by following ways:

- Attracting new customers, increasing the market size and boundaries. We believe that this can influenced by tactical promotions aimed at first time or non-users of the products.
- Increasing the share of wallet of existing customers. One way to achieve it is to have improved product bundling (such as, buy 2 & get 1 free), to make the product more economical to the regular buyers, allowing SFS retailers to have pricing more competitive with larger retailers.
- Pricing analytics and having SFS specific product attributes such as smaller case pack size or special variants are other ways that FoodCo could look into improving SFS sales.

Almost all of the above recommendations are aimed at the Marketing team that handles product pricing and the Category Management team that is responsible for promotions and product bundling. A collaborative planning and replenishment initiative with the retailers would help FoodCo reduce inventory, increase shelf availability and consequently, the share of wallet of the end consumer. A central distributor would provide volume scales and also make it easier to plan for and implement merchandise events. Feedback from the channel partners would be helpful in enhancing the product attributes.

We conclude that following our recommendations would enhance the efforts of the Category Management function and lead to increase of the overall sales volume in small format store (SFS) channel.

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Interview 3 with Expert/Former Industry Practitioner (2012) from a food products company in South Asia

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