On Shelf Availability: An Examination of the Extent, the Causes, and the Efforts to Address Retail Out-of-Stocks

Daniel Corsten[1] and Thomas Gruen[2]

[1]Kuehne-Institute for Logistics, University St. Gallen, Switzerland, Unterstrasse 16, CH-9000 St. Gallen, phone +41.71.2282430 (direct: 441) fax: 455, www.klog.unisg.ch, e-mail: daniel.corsten@unisg.ch

[2]Assistant Professor of Marketing, University of Colorado, Colorado Springs, 1420 Austin Bluffs Parkway, P.O. Box 7150, Colorado Springs, CO 80933-7150 USA, Phone: 719-262-3335, FAX: 719-262-3494, www.uccs.edu/tgruen, e-mail: tgruen@uccs.edu

1 Introduction

Several trade associations such as the Grocery Manufacturers of America and the Food Marketing Institute, and joint trade-industry bodies such as ECR Europe or ECR Asia have sponsored and/or released major reports on out-of-stocks (OOS) in the past few years (see, e.g., ECR Australasia/PWC 2001; GMA 2002; ECR Europe 2003). All of this attention to OOS points to one thing: availability of products to the customer is the new battleground in the fast-moving-consumer-goods (FMCG) industry. Moreover, our research shows that 75 percent of the responsibility for OOS rests at the store level, but our research also found that improved availability will be found through retailers and suppliers working together.

In an era where retail competition is so fierce than ever, retailers continue to search for ways to enhance performance. In our view, retailers are not spending enough attention to examining their own shelves, where according to our research retailers can boost earnings per share up to five percent by addressing their OOS issues. After all, where else can a retailer find so much potential revenue without spending to attract new customers? In the pages that follow, we summarize and elaborate on the findings of our OOS research project (Gruen, Corsten and Bharadwaj 2002; described in Appendix 1).

2 What Is the Extent of Shelf Out-of-Stocks?

The average worldwide out-of-stock rate we found was 8.3 percent, as is shown in Figure 1 (see Appendix 2 for discussion of what makes up an OOS). The average of the reported highs in the studies was 12.3 percent, and the average of the lows was 4.9 percent. This is similar to, the primary USA benchmark of 8.2 percent that was reported in the 1996 Coca-Cola Research Council. Our finding also falls within the range of two other recent studies. A 2002 GMA study on direct-store-delivery in the USA reported an out-of-stock rate of 7.4% with categories ranging from 3.2% to 11.2%. ECR Europe's 2003 on-shelf-availability study reported an out-of-stock rate of 7-10% with categories ranging from 5% for canned food to 18% for fresh meals and even 32% for ladies stockings. Keep in mind that the studies used slightly different measurement methods, different people, measured different categories, and examined different durations and different daily and weekly factors. All of these can affect the measurement of out-of-stock rates. Regardless of the method, when all factors are considered together, the averages regress to an uncanny similarity. This provides a sense that the findings are reliable in the aggregate.

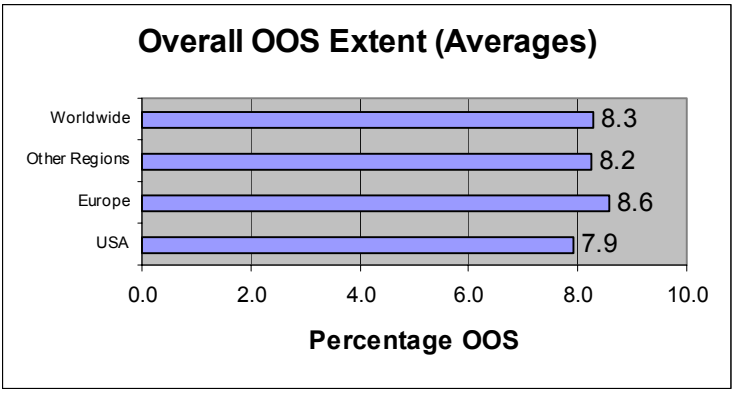

Fig. 1: Composite OOS Averages

When we split Europe into its northern and western region (Norway, Denmark, Sweden, France, Belgium, Netherlands, Germany, Switzerland, Austria, United Kingdom, Finland) and into its southern and eastern region (Portugal, Spain, Greece, Poland, Hungary, Czech Republic, Slovakia), we found that countries within each of these two areas showed similarities in OOS rates, but differences between the two regions were substantial. Northwest Europe showed the lowest OOS rates of any region in the

world, while Southeast Europe showed the highest. OOS rates in "other regions" (South America and Asia) were lower on average although details varied.

We found several factors to affect OOS rates that were consistent across geographies. First, for promotional effects, our research consistently found OOS rates to be higher on promoted items than on non-promoted items. In some cases, the differences are minor, but in most the difference is substantial – even though promoted items should be receiving retail store managers' attention. While the differences vary among studies, in general, we found a 2:1 ratio of promoted vs. non-promoted OOS rates. Second, OOS rates varied by day of the week with Sunday and Monday having the highest levels, and levels decreasing throughout the week. This pattern makes sense when one considers that shopping will be highest on weekends, while retailer ordering and delivery to stores does not occur until Monday and Tuesday.

3 What Are the Consumer Reactions to Shelf Out-of-Stocks?

We also looked at a worldwide study of more than 71,000 consumers that was conducted in a series of 29 studies across 20 countries across a variety of FMCG categories. The results of this analysis are presented in Figure 2. Academic research has identified and categorized up to 15 possible consumer responses to an OOS, though typically, managerial researchers measure five primary responses (see, e.g., Campo et al. 2000; Emmelhainz et al. 1991; Fitzsimons 2000; Progressive Grocer 1968; Schary and Christopher 1979). All five responses result in direct and/or indirect losses to both retailers and manufacturers. These are: (1) buy item at another store (store switch), (2) delay purchase (buy later at the same store), (3) substitute-same brand (for a different size or type), (4) substitute-different brand (brand switch), 5. do not purchase the item (lost sale).

In the aggregate, delay of purchase and not purchasing at all are reasonably similar worldwide. The major overall difference between USA and European consumers is the lower willingness of USA consumers to switch brands. European consumers are almost 50% more likely to switch to a competing brand when faced with an OOS on the desired item (see Figure 3). Alternatively, USA consumers are more likely to substitute a different package size or variation within their preferred brand. Thus, in the aggregate, USA consumers act in a more brand loyal manner than do

consumers outside the USA. Store switching is greatest outside the USA and Europe. Europeans are the least likely to switch stores due to OOS.

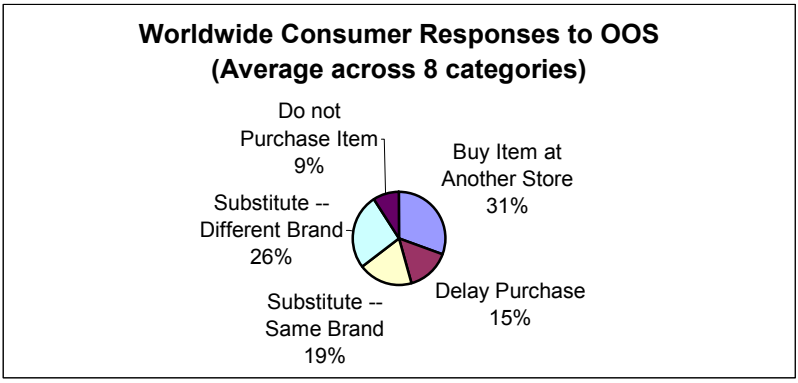

Fig. 2: Composite worldwide consumer responses

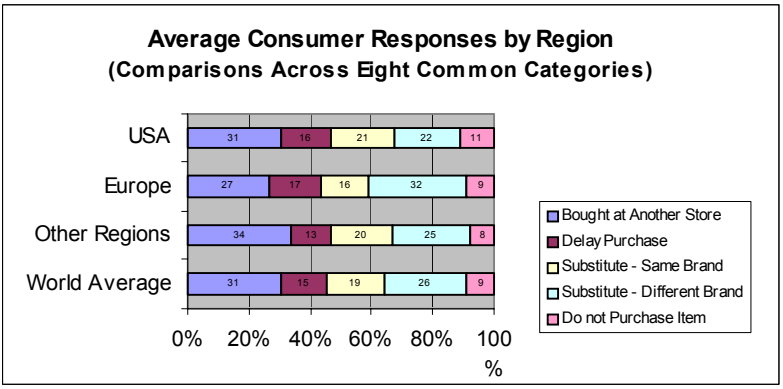

Fig. 3: Composite consumer responses by region

Consumer Responses vary considerably by category. Figure 4 shows the worldwide average for several of the categories examined in the study. Several factors affect the consumer response to OOS items. Traditionally, these have been categorized based on the nature of the category, type of product, type of consumer, the immediacy of need, and the general brand loyalty. However, all of these factors interact, making it difficult to develop a generalized scheme to help determine the likelihood of a consumer's reaction.

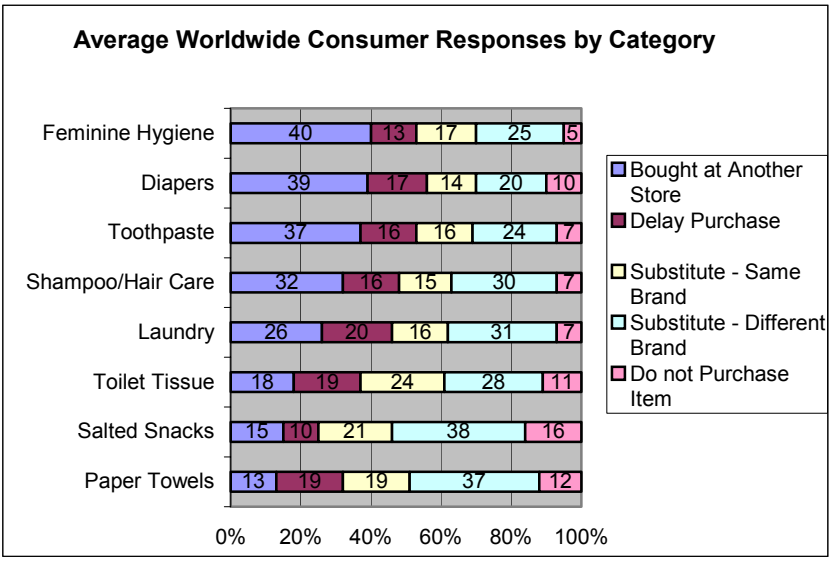

Fig. 4: Consumer responses by category

To present a generalized approach, we found that there are three primary drivers that interact and cause the consumer to take one action over another. Using economic theory, Campo et al. (2000) present the opportunity cost of not being able to consume the product immediately, the substitution cost of decreased utility of a less preferred alternative, and the transaction cost of the time and effort required to obtain the preferred item. When the opportunity cost of not being able to immediately consume the product is high (for example when one runs out of diapers), the consumer will either substitute or find the item at another store. Alternatively, a low opportunity cost will lead to either purchase delay or cancellation. When the substitution cost of using a less preferred brand is high (for example in the case of feminine hygiene and laundry), the consumer will take any action except to substitute another brand. When the transaction cost is high in terms of the time and effort required to purchase later or elsewhere, the consumer will either substitute or cancel purchase. This perspective explains why consumers tend to switch more in some categories than others. For example, we found that feminine hygiene has low substitution, since these are very personal products and there is a high substitution cost. However, when the brand is less personal e.g., paper towels, more substitution between brands may occur.

4 What Is the Cost of Shelf Out-of-Stocks to the Retailer?

While most studies concentrate on the sales loss to the retailer created by OOS items, the total "cost" of OOS can be divided into four areas: 1) *retailer shopper loss risk,* where shoppers permanently switch stores due to OOS situations; 2) *retailer sales loss risk,* where consumers buy the OOS item at another store, cancel their purchase, or substitute a smaller and/or lower priced item; 3) *manufacturer shopper loss risk,* where consumers switch to a competitor's brand within a category, not only for the immediate purchase but also for ongoing purchases; and 4) *manufacturer sales loss risk,* where consumers substitute a competitor's item or cancel a purchase. The key to understanding the implications of OOS (as well as the benefits of addressing OOS at the retailer) is that the four areas of loss are interdependent. A reduction in the sales loss to the retailer also reduces the resulting shopper loss risk, the risk to the supplier, and the resulting supply-chain inefficiencies.

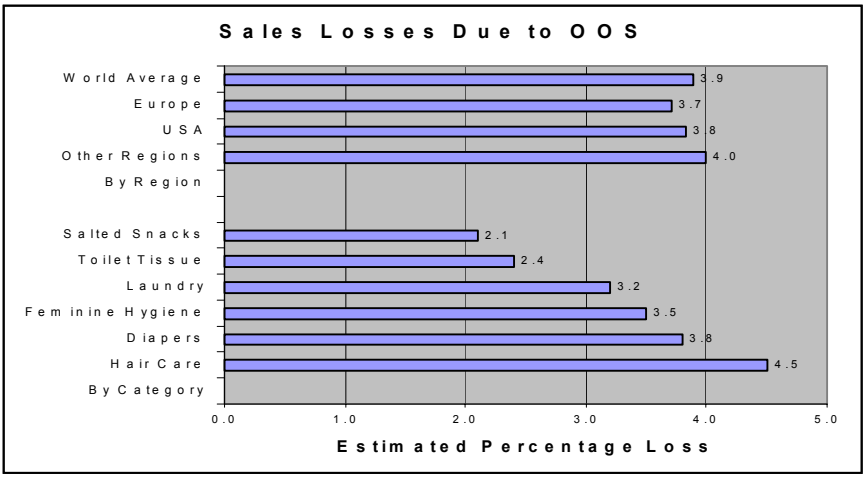

Fig. 5: Computed losses due to OOS by region and category

Most of the attention in measurement has been in the area of retailer sales loss, which is typically estimated based on the following formula:

Percentage of consumer responses that negatively affect the retailer x OOS Extent.

Figure 5 shows that the worldwide benchmark average is 3.9% sales loss at retail due to OOS items. The regional averages as well as worldwide averages by category are also presented. The chart shows that overall sales losses are similar worldwide, with a narrow range from 3.7%-4.0%.

However, category sales losses vary dramatically from 2.1% to 4.5%. Regardless of how the data is cut, the implication is still the same: both the manufacturer and the retailer have created value for the consumer, but nearly 4% of this effort is wasted because the retailer cannot extract the value from the consumer due to OOS items.

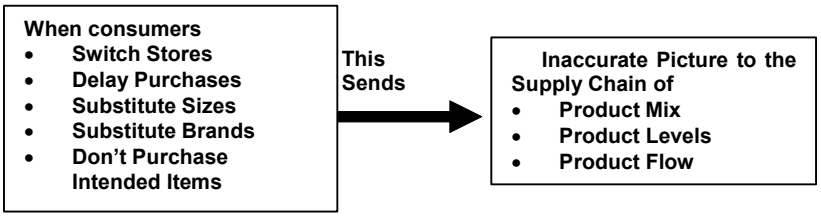

Fig. 6: Consumer responses to OOS negatively affect information flows

Other implications of OOS include logistics and information inefficiencies in the supply chain. Irregular, fill-in, and "rush" orders due to OOS situations cause logistics-fulfillment inefficiencies. These are subject to "demand amplification" or the "bullwhip effect", where small shifts at the retail level become magnified further up the supply chain. Information inefficiencies are created when the ordering signals sent up the supply chain reflect a pattern other than true consumer demand. What is worse, out-of-stocks not only disappoint customers, but perpetuate themselves and drive up costs throughout the supply chain. When a retailer needs to reorder a product, the buyer will typically examine the sales history of that product. When the item has been out of stock, the sales history data provides inaccurate information on what is the necessary purchase quantity to meet actual consumer demand. If the out-of-stock has not been detected, then the buying decision will most likely be too low to meet the normal customer demand plus those consumers who delayed purchase until the retailer received additional stock. Alternatively, if the buyer is aware of the OOS situation, the tendency may be to over-order, because the buyer is unable to determine the permanent customer loss to the brand caused by the OOS through brand substitution or to the store due to store switching. In sum, the OOS forces the buyer to work with a greater margin of error, and this increases the variability in the ordering, as summarized in Figure 6.

5 What Are the Root Causes of Shelf Out-of-Stocks?

Previous studies have placed most of the responsibility for OOS on retailer store ordering and forecasting practices. Our research confirms this, as Figure 7 shows. Between two-thirds and three-fourths of OOS are caused in the store, while one-fourth to one-third is due to upstream causes. Worldwide, the two greatest causes are inaccurate forecasting (34%), an indicator of increasing demand volatility, and shelf-replenishment (25%). The latter is particularly surprising when compared to the much-cited 1996 Coca Cola Research Council study. That study attributed a higher percentage to ordering (19%) and forecasting (54%), but it traced an average of only eight percent of the OOS situation to product being available in the backroom but not on the shelf.

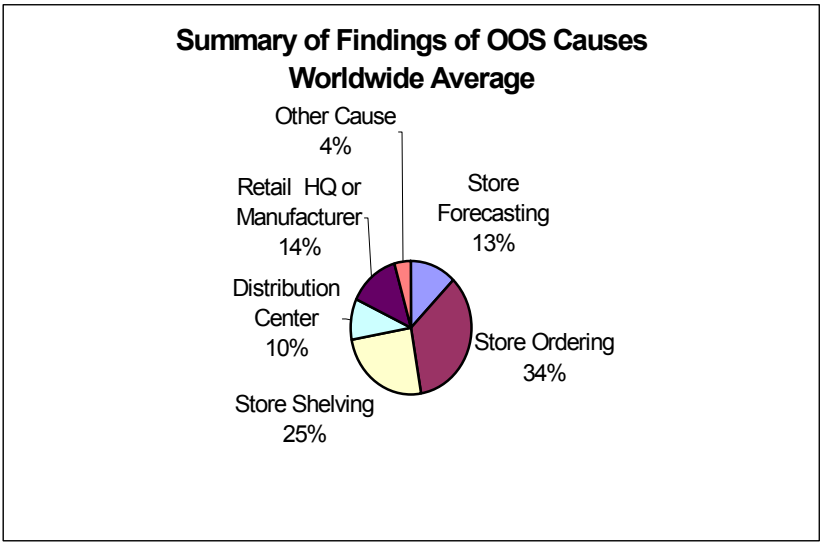

Fig. 7: Composite average causes of OOS

Figure 8 shows how OOS causes vary by region. We were surprised to find that, in the USA, significantly more causes of out-of-stocks are attributed to ordering practices (51%) than in Europe (32%). On the other hand, in Europe, there seem to be more problems with regard to replenishment (47%) than in the USA (32%), particularly shelf replenishment (i.e. when the product is already in the store). This is counterintuitive, as one would have guessed that smaller back rooms and efficient transport networks in Europe would alleviate this cause. Somewhat striking, 72% of all OOS

across the world are caused in the store, by poor store processes, late and insufficient ordering, incorrect forecasts, or shelf restocking problems. Retailer store managers must simultaneously manage thousands of stock-keeping units and work with hundreds (often thousands) of simultaneously promoted items (which cause demand to fluctuate), while keeping personnel costs in reason (Dubelaar et al. 2001). Furthermore, retailers face complementary issues, such as shrinkage that becomes more difficult to control as inventories increase. Thus, it is not surprising to see a strong linkage of out-of-stocks with store ordering practices.

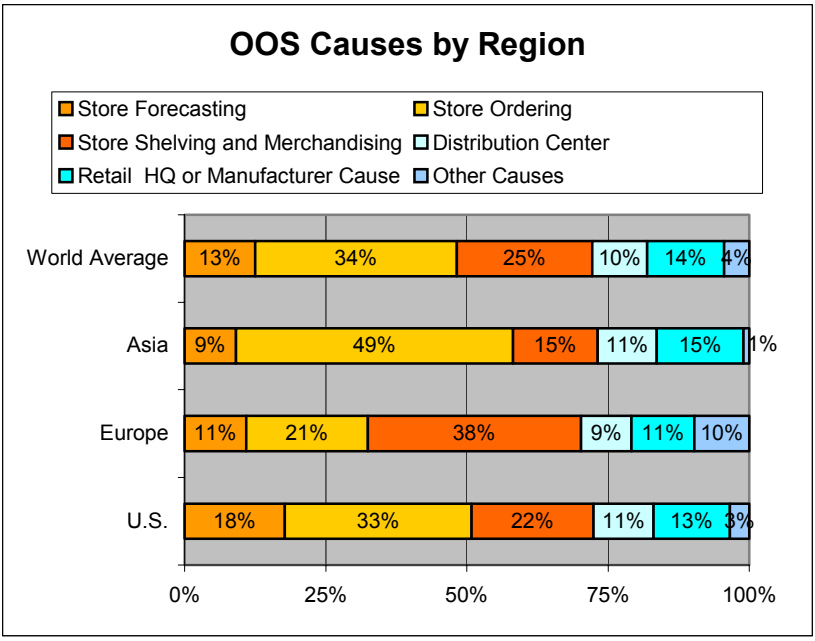

Fig. 8: Regional differences in OOS causes

However, the real story is more complex. Broadly speaking, causes of out-of-stocks tend to be assigned to one of the following three general processes, detailed in Figure 9.

Root Cause		
Planning	**Ordering**	**Replenishing**
Store		
• Incongruence between shelf capacity and replenishment frequency. • Product purchasing frequencies. • Large number of SKUs in assortment.	• Data (bad POS data, inaccurate records). • Forecasting (inaccurate forecast, long cycles). • Inventory (inaccurate inventory or book-stocks). • Ordering (no order, late order, wrong order, backorders).	• Staffing (insufficient or busy staff). • Backroom (congested). • Receiving (receiving errors, inaccurate records). • Shelf replenishment (infrequent, late or no shelf filling). • Planogram (bad execution and compliance). • Shrinkage (damage, theft).
Distribution Center		
	• Data (bad data, inaccurate records). • Forecasting (inaccurate forecast). • Inventory (inaccurate inventory or book-stocks). • Ordering (no order, late order, wrong order, backorders).	• Transportation (shipping, loading). • Receiving (loading errors, inaccurate records). • Storage (put away/ break pack). • Replenishment (infrequent, late or no store replenishment). • Lead times (long and infrequent). • Shrinkage.
Wholesaler/Retail Headquarter		
• Assortment (new or discontinued item). • Data and communication (master data). • Planogram design and implementation (shelf allocation). • Promotions and pricing decisions. • Advertising and display planning. • Store layout and service levels.	• Data (bad data, inaccurate records). • Forecasting (inaccurate forecast). • Inventory (inaccurate inventory or book-stocks). • Ordering (no order, late order, wrong order, backorders).	• Availability (shortage).
Supplier		
• Assortment (new or discontinued item). • Data and communication (master data). • Promotions and pricing decisions. • Advertising and display planning.	• Data (bad data, inaccurate records). • Forecasting (inaccurate forecast). • Inventory (inaccurate inventory or book-stocks). • Ordering (no order, late order, wrong order, backorders).	• Availability (packaging, raw materials and ingredients).

Fig. 9: Root Causes of OOS by Supply Chain Level

They are described as follows: 1) *ordering practices,* which is when the retail store may have ordered too little or too late, so that the warehouse could not deliver before the retailer ran out of the item, or when the retailer forecast may have misjudged demand for an item and ordered an insufficient supply; 2) *Replenishment practices*, which is when the product is in the store (often in the backroom, but also sometimes in another area of the store) but not on the shelf when the consumer comes to buy the product, or when the warehouse may have insufficient inventory to meet demand and "scratches" the retailer's order; and 3) *planning practices*, which is when the item may have been discontinued but not communicated to the retailer, the manufacturer may not have shipped adequate inventory, or there may be a product "drought", namely the manufacturer is unable to produce enough to meet demand.

6 How Can On-Shelf Availability Be Improved?

The previous discussion showed that the majority of the root causes are in the store, however, that's not the place to start in order to find a solution. Ideally, a sustainable on-shelf availability management process consists of a set of linked decisions on category tactics and shelf space allocation, as well as the mode, frequency and quantity of ordering and replenishment. An integrated process must address the three supporting pillars of process responsiveness, operational accuracy, and incentive alignment in order to effectively address the root causes of out-of-stocks.

Remedy 1: Process Improvements

Assortment Planning and Space allocation. Given the continuously changing and growing assortments, most stores end up in a dilemma where they allocate relatively too little shelf space for fast movers and too much shelf space for slow movers (Corstjens and Doyle 1981). Fast movers are particularly susceptible to out-of-stocks and, counter-intuitively, we found that fast movers often get less than their fair allocation of shelf-space given their sales potential. Clearly, a fast mover or a promoted item with high demand volatility needs more, rather than less, shelf space to fulfill consumer demand at any given moment otherwise it runs the risk of being out-of-stock.

Automatic Ordering systems: Traditionally, store managers evaluate inventory by walking through the store, and order products based on intui-

tion rather than on accurate forecasts. This of course leads to lost sales because near and complete out-of-stocks are spotted too late. While shelf-replenishment remains, even today, a predominantly manual process, automatic or computer-assisted store ordering has emerged as a key lever for better on-shelf availability. Spain, for instance, has improved availability by more than 66% (i.e. from 13-15% OOS to 5%) in test stores that moved from manual ordering to computer-assisted store ordering.

EDI, Internet and Real-time Ordering: Batching orders disrupts the product flow to the shelf, and causes the well-known "Bullwhip Effect" throughout the supply chain (Lee 2002). To address this, many retailers have already increased their ordering frequency, implemented EDI and internet ordering, introduced mixed truckloads, adapted minimum pack sizes, reworked delivery schedules and automated ordering to break batches. Tesco has gone even further, by exploring how its systems can pass orders continuously to its suppliers, rather than once a night.

Inventory Control: Retailers and suppliers can and should work together to reduce total supply chain inventory. While, intuitively, most would think that supply chain inventory levels positively correlate with on-shelf-availability, we found the contrary to be true. Higher supply chain inventory actually correlates with higher out-of-stock rates! This apparent paradox can be explained by the fact that retailers with lower inventory levels tend to manage their supply chains better and have their inventories in the appropriate places.

Remedy 2: Improve Operational Accuracy

Automatic Availability Measurement: Advanced technology-based solutions have emerged that automate out-of-stock measurement and detection. For example, Sainsbury's has introduced an automatic "Shelf Availability Monitor" (SAM). This system tracks the sales transaction data (rather than the inventory) for a store's top 2,000 products, and can be used to flag items that may be out of stock. It is in use at most stores, with regular reports highlighting where sales have been missed, how long items have been unavailable, and converting these numbers into a cash figure of lost sales. Furthermore, it tracks a store's sales in 15-minute blocks, and stores can plan their activities to ensure products are available when there is likely to be shopper demand. Since the introduction of SAM in early 2001, there has been an improvement across the company of 1% on-shelf availability. Another solution has been developed by Data Ventures and Procter & Gamble. The "Item Velocity Monitor" predicts with 90% accuracy the

out-of-stock status for items that move four or more times per day. This can provide a real-time signal to store managers and does not depend on store inventory records. These new solutions all share the ability to utilize technology (as opposed to inventory or manpower) to address out-of-stocks items on a rapid basis. This provides the potential benefits of reduced out-of-stock levels without committing high cost labor to address the problem.

Inventory Record Accuracy: Inventory inaccuracy presents a major obstacle to on-shelf-availability, and needs to be addressed. This is crucial, since ordering and inventory models assume that inventory records are accurate. However, recent research indicates that inaccurate inventory levels and misplaced stock-keeping-units are both significant and expensive, contributing to a profit reduction of more than 10 percent (Raman and Ton 2001). Due to data inaccuracy, retailers have to hold larger safety stocks, which increase the inventory costs. In addition, when inventory records (that are based on point-of-sales data) differ significantly from physical inventory levels, retailers cannot effectively use point-of-sales data for inventory management purposes.

Automatic Identification: One exciting technological advancement that provides great hope for improving on-shelf availability is based on the emerging technologies of intelligent tags or smart chips such as those promoted by the Massachusetts Institute for Technology's Auto-Identification center. Recently, Procter & Gamble and SAP announced a joint trial of the use of radio-frequency identification (RFID) transponders. In Rheims, Germany, Metro introduced a test of this technology in a retail store.

Remedy 3: Improve Incentive Alignment

Ordering Incentives: Store managers are faced with a confusing array of incentives. We found that many retailers penalize their store managers for out-of-stocks instead of encouraging them to improve on-shelf-availability. Simultaneously, store managers are generally liable for stolen merchandise and other sources of shrinkage. This encourages managers to purposely keep shelves "empty" or lock up merchandise behind the counter. Furthermore, when store managers are penalized for high inventory they will reduce stocks despite the risk of out-of-stocks. Hence, rather than penalizing inventory, stores should focus on on-shelf availability.

Incentive System: An even larger problem than the mixed incentives to managers is the lack of connection between headquarters buyers and the retail store managers. Buyers determine which products should be held by

the stores, but often they do not base their decisions on store sales information, nor do they account for the store managers' understanding of their shoppers' behavior. Rather, the buyers' decisions are governed by a range of functional factors, including purchasing term negotiations, margin, and volume-based performance incentives. To compensate for this, many stores deviate from the list of products prescribed by the buyers at the headquarters.

Change Culture: To motivate associates to have a real passion for availability retailers such as Delhaize or Safeway have begun to create a culture with a passion for availability. They have launched comprehensive initiatives involving supply chain and store associates, internal competitions and awards. By setting tough targets, aligning incentives and controlling the process, they have achieved a change in employee attitudes to availability.

7 Conclusions

What does one conclude from all of this? There are several lessons.

- First, all of the studies we examined point to a common concern: OOS has been, is, and will continue to be a problem. The aggregate extent we found of 8.3 percent (and the similar results found through other industry studies) continue to (and should) raise alarms throughout the FMCG industry.
- Second, OOS is costly. While the total costs to the supply chain have not been investigated, we found that, worldwide, average sales loss due to OOS is 3.9%.
- Third, not all OOS are the same. A slow moving item that is OOS will be less costly to the store than a fast moving item. Similarly, consumer substitution varies extensively among categories, affecting the retailer and manufacturer to different degrees.
- Fourth, duration of OOS is important. While techniques for measuring the duration of OOS are fairly new, the impact of long-term OOS problems affects not only the sales of the item, but also the likely potential of a consumer to switch stores.
- Fifth, most of the responsibility for lowering OOS rests in the retail store. Unfortunately, manufacturers have placed their resources towards lowering OOS on solving supply chain problems. This focus will need to shift, if the problem of OOS is to be effectively addressed.
- Sixth, as we examined consumers across the world, we found that consumers are indeed localized in their choices. However, when their choice is taken away through an item being out-of-stock, consumers

behave in a similar manner globally. In the end, the retailers (and their supply chains) that satisfy customers on this issue will be those more likely to succeed.

In summary, improving availability is imperative but it comes at a price. Reducing OOS requires initiatives that cut across functional boundaries and may require a fundamental rethinking of retailer processes. We believe most retailers have not yet reached the threshold where it will cost them more not to reduce the incidence than it will cost them to invest in solutions. Clearly, there is a minimum out-of-stock rate where cost to reduce further is more than the benefit. In fact, in some categories occasional out-of-stocks can be even beneficial, as certain availability may eventually increase price competition. Regardless, out-of-stock (or its counterpart, availability) remains a major issue not only for retailers, but also for all parties in the supply chain.

8 References

Campo, K., Gijsbrechts, E., and Nisol, P. (2000), Towards understanding consumer response to stock-outs, *Journal of Retailing*, 76 (2), pp. 219-242.

Coca-Cola Research Council / Andersen Consulting (1996), *Where to Look for Incremental Sales Gains: The Retail Problem of Out-of-Stock Merchandise.* The Coca-Cola Research Council, Atlanta, GA, USA.

Corstjens, M. and Doyle, P. (1981), A Model for Optimising Retail Space Allocations, *Management Science*, 27 (7), pp. 822-833.

Dubelaar, C., Chow, G., and Larson, P. D. (2001), Relationships between inventory, sales and service in a retail chain store operation, *International Journal of Physical Distribution and Logistics Management*, 31 (2), pp. 96-108.

ECR Australasia and PriceWaterhouse-Coopers (2001), *A Guide to Efficient Replenishment and Reducing "Stock Outs" within the Grocery Industry*.

ECR Europe and Roland Berger (2003), *Optimal Shelf Availability: Increasing Shopper Satisfaction at the Moment of Truth.*

Emmelhainz, M. A., Stock, J. R., and Emmelhainz, L. W. (1991), Consumer Response to Retail Stock-outs, *Journal of Retailing*, 67 (2), pp. 138-147.

Fitzsimons, G. J. (2000), Consumer Response to Stockouts, *Journal of Consumer Research*, 27(September), pp. 249-266.

Grocery Manufacturers of America and Roland Berger (2002), *Full-shelf Satisfaction. Reducing Out-of-Stocks in the Grocery Channel: An In-Depth Look at DSD Categories*.

Gruen, T. W., Corsten, D., and Bharadwaj. S. (2002), *Retail Out of Stocks: A Worldwide Examination of Extent, Causes and Consumer Responses*, *Grocery Manufacturers of America, Washington D.C.: 2002.*

Lee, H. (2002), Demand Based Management*, ECR Journal*, 2 (2), pp. 61-73.

Progressive Grocer (1968a). *The Out-of-Stock Study: Part I.* October, pp.1-16.

Progressive Grocer (1968b). *The Out-of-Stock Study: Part II.* November, pp.17-32.

Raman, A., DeHoratius, N., and Ton, Z. (2001), Execution: The missing link in retail operations, *California Management Review*, 43 (3), pp. 136-152.

Schary, P. B. and Christopher, M. (1979), The Anatomy of a Stock-Out, *Journal of Retailing*, 55(2), pp.59-70.

Appendix 1: The Research Study Description

This paper is based on a report entitled, *Retail Out-of-Stocks: A Worldwide Examination of Extent, Causes, and Consumer Responses* (Gruen, Corsten and Bharawaj 2002). This report presents what is believed to be the largest and most current single compilation of findings regarding the extent, causes, and consumer responses to retail out-of-stock (OOS) situations in the fast moving consumer goods (FMCG) industry. This is also the first study that enumerates OOS on a worldwide basis. Funded by a grant from the Procter & Gamble Corporation, the study was conducted in 2001-2002.

The inputs for this report come from 52 studies that examine OOS. This includes previously published results of 16 industry and academic studies, as well as the results from an additional 36 studies proprietary to this report. To provide a sense of the extensiveness of the studies that were used to develop this report, consider the following:

- Number of retail outlets examined: 661
- Number of FMCG categories included: 32
- Number of consumers surveyed world-wide: 71,000
- Number of countries represented: 29
- Studies addressing extent of OOS: 40 (of 52 total studies)
- Studies addressing the root causes of OOS: 20 (of 52 total studies)

- Studies addressing the consumer responses to OOS: 15 (of 52 total studies)

The basic process used in the research followed five general steps:

1. Collect and review published and unpublished OOS studies worldwide.
2. Collect and review related research on OOS from academic and applied sources.
3. Delineate findings from research.
4. Isolate limiting factors.
5. Synthesize findings and determine areas of consensus, trends and key findings.

More specifically, to develop this report, information was collected and synthesized from the following general sources:

- Previously published industry reports and studies of out-of-stocks.
- New data provided by two large-scale consumer studies conducted in 1999-2000 (one in the U.S. and a second identical study conducted in 19 countries outside North America).
- New data provided by studies of three retailers' scanner and inventory data conducted in 1999-2001.
- New data provided by a series of traditional store audit studies conducted in 1998-2000.
- Various academic articles published from 1962-2001 on out-of-stock studies.
- Industry press and articles that addressed and/or reported on other out-of-stock studies.

The academic and industry studies provided background and theory regarding the way out-of-stocks have been measured, the likely consumer responses to out-of-stocks, and the value of addressing the issue at the retail level. The majority of the academic studies focused on consumer responses and provided important theoretical and categorical approaches to examining consumer response data. The industry studies were examined to provide baselines for evaluating the information we would then examine from the new studies. The review of the industry studies led us to systematically arrange the information contained in all studies into the following categories:

- Methodology.
- Categories examined.
- Extent of out-of-stocks found.
- Consumer responses.
- Root causes identified and assigned.

- Efforts examined / suggested to address out-of-stocks, the costs and returns.

The logic of the arrangement is straightforward. First, the methodology was reviewed to determine any likely limitations or concerns faced when examining the data from the study. This methodology also provided a way to categorize the studies. Second, the categories examined were listed in order to make comparisons among the studies that examined the same or similar categories. Consumer responses to OOS situations tended to vary widely among categories, thus category identification is a key variable.

Following general categorization, examination of the extent of out-of-stocks in the report was the logical place to begin, since it answers the question: "Is there a problem?" After identifying the extent, the logical next question is: "Does the OOS matter?" This is answered by examining the consumers' responses to OOS situations. The search for the cause to the problem leads to the next question: "Who is responsible for causing the problem?" This leads to the final questions: "Can and should it be fixed? If so, how?"

Appendix 2: Measuring Out-of-Stocks

The definition of what makes an OOS affects the extent that gets reported in studies. While many variations exist, recent studies tend to settle on a consumer-based definition. Two general alternative definitions emerge based on the method of measurement. As the first and most accepted approach, the OOS rate is measured as a percentage of SKUs that are out-of-stock on the retail store shelf at a particular moment in time; i.e., the consumer expects to find an item that the store usually carries, but it is not available. Normally, the OOS rate is reported for each category individually, and then the categories are averaged (normally unweighted average) to create and report an overall rate for the study. Due to the number of studies that have used this approach, a major advantage of using this method is the availability of excellent baselines. The limitations to this type of measurement include the arbitrary nature of selection of the categories, frequency and timing of the audits, duration of the study, and human error that can and does enter from many sources. In addition, differences in sales volume are not taken into consideration hence this definition does not indicate lost sales.

A second definition of an OOS is the number of times a consumer actually looks for the SKU and does not find it. The percentage rate is calculated as the number of times the consumer does not find the SKU divided

into the sum of the times the consumer does find the SKU *plus* the number of times the consumer does not find it. Instead of relying on physical audits, the second approach is measured through the use of models that determine OOS rates from store scanner and inventory data. This view provides the advantage of determining the extent of out of stocks that actually matter to the retailer and the upstream supply chain members. The major limitation of this method is that the OOS rates are estimated based on historical sales patterns, and thus can only be calculated for SKUs that sell with a minimum frequency (thus, it cannot detect OOS for very slow moving products). Few studies have used this method, and therefore baselines do not readily exist.