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On-Shelf Availability in Retailing: A Literature Review and Conceptual Model

By

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On-Shelf Availability (OSA) is a key performance indicator for the retail industry, greatly impacting profit and customer loyalty. Strong competition in the industry causes retailers and suppliers to put heavy emphasis on improving performance in an effort to satisfy consumers and keep them coming back to their store or product. Over 40 years of research has been done on OSA and its complement, out-of stock (OOS), however very little progress has been made in improving performance in these areas, leading to the belief that gaps in extant research exist. In order to solve the OOS problem, the key drivers of OOS events must first be identified and then addressed. This paper focuses on identifying the drivers of poor OSA performance through a three step process. First, a comprehensive literature review was performed to identify the drivers of OOS addressed in existing literature. Second, interviews with industry professionals revealed potential drivers of poor OSA performance that have been explored at an industry level. Finally, the two lists were examined against each other and the potential drivers identified in the interviews that had yet to be researched were highlighted. This paper gives strategic direction for future research to help solve the OOS dilemma facing manufacturers and retailers today.

1. Introduction

Strong competition in the retail environment creates constant pressure on retailers to continually improve performance. On Shelf Availability (OSA), the probability that a product is in stock when a customer order arrives (Chopra and Meindl 2007, 77), is a key performance measure that affects profitability for both retailers and manufacturers (Fernie and Sparks, 2004; Aastrup and Kotzab, 2009). Out-of-stocks (OOS), a counterpart to OSA, occur when a consumer at a retail outlet arrives at the shelf and the specific product they are seeking is not there. Consumer tolerance for OOS is decreasing (Gruen et al, 2002), threatening retailers through lost sales and declining customer loyalty (Trautrims et al, 2009). OOS events cut deep into retail profits with some research showing that OOS events can cause the sales of a $1 billion retailer to be cut by $39 million (Corsten and Gruen, 2003). With the potential for such a high impact on profit (Katia et al. 2000), improving OSA is a major emphasis of retailers and manufacturers (Boyle, 2011).

There has been over 40 years of research that specifically addresses the causes of and consumer responses to OOS (Progressive Grocer, 1968a; Progressive Grocer, 1968b; Walter and Grabner, 1975; Emmelhainz et al. 1991; Coca Cola Research Council, 1996; Corsten and Gruen, 2003; Fernie and Grant, 2008; Trautrims et al. 2009). Despite this research, however, OOS levels have stayed relatively the same (Aastrup and Kotzab, 2009), hovering around a worldwide average of 8% (Corsten and Gruen, 2003). This means that on a given day in a given store, 8% of items being sought out by shoppers are not on the shelf. The lack of measurable improvement in OOS levels leads to the belief that there are gaps in the research of the determinants of OOS

that need to be filled. This will be the focus of my research. Specifically, the aim of this research is to identify gaps in extant research and identify factors that could potentially be key root causes of out-of stocks. Such insights could lead to further developing strategies or practices to aid retailers at the store and manufacturer level in reducing their OOS levels. For example, product life cycle is a potential driver of poor OSA performance; however, there has not been detailed research on product life cycle and its four stages in relation to OSA. Factors such as these that have not been extensively explored could contain keys to increasing OSA performance.

The body of literature surrounding OSA and OOS can be narrowed down to two major categories: consumer response to OOS and root causes of OOS events (Astrup and Kotzab, 2009). The first major contribution to OOS research was done in 1968 by the periodical Progressive Grocer and the two streams developed out of that paper. Since that time, the majority of the research has fallen into the consumer response stream with many papers aimed at understanding and evaluating consumer behavior in an OOS situation (Progressive Grocer, 1968; Walter and Grabner, 1975; Schary and Christopher, 1979; Emmelhainz et al, 1991; Campo et al, 2000; Fitzsimmons, 2000; Corsten and Gruen, 2003; Zinn and Liu, 2008). Corsten and Gruen (2003) identified five main responses of consumers when faced with an OOS situation: substitute same brand different size, substitute another brand, delay purchase, purchase at a different store, or not purchase at all. Each of these responses carries a different cost to the retailer or manufacturer with the potential of greatly hurting their bottom line. It is to this end that the second stream of research came into play.

As to the study of the root causes of OOS, the Progressive Grocer (1968) paper addressed the supply side issues associated with OSA; however literature was scarce for many years. The Coca Cola Research Council produced a report in 1996 that identified various causes for OOS. Following that study, Gruen, Corsten, and Bhardawaj (2002) published the most comprehensive analysis of OOS drivers up to that time (Aastrup and Kotzab, 2009). Their study defined three general processes as the major causes of OOS: ordering practices, replenishment practices, and planning practices. Literature addressing root causes of OOS generally assigns responsibility for poor OSA to either the store level or up-stream supply chain level. According to several studies, store level issues carry the majority of the weight of responsibility in OOS situations (Coca Cola Research Council, 1996; Corsten and Gruen, 2003; ECR Europe 2003). However, fixing this problem will require a holistic approach involving members of the entire supply chain. Corsten and Gruen (2002) reported that reducing out of stocks would require process changes at the store, supply chain and supplier level. Trautrims et al. (2009) stated, "there is a cumulative effect on customer service levels from supplier to manufacturer to distribution center (DC) to retail store to the shelf that dramatically impact OOS and OSA rates."

The emphasis of this research will be within the realm of identifying causes of OOS events through a three step process. First, existing literature is summarized to find currently identified drivers of OOS. Second, the literature review is complemented by interviews with industry professionals who outline the industry perspective of the drivers of poor OSA performance. Finally, a comprehensive conceptual model is created that shows the gaps in existing research on the drivers of OOS. The findings of this research will benefit other researchers as they endeavor to investigate possible solutions to poor OSA performance, narrowing down priorities of research topics. Focused research by Academia on the gaps in extant research will benefit the retail industry and the consumer. Retail industry professionals, at the store and supplier levels, will be able to consult this paper to seek resources for identifying problem areas within their

supply chain that lead to poor OSA levels. They can then, in turn, use this research to find strategies for addressing these areas and move toward optimizing OSA within their organizations.

2. Literature Review

This paper is broken into three parts with the literature review at the beginning. To clearly outline the OOS drivers discussed in existing literature, three major categories of responsibility, or ownership, of the drivers were created: Supplier, Retailer, and Time. These categories allow the findings from the review to be streamlined for future examination and research and shows where the majority of research has been focused up to this point. The literature review will be presented through examination of these three major categories and the OOS drivers researched within those categories, starting with Supplier driven causes of OOSs and moving through manufacturer, and time. The drivers of OOS found within the existing literature will serve as the foundation for discovery of future research agendas. The potential drivers identified during the interview process will build upon the drivers found in literature. Drivers that do not fit inside the areas exposed in the existing literature, the gaps, will be examined as possible areas of future research.

2.1 Supplier

The retail outlet relies on a number of inputs outside of its organization to make it run efficiently; perhaps the most significant of those inputs is the supplier. This section of the paper will focus on three specific supplier controlled drivers of OOS controlled have been evaluated in current research. Case pack size will be discussed first followed by DSD and then merchandising coverage.

Case pack size

Case pack size is an issue that has been examined heavily through academic research; however, it has just recently been evaluated in direct relation to on shelf availability. The size and quantity of a case pack can have direct impact on the shelf availability of a product. Case pack size has been looked at from a variety of angles in relation to OSA, specifically in the areas of shelf space allocation and replenishment needs (Waller et al, 2010; Broekmeulen et al., 2004).

Research shows that 91% of the products in a store are allocated shelf space based on the size of the case pack (Gruen & Corsten, 2007). Additionally, the relationship between shelf space and rate of sale should be noted. The more shelf space given to a particular product, the more sales that product will produce due to the familiarity, or recognition, of the product (Trautrums et al., 2009). Therefore, the expectation would be that the larger the case pack, the more space allocated to that product and that product will experience a relatively higher rate of sale than substitutes with less shelf space. There are two possible implications in regards to shelf availability. First, the larger the case pack size, there will be less frequent replenishment requirements leading to a lower risk of OOS occurrences (Waller et all, 2008). However, high volume items are more susceptible to stock outs (Gruen & Corsten, 2007), therefore that may countervail the original effect. Another converse effect of a larger case pack size is observed when partial replenishment occurs; when the store associate goes to restock the shelf and the current case on the shelf still has product in it (Waller et al., 2008). For example, suppose the case pack quantity is 20 items and the product is allotted shelf space that accommodates one case pack. When the store associate goes to restock that product, there are still 10 items on the shelf. The new case won't fit on the shelf so the associate fills the existing shelf and takes the

remaining case to be stored in the back room; this process is called partial replenishment. This leads to an immediate concern and increases the likelihood that an out of stock will occur, "Up to 10 per cent of the time, store employees cannot find items when they are replenishing shelves with product from the back area, even though they are available." (Waller et al, 2008).

The days of supply contained in a case pack is another issue that can have a bearing on the OSA level of a product. The days of supply are obviously connected to the demand of the product. Depending on the product, case packs may have a seven day supply or a four day supply, requiring different replenishment cycles per product. Gruen and Corsten, in their 2007 paper, A Comprehensive Guide to Retail Out-of-Stock Reduction in the Fast-Moving Consumer Goods Industry, addressed this very issue by looking at concept called "net shelf space", originally studied by TU/e Retail Operations Group. Net shelf space exists when products are allocated more space than necessary to efficiently sell the product (Gruen & Corsten, 2007). This all comes down to days of supply in the case pack. One product may have a case pack with seven days of supply and another in the same category may have a two week supply and another may only have a two day supply. It seems that it would be best to optimize the shelf space to hold fewer of the low performing items and more of the higher volume items. This would require an optimization of the case pack size as it is most efficient to stock shelves with full case packs. This may not be very practical and when considered on a store wide level may not be cost effective. In one market, a product case pack may represent a two week supply and in a different market a case pack may represent a one week supply.

Case pack size cannot be looked at from the singular perspective of OSA. Operational factors such as packaging machinery capabilities, pallet dimensions, warehouse rack heights, and transportation are all considered when making case pack attribute decisions (Waller et al, 2008). Therefore it is not reasonable to suggest case pack size decisions can be made solely based on OSA. However, literature shows the connection between case pack size and OSA levels and highlights the importance of considering case pack size when suppliers and retailers plan for the future.

DSD

Direct store delivery (DSD) is defined as when a supplier delivers the product directly to the store and is responsible to replenish the shelves. Research in the area of DSD and OSA shows mixed results. These results range from *worse* to *better* to *no difference* in OSA levels between DSD delivered merchandise and products delivered from the retailer warehouse.

Recent GMA studies addressed DSD in the retail environment (GMA 2008; GMA 2011). In the 2011 study "Optimizing the Value of Integrated DSD", their research showed that the average in-stock level for the DSD products were 98.2 percent, which is significantly higher than the in-stock average in-stock level of 94 percent, reported in other studies. Both the 2008 and 2011 studies produced by the GMA strongly support DSD as a method to reduce OOS occurrences at the shelf. Gruen & Corsten reported in their 2007 paper, A Comprehensive Guide to Retail Out-of-Stock Reduction in the Fast-Moving Consumer Goods Industry, the absolute opposite of the previously mentioned study. Products delivered directly to the store had lower OSA levels than those delivered from the retailer's warehouse. This was a result of the unmatched store replenishment and delivery schedules and the inability for store management to enforce store policies on the supplier's merchandisers. They went as far to say, "In a large U.S. retail chain, DSD posed the biggest single problem to reducing OOS…." (Gruen & Corsten,

2007). The ECR 2003 report concluded that there was "no significant difference between DC & DSD *(delivered)* items."

The different results reported in the various studies could be attributed to a variety of factors. One possibility could be whether the product being delivered is vendor managed inventory, meaning the vendor does the ordering and forecasting for the product, or store/retailer managed inventory. Items that are vendor managed would have delivery schedules aligned to ensure proper and timely replenishment. Another possible reason for the discrepancy could be the products or categories utilized in the studies.

To obtain a clear picture as to whether or not DSD impacts OSA levels across many retail outlets would require an in-depth analysis of the store practices at the different retail outlets. The requirement of in-depth analysis points to the clear fact that OSA levels will not be improved through simply one method, but will require a comprehensive plan of action. DSD could be a possible piece of the puzzle in decreasing OOS at the shelf level; however there is too much variability in current research at this point to decisively reach that conclusion.

Merchandising Coverage

Merchandising coverage, as related to supplier attributes that impact OSA performance, refers to supplier employed merchandisers responsible for the stocking and restocking of product at the retail outlet. The ECR 2004 report listed in-store merchandising as a potential spoke in the proverbial wheel of the OSA dilemma.

In the above section regarding DSD, the following comment was included, "In a large U.S. retail chain, DSD posed the biggest single problem to reducing OOS…." (Gruen & Corsten, 2007). Gruen & Corsten stated that the reason for DSD being such an issue specifically related to the merchandising coverage that accompanied the direct store delivery setup. They reported that delivery schedules of the product were not aligned with store replenishment schedules and that the supplier's merchandisers were not bound to store policies and therefore it was very difficult to enforce alignment to store practices.

Emberson et al., in their 2006 study Managing the Supply Chain Using In-Store Supplier Employed Merchandisers, examined the relationship between supplier employed merchandisers and the retail outlet. There are many factors that go into making the relationship work between the retail associates and the merchandisers and the ultimate conclusion is that it is a complex relationship. The results were worth the effort, as the supplier company examined in the research experienced a 10% sales increase in the stores where they deployed merchants (Emberson et al., 2006).

Some suppliers have used a form of merchandising coverage that does not involve stocking of shelves, but more of a monitoring approach. Throughout the course of this research project, examples were found where supplier companies are sending merchants into the stores on a regular (weekly) basis to evaluate the in-stock level of their products. They are not stocking shelves and they are not delivering product, but they are acquiring actual shelf level performance. Future research could include case studies where projects of this nature are examined for effectiveness of improving OSA performance and techniques or processes implemented based on learnings from the in-store merchants and the data they collected. This could prove valuable for other companies trying to improve their in-stock position at the shelf level.

Existing research reveals that the use of supplier employed merchandisers can have a positive impact on the OSA of their products which leads to increased sales. However, both the retailer and the supplier must be committed to developing the relationship and see the mutual benefit

from the relationship. This is certainly an avenue worth exploring when building a comprehensive approach to improving OSA performance.

2.2 Retailer

Consumer access to products is generally through the retail outlet and if the product isn't on the shelf then both the retailer and the manufacturer lose. Over the last several years of research there has been a focus on "the last 50 yards", meaning the execution of the supply chain activities at the store level. Service level deteriorates as it moves through the supply chain; starting at 99 percent service level from the manufacturer to the retailer DC, reducing to a 98 percent service level from the retailer DC to the retailer storeroom, and finally decreasing to 90 to 93 percent from the storeroom to the shelf (ECR 2003). Corsten & Gruen reported in 2003 that "72 percent of all OOS across the world are caused in the store…" The following section of this paper will evaluate eleven different root causes identified in the existing literature, including store ordering, store replenishment, store size, store format, store fixed effects, backroom, number of facings, modular discipline, shelf maintenance, price promotion, and substitutes.

Forecasting & Ordering

Store forecasting and ordering have been cited as major drivers of OOS by recent literature (Gruen et al., 2002; Fernie & Grant, 2008; Aastrup & Kotzab, 2009). Research shows that 35 per cent of all OOS can be attributed to store ordering practices (ECR 2003) and if ordering and forecasting are combined that number can reach up to 47 per cent (Gruen & Corsten, 2003). These two factors walk hand in hand as wrong forecasts will lead to wrong order quantities. This leads to a major concern in the retail industry, the accuracy of perpetual inventory (PI) data. PI drives the forecast which then in turn drives the order.

Inaccuracy in the PI data creates problems all the way up the supply chain (Raman et al., 2001; ECR 2003, Gruen & Corsten, 2007; Fernie & Grant, 2008). "…physical audits consistently show that PI data are typically accurate for less than half of the items in the store" (Gruen & Corsten, 2007). The inaccurate data either leads to phantom inventory, inventory that shows it is on the shelf but is not there, and hidden inventory, inventory that shows it should be in the store but cannot be found. One driver of inaccurate PI data discussed often by those in the industry is item scanning at the checkout. Take jello as an example. Suppose a customer places six packets of jello on the belt at the register. She has two orange, two strawberries, and two lime. The cashier picks up one lime packet and scans it six times. The POS data feeds the PI data and it is wrong. For the supplier of that jello, mistakes like that could be multiplied across thousands of grocery outlets on a weekly basis. Part of fixing the PI data accuracy will lie in training cashiers to input data accurately at the register. Accuracy in PI data can also be skewed when products are in the store, but not on the shelf. Since the product is not on the shelf then there will be no recorded sales for that data. Therefore, the demand signal is very low and the forecast will be adjusted to account for lower demand.

The PI data is used to create forecasts which in turn feed into a computer automated ordering system, used by majority of retailers today. If these orders are sent unadjusted by management then they will not be accurate and the wrong amount of product will end up at the store, increasing the opportunity for OOS occurrences.

Even if the PI data is accurate and the orders produced by the system are right, store managers and associates often adjust the order amount. This leads to either an over or under order of products. Research shows that the orders generated by a computer automated system

are more accurate than the order amounts adjusted by store management (Gruen & Corsten, 2007).

Store Size

Store size has been found to impact OSA levels (Aastrup & Kotzab, 2009; Fernie & Grant, 2008). Store size can be broken down into two broad categories: large-usually big box chain retailers but could also be independent and small-generally independent grocery/retail stores. Each store size carries with it unique characteristics that can either help or harm OSA performance.

Larger stores have more shelf space and are able to give more space to high volume products without eliminating low demand items thereby reducing variety (something important to the consumer). The bigger stores also tend to have more associates with a number of them devoted strictly to replenishing the shelves (Aastrup & Kotzab, 2009). These two characteristics create an environment for good OSA performance. On the down-side, large stores have more variety which means more complexity which can possibly reduce OSA.

Small stores, mostly independently owned and managed, perform fairly poorly in regards to OSA, *in comparison to* the larger retailers (Aastrup & Kotzab, 2009). The main reason for this is the processes in place in a small store are so very different than those in the larger retail outlets. Aastrup & Kotzab found that in the smaller independent stores that shelf replenishment was the responsibility of one associate or the owner. Of course, they have responsibilities beyond shelf replenishment and the task of stocking the shelves is done in between completing their other responsibilities. Aastrup & Kotzab found a wide range of OOS levels among the small independent stores and attributed the variety to the emphasis of management on shelf replenishment. In stores where management emphasized this, generally they experienced a lower OOS level. Another attribute of the small store is their ordering and forecasting processes are less efficient as they do not have access to sophisticated perpetual replenishment and forecasting software. Although the use of software alone will not guarantee good OSA performance it is a tool that can aid in producing more accurate forecasts and corresponding orders. Much of the ordering in small independent stores is "non-data based" (Aastrup & Kotzab, 2009). This has an obvious impact on OSA.

The benefit of the research on how store size impacts OSA allows store management to be aware of the potential issues they face within their stores and to address them through various research driven solutions. As seen in the Aastrup & Kotzab study there are small stores with really good OSA. They have implemented processes that mitigate the characteristics of smaller stores that lend to poor OSA performance. Therefore, store size doesn't dictate OSA performance, but knowledge of the unique characteristics leads to the ability to perform well and meet the needs of the consumer.

Store Format

During the course of this research very little literature was found addressing store format as a root cause of OOS occurrences. The ECR 2003 study briefly reviews this concept, comparing the stock-out levels of supermarkets versus hypermarkets. They found that there was on average a difference between the OSA levels in two different store formats. "However, store format alone does not explain enough to justify different out-of-stock levels among the same type of store format" (ECR 2003). This mirrors the conclusions drawn in the store size discussion. Although there are some unique characteristics that can influence the OSA performance of a store, the format of the store alone does not necessarily dictate OSA.

Store Fixed Effects

Store fixed effects, as defined for the purpose of this research, are the unobserved differences in "store execution". Specific to this project, we will look at inventory control systems used by the store, such as RFID or specific shelf replenishment guidelines and processes, and the impact of they have on OSA. Of course, there are other systems that will be unique to individual stores that could have a positive or negative impact on OSA. These would have to be observed throughout the course of research to understand the impact of those unique systems on the OOS level in a specific store. Some of these could be found by evaluating the specific systems implemented in stores with very good OSA levels and those with average to very poor OSA levels and find the key differences. From there, the specific impact of the different practices could be determined through further research and analysis.

RFID technology has been a part of the discussion in helping to reduce OOSs at the shelf level. By providing visibility to products throughout the entire supply chain, RFID is said to have the ability to help retailers, among other things, reduce OOS occurrences (Kamaladevi, 2010; Hardgrave et al., 2008). The key value of RFID is the visibility it provides to the location of the product. A major issue facing retailers today in the realm of OSA is when the product is in the store but not on the shelf. RFID technology would help with these types of situations; sensors would read when a case is received at the store and when it leaves the backroom to go out to the sales floor. Then store associates could check to see when/if the product was received and when/if it left the back storeroom. Major retailers have been implementing RFID technology over the last few years and have seen substantial results in reducing OOS levels in stores using RFID (Hardgrave et al., 2008).

Retailers around the world use a very wide variety of systems for replenishing their shelves, from entirely manual to completely automated shelf replenishment systems. These systems, often designed by consulting companies or software vendors, claim to reduce the number of out-of stocks at the shelf. There are too many of these systems to evaluate within the scope of this project. Existing research does not dive deeply into the specific systems. As stated above, future research could include case study type projects that evaluate the before and after effects of implementing specific shelf replenishment systems.

Backroom

The existence of a backroom, or storage area, can have a big impact on the efficiency of shelf replenishment, especially if inventory in these areas is not well organized (Raman et al., 2001). Remember one major issue with OSA is product that is often in the store, but cannot be found, leaving the shelf empty. This can often be the result of cluttered backrooms. 10 percent of the time store associates, when attempting to stock the shelves from storage or backroom areas, cannot find the product (Waller et al., 2008). Consider a case of product that leaves the backroom to go out to the shelf and only half of the case will fit on the shelf. The store associate brings the remaining half of the case to the backroom and sets it on a shelf. If there is not a systematic way to catalogue the remainder of the case then it gets lost in the backroom, adding to the phantom inventory problem.

Some research exists showing that reducing the amount of inventory in the backroom, along with other measures, can positively impact OSA (Fernie & Grant, 2008). This research, Fernie & Grant, 2008, told of a retailer that implemented a system that extra stock that would not fit on the shelves went on special carts. The associates on the next shift knew to replenish shelves

from those carts first. The result was a significant reduction in the amount of inventory in the backroom.

Number of Facings
     The number of facing given to a specific SKU impacts the number of sales of that item (Trautrims et al. 2009). This concept closely mirrors the argument made earlier in the Supplier section of the paper regarding shelf space allocation. More shelf space, or the larger the number of facings given to a product, will translate into more sales. Allocation of facings, or shelf space, is a complex opportunity and one that certainly deserves a closer look.
     Allocating space is a complex process and often in large retailers requires a lot of involvement from a variety of sources and inputs. It seems to make sense to give more space to both higher volume and higher profitability products to help buffer against OOS occurrences. One recommendation found in the research encourages retailers to determine the necessary days of supply for a specific product and assign shelf space accordingly (GMA 2011).   Another study researched the impact of eliminating the 14 slowest items and giving more shelf space to the 14 fastest moving items (Gruen & Corsten, 2007). The quandary here is that to increase the shelf space of the most profitable products will reduce the shelf space allocated to the other products. In a large store environment, it is the expectation of the consumer/customer that there will be variety offered. Therefore, it becomes hard to start taking shelf space away as that could lead to a decrease in variety and dissatisfaction of the consumer (Trautrims et al. 2009). Therefore, there is an optimal level of shelf space which minimizes the risk for OOSs and maximized customer satisfaction.

Shelf Maintenance
     Keeping shelves straight and accurate is quite important for both addressing OOS and building a strong OSA level. Shelf Maintenance has had some research linking it to OSA performance. Corsten and Gruen found four common failures when it comes to item management: wrong tag, shelf tag missing, product hidden behind another product, and holes covered (empty facing) covered by another product (Corsten & Gruen, 2007). Their study shows that when failures in item management are addressed there is significant impact on OOS levels. The study involved a group of test stores where shelves were "shored-up" each week, meaning mistakes in tagging, stocking, etc. were fixed. With clean and accurately tagged shelves OOS were obvious and apparent. The control set of stores were not corrected and their OOS levels were significantly higher than the test stores OOS levels.

Price Promotion
     A very large amount of research exists that shows a connection between price promotions and poor OSA performance (Corsten & Gruen, 2003, ECR 2003, Taylor & Fawcett, 2001). Demand for promoted products increases, but there is little reference to how much it will increase and therefore variability in demand creates an environment where OOS can occur.
     In the late 1990's and early 2000's, the OOS level of promoted items was reported as higher than that of non-promoted items (ECR 2003; Coca Cola Research Council, 1996). However, in recent years the OOS rate of promoted items seems to be improving. In the "case study" research performed by Fernie and Grant, 2008, they found that promoted items actually had a higher OSA level than for non-promoted items. Average availability for products not currently being promoted was 95.5% and for items being promoted it was 97.7%. This has been a huge

focus in the UK for the last several years and therefore there is a heightened awareness to ensure OSA for promoted items. This is an example where emphasis has shifted due to the exposure of the problem to the industry.

Substitutes
        The issue of substitution is thoroughly covered in the large body of literature addressing consumer responses to stock out occurrences (Coca Cola Research Council, 1996; Gruen et al., 2002; Aastrup & Kotzab, 2009). However, there is very limited research linking substitution as a root cause of the OSA problem. The issue of substitution must be looked at from the back door. The other issues addressed in this research paper can be viewed as negative influences on OSA and therefore provide opportunities for improvement in those areas leading to a positive impact on OSA. However, substitution is not a root cause, but the issue of more substitutes may lead to higher levels of OSA for a "collection" of products. This would not necessarily be true for a single product, but the OSA level of multiple products in a category or sub-category could have positive results with higher substitutability of products.
        One study was found addressing the issue of substitutes within the bounds of OSA, Optimizing On-Shelf Availability for Customer Service and Profit (Trautrims et al., 2009). In this study they looked specifically at OSA in the chilled juice category. This is a highly substitutable product, meaning that if one juice goes OOS then the demand for the other juices increases considerably. The ability to substitute either the same brand in a different size or a different brand that is very similar eases the consumers concerns about the OOS and causes them to be less likely to switch stores due to frustration with the item they wanted not being on the shelf.
        Further research in this area could yield recommendations on product assortment within categories or sub-categories, optimizing customer satisfaction customer satisfaction through category assortment. Of course "optimal assortment" is the key phrase as too much assortment can lead to uncertain demand, as can be seen in categories with a very large number of SKUs.

2.3 Time
        Time is a very significant characteristic that bears consideration when evaluating OSA performance. The fact that increased demand for a product creates more opportunity for OOS occurrences has already been established. Demand varies throughout the week based on a variety of factors and that demand variation can be felt at the shelf. With the majority of adults working during the week, retail outlets are busiest on the weekends. Additionally, events throughout the month create peak shopping days. These peak shopping times require an organized and streamlined supply chain to ensure the needs and desires of the consumer are met.

Day of Week
        Research has shown that OOS levels vary by day of week/month and time of day (ECR Europe, 2003; Taylor & Fawcett, 2001; Fernie & Grant, 2008; van Woensel, et al., 2007). The usual trend is that in-stock levels decrease as the week progresses (Taylor & Fawcett, 2001). Sales on Friday and Saturday account for an average 43 per cent of weekly sales, and in some stores that number can go as high as 50 per cent (ECR 2003). Therefore, the opportunity for stock-outs increases on the weekend as more products are being purchased.
        Store replenishment practices must be aligned to ensure that shelves are restocked to meet weekend demand. One grocery chain decided to attack the OSA issue, in part, by having

nighttime associates do "gap counts", visually checking the store inventory, on a daily basis before the store opened in the morning and adjusting the forecast and order accordingly. However, on the busiest days (Thursday through Sunday) they would have associates do "gap counts" throughout the day (Fernie & Grant, 2008). This highlighted shelves that needed immediate replenishment so that back room stock could be taken directly to the shelves.

A variety of drivers of OOS occurrences at the store shelf have been identified within the literature. These drivers fall within the categories of supplier controlled, retailer controlled and time controlled. The drivers within each area interact with one another and the impact of it all is observed at the retail shelf. Retailer controlled drivers dominate the literature and even the supplier controlled drivers deal with execution at the store level, showing that store execution is one of the biggest challenges in improving OSA performance. The drivers addressed in existing literature form a good place to start in addressing OOS, however they have not proved to be enough to bring OSA to an acceptable level.

3. Interviews

The literature has provided a basis for addressing OSA and the lost revenue experienced by both the retailer and the supplier. However, even with this research, progress has been slow. The 1968 Progressive Grocer study reported an average OOS of 12.2 percent. Thirty-five years later, Corsten & Gruen (2003), reported an average OOS rate of 8 percent, showing there is still opportunity for vast improvement. There are gaps in the existing literature that need to be filled; drivers of OOS that have yet to be discussed in research. Filling these gaps with focused research has the potential to give practitioners the tools they need to bring OSA to an acceptable level, for both the retailer and the supplier. To begin understanding additional drivers of OOS, interviews with industry practitioners were conducted. The purpose of these interviews was to gain industry input as to additional drivers of OOS that have yet to be explored in extant literature.

The interviewees selected for this research were from the vendor/manufacturer community and the industry trade organization sector. Both sides have a clear understanding of the OSA issue and have conducted some forms of research to address the problem. In selecting these participants, the design was to go beyond issues that have already been researched as drivers for OOS and to drill down to potential issues that have yet to be discussed. A total of 10 industry experts were interviewed in a semi-structured format. Prior to the interview, all participants were sent an overview of the research project and a short video describing the project and the information desired to be collected during the interview. Each interview lasted between one and two hours. Detailed notes were taken during the meetings and transcribed following the interviews. The interviewees and their responses will remain anonymous to protect the disclosure of any proprietary information shared during the process. The responses of the industry professionals during the interviews were examined and common themes were extracted. These themes compose the issues addressed below as potential future research streams.

There were some OOS drivers discussed in the interviews that already had large bodies of research that had examined them, such as forecasting, shelf space allocation, and the accuracy of PI data. However, there were several issues brought out during the interviews that warrant the need for further investigation and should be added to the potential streams of future research. These issues will be discussed individually in the following section.

3.1 Supplier
Supplier Category-specific Market Share

There is a connection between market share of a specific product or category and OSA performance. Market share is a function of demand and it is well established by this point that the higher the demand for an item, the higher the volume, which leads to more susceptibility to OOS situations. In addition, the higher volume items are often given prominent shelf placement which makes the items more visible to the consumer and therefore lead to even further sales, thus leading to potential decline in OSA performance.

Further research in this area will provide understanding on the impact of supplier-category specific market share and will highlight the importance for both suppliers and retailers to understand the unique demand and flow of the sales of the products they produce and carry. In this specific example, this allows for more focused attention on the high volume products to ensure that the product is managed well from both the retailer and supplier perspective and that OSA levels are monitored to ensure availability when the consumer goes to purchase the product. The interviewees from the vendor community were quite interested in this as they must ensure their high volume products with larger market share have the prominence and attention they require in the store. Research in this area would allow them to better collaborate with the retailer as they work together to increase OSA performance.

Planogram Compliance

Modular Discipline is a very important topic to in the retail industry and was mentioned in the interviews as a point that needs addressing. Generally, both suppliers and retailers collaborate together to develop a modular design. Planograms are designed to attract the customer, but also contained in their specific design is the intent to have enough product on the shelf when the consumer wants it. Imperative to the design of the modular, or planogram, is associate execution in the store. The nature of collecting data on the behavior of store associates is quite complicated, labor intensive, costly and altogether impractical (as it would require associates being followed around by someone recording their actions which would bias the result, among other problems). That being said, there is validity to the argument that store labor, in regards to planogram compliance, is imperative to accurate shelf replenishment. If a store employee responsible for stocking shelves has never seen the plan-o-gram for their department they have no idea the correct staging for the shelf they are replenishing and the likelihood of the shelf being compliant with the planogram is very slim.

Store Labor

As mentioned above, store labor is integral to excellent store execution. There are many aspects of store labor that could be drivers to OOS occurrences and analysis of this issue is important to industry professionals. One of those issues is the scheduling of the associates. Are they scheduled in alignment with peak shopping hours and also DC deliveries? Management of store labor and the execution characteristics of store labor are difficult to research. Data is difficult and expensive to obtain. However, store labor is the front line defense against poor OSA performance. Therefore, perhaps case studies could be performed to evaluate the effectiveness of highly trained staff and through the use of similar stores as controls. Another argument in regards to store labor is that they are very detached from the impact of lost sales due to OOSs. Perhaps if there was an incentive program in which they understood the connection

between accurately stocked shelves that matched the planogram and they were rewarded for accuracy the retailer would begin to see an increase in OSA levels.

Product Placement

There are certain products, such as batteries, that are placed in various locations throughout a store. However, the inventory of the product is listed as an aggregate figure and not listed by location in the store. Therefore, product could be out of stock everywhere in the store but one location and it will show the product as being in-stock. The interviewees were interested in understanding whether the placement of a product impacted OSA and if products that are placed in various locations experience more or less stock-outs. This could possibly have an impact when designing plan-o-grams and the distribution of the products throughout the store. Understanding how this affects OSA could lead to more focused assignments of store associates. For example, using batteries, let's look at a potential scenario in a large big box retailer. There are four displays of batteries throughout the store: two in front of the registers, one in toys and one in electronics. Who is responsible for these? Is there one person assigned to batteries and they stock all of them or does someone in each department responsible to stock the batteries. If further research finds that these products are highly susceptible to poor OSA rates then perhaps retailers would assign a specific associate to be responsible to stock the batteries.

Number of SKUs

The interviewees talked about the decision set of the customer and OOS situations. This led to the thought that perhaps the number of SKUs in a given category has an impact on OSA. Research linking the number of SKUs in a category as a driver for OOS was not found throughout the course of this project. However, research shows that the health and beauty category consistently performs poorly in the realm of OSA (Gruen et al., 2002). Health and beauty is a SKU intensive category and there is the feeling that the poor OSA performance can be linked to the huge number of products in the category. Purchasing behavior is harder to predict when presented with a very large variety of products (Chernev, 2006). This leads to greater demand variability and with that comes greater risk for experiencing an OOS.

From a different perspective in relation to the number of SKUs, a lot of research so far has been done on OSA at the category level. There is an argument to focus more at a product level – at least in regards to the highest volume items. Corsten and Gruen 2008, argued this exact point. Their research showed that in general, when evaluating the items that are driving sales at the retail level, the 80-20 rule is in play. Large grocery stores in the U.S. carry approximately 50,000 SKUs. On a peak day they found that approximately 5,000 items (unique SKUs) accounted for over 70 percent of the store's sales. This seems to indicate that focusing on getting those 5000 items consistently on the shelf would produce a lot of benefit to the retailer. Then, once the processes associated with those products are streamlined, they can be transferred to other products within the store.

This area of focus, the number of SKUs, presents a clear path for future research that could strongly influence overall OSA performance at all levels of retail – store, category, and product.

Payday

Demand variation was talked about by the interviewees in relation to different days of the week and "events" throughout the month, one of those events being payday. Although some of this discussion centered around store labor scheduling it became apparent that payday type

events could have an impact on OSA. Payday as a driver for OOS occurrences follows an intuitive pattern. When people receive their paychecks they go out to purchase needs and wants, from groceries to electronics. Many people do not have a lot of discretionary income and therefore wait until they are paid to purchase things they need, such as groceries. Therefore, on days where paychecks are given there is a spike in volume at the retail outlet. Also included in paycheck references would be social security checks and food stamps. At the time these checks and allowances are issued customer volume increases leading to a subsequent strain on demand. This can lead to greater opportunity for OOS occurrences.

Time seems more of a factor than a root cause. If root causes to OOS are being addressed and comprehensive models for reducing OOS occurrences have been built and implemented, then peak times of demand will be planned for and the suppliers and retailers will be as ready as possible. More research in the area of Time as a root cause for poor OSA performance does not seem to be necessary; rather a perspective shift in regards to time seems more appropriate. The time of day, day of week/month, etc. is a factor to consider in regards to OSA, but perhaps not a root cause to be addressed.

Market Size & Competitive Density

During the interviews, the discussion regarding varying performance among stores led to the question as to whether or not the specific market in which the store was located had an impact on OSA. Different market sizes have unique characteristics. For the sake of this analysis let's consider a large market. Large markets will have greater sales volume due to the larger number of consumers in the market. As previously stated, higher volumes of sales are associated with an increased prevalence of OOS occurrences due to increased need for shelf replenishment and accuracy in order amounts and timing. In addition, there will be a greater breadth of tastes and preferences, or customer heterogeneity. This has a variety of implications; two of them being variability of demand and more SKUs on the shelf. Both of these implications can lead to lower OSA. Variability of demand creates more difficulty in forecasting which has an impact all the way through the supply chain and certainly on the shelf. More SKUs means less shelf space for the higher volume items and an increase in shelf replenishment cycles as less product fits on the shelf.

Competitive Density refers to the number of competing stores within a specific market. This will impact OSA performance as retailers in markets with fewer retail outlets will experience a higher demand for their products. This higher demand leads to the opportunity for more OOS occurrences. Conversely, markets with many retail outlets and more options for consumers could be more difficult to forecast as demand for the product is spread across all of the retail outlets. Inaccurate forecasting is a major cause of poor OSA performance (Corsten & Gruen, 2003).

A statement by one of the industry experts clearly states where companies want to be in respect to out-of-stocks, "In regards to global replenishment there are two views, the windshield view and the rear view mirror. Right now we are looking through the rear view mirror trying to chase OOS's." Implicit in this statement is the desire to be able to look out the windshield and address the OOS before it occurs. Perhaps through further research and the implementation of research based practices, over the next few years retailers and vendors will have a windshield view of OSA.

4. The Model

Once the interviews were completed and the content transcribed, the potential drivers discussed by the experts in the interviews were compiled based on the three major categories used for the literature review. An additional category was added after evaluating the feedback from the interviews as Market issues were brought up that were not discussed in the literature. The complete list of drivers discussed during the literature review and the interviews is shown in Table 4-1. Any drivers that overlapped with those that had been addressed in extant research were removed and what remained were topics with potential for future research. These potential drivers are shown in Table 4-2. The future research topics extracted through this model are very relevant to the industry as they originated from the experience of current practitioners that confront the OSA issue on a daily basis.

Table 4-1
Drivers of OOS Addressed in Literature & Interviews

Literature Review	Expert Interviews
Supplier	**Supplier**
Case Pack Size/Shelf Space DSD Merchandising Coverage	Case Pack Size/Shelf Space Supplier-Specific Market Share
Retailer	**Retailer**
Forecasting & Ordering PI Data Store Size Store Format Store Fixed Effects Back Room Number of Facings Shelf Maintenance Price Promotions Substitutes	Forecasting PI Data Planogram Compliance Store Labor Product Placement Number of SKUs
	Time
	Payday
	Market
	Size & Competitive Density
Time	
Day of Week	

Table 4-2
Drivers Extracted for Future Research

Supplier
Supplier-Specific Market
Shared

Retailer
Planogram Compliance
Store Labor
Product Placement
Number of SKUs

Time
Payday

Market
Size & Competitive
Density

5. Conclusion

The object of this research project was to discover future research streams for the next phase of OSA literature. On shelf availability has been a topic of literature since the late 1960's and there has been minimal improvement to OSA levels since that time. The retail industry views OSA as a key indicator of performance (sales) and customer satisfaction. Consistent throughout the literature and the interviews was the emphasis on store execution as the breakdown in OSA performance. However, the retail controlled drivers are not the only issues confronting good OSA performance as found throughout the literature and interviews drivers controlled by factors relating to the supplier, market, and time.

The limitation of this research project stem from the scale of the interview process. Industry experts were not sampled from retailers for the interviews. However, the perspective of the retailer is considered in the analysis of the potential drivers. Additionally, from the practitioner perspective any improvement in OSA derived from future research suggested in this paper will benefit the retailer as OSA must be addressed at all points in the supply chain.

The findings of this research isolated potential drivers of OOS that have yet to be addressed in literature and are relevant to the industry and timely for examination. This research adds to the current body of OSA research and contributes to the next phase of OOS literature, building on the foundation established in the literature of the last 40-plus years. The seven suspected drivers extracted from the model will guide future research. The industry perspective developed through the interviews makes these drivers significant in the future of OSA research. A significant cut could be made in average OSA levels as future research encompasses a comprehensive approach at multiple levels of the supply chain.

The complexity of this issue cannot be understated and will require a comprehensive approach. The majority of the drivers discussed in the current literature are still relevant today.

However, addressing these current drivers independently of one another is not driving down OOS rates. As more research is done on OSA and more drivers are discovered, comprehensive plans engaging multiple drivers must be designed and staged at multiple levels of the supply chain in order to really see OSA reach acceptable levels.

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