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BEST IN CLASS USE OF POINT OF SALE DATA TO DRIVE DEMAND PLANNING AND FORECASTING

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ABSTRACT

In recent years there has been a significant shift in industry strategy and business due to the emergence of data-driven business models. New industry standards and technological advances have allowed point-of-sale (POS) data to be utilized in increasingly inventive and strategic ways. One of the most effective uses of POS data is in inventory management. POS data gives users supply chain transparency. This transparency results in a more robust understanding of demand, which improves both forecasting and replenishment. However, many of the capabilities of this POS data are still unknown as companies struggle to aggregate, cleanse, and make effective future decisions from the data. There is tremendous potential to use this customer data to influence long term forecasts and prevent stock outs. Reducing out-of stocks generates incremental sales, therefore effectively improving business performance.

To help the industry better understand the potential uses of POS data in this space, a background review of publicly available information was conducted to identify current and planned future strategies of customer data use. Furthermore, interviews were conducted with leading companies of varied sizes in various industries to understand specific POS strategies and uses within each respective company (See interview guide Appendix B). The findings of these conversations were compiled to identify the best in class use of customer data.

Furthermore, one company in particular, Company 'A', was targeted to develop an in-depth understanding of its use of POS data. After conversations with many different employees involved in various segments of Company 'A', the dissemination of this customer information from the register in store to high level demand planning was mapped. This current flow of POS data was then analyzed to target inefficiencies, and offer recommendations for improvement.

Ultimately, throughout the investigation into the methods employed by industry leaders as well as Company ‘A’ it was concluded that most organizations struggle to use POS data effectively. Due to the lack of control over POS data availability, detail, and format industry professionals have struggled to aggregate the data and use it to impact long term demand planning. However, POS data is being used effectively to better understand buying behavior of consumers, and track promotions and new products.

The recommendation to Company ‘A’ is the development of a central data repository. In this data bank Company ‘A’ can streamline and aggregate incoming data from various third party providers and retailers. By ensuring all incoming data meets required minimum parameters and timeliness the data in the repository can be assured useful. Moreover, syndicated market data can also be incorporated in the repository to allow more robust analysis and review when needed. Individuals in all functions of Company ‘A’ can be given access to the data bank, therefore simplifying the streamlining the data analysis process. This tool can also be valuable at the headquarters level when conducting monthly demand and supply review and creating the national level forecast. The remainder of this paper is organized first by the literature review, followed by the methodology, concluding with the discussion and recommendation.

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Chapter 1

Literature Review and Background

POS data usage has been the topic of much research and discussion in recent years as its capabilities continue to grow. In many businesses point-of-sale data is used in virtually every function of the organization including marketing, sales, financing, operations, supply chain, and manufacturing. Studies have found that POS data is the best measurement of out of stock rates as it can yield a broader set of measurements provided it is sustained and points toward root causes (Greun 2007). In fact POS data has 85 percent or greater potential accuracy of estimating out of stocks. This can have a profound impact when implemented by businesses as retailers lose 4 percent of annual sales due to out of stock items, costing manufacturers $23 million for every $1 billion in sales.

However, this data must first be routed from the customer, through a third party data provider and finally to the company. While different third party providers are used by different customers, such as RSI or Market6, most perform the same basic functions of data scrubbing creating more accurate reports and analyzing capabilities.

One of the biggest obstacles to increased POS application and data use has been the reluctance of retailers to share this data with suppliers (TIBCO 2011). Only 83 percent of retailers share POS data with their suppliers (FMI/GMA 2015). Often retailers do not allow access to store level POS data because they don’t want to give up control of their own replenishment. This divide can be frustrating for many suppliers who feel they could run a much

more efficient and clean business by using this POS data to drive their own replenishment decisions.

In fact it is important to note the potential positive impact of POS information sharing for both suppliers and retailers. Product availability drives where customers shop. In fact, it has been found as one of the top three reasons a customer chooses a certain store or retail location. Therefore, on-shelf availability (OSA) is key to keeping loyal customers coming back. In fact, 70 percent of customers will permanently abandon a specific store or location after the third instance of stock out for the particular item they need (FMI/GMA 2015).This results in significant potential lost revenue for retailers. Nevertheless, the out of stock (OOS) rate remains somewhere around 8 percent, up to 10 percent for promoted items (FMI/GMA 2015). Obviously, this is an issue that requires greater communication and collaboration of retailers and suppliers in order to be solved.

Fifty-nine percent of manufacturers base OOS calculations on retailer provided POS data. Therefore it is in the retailer's best interest to share this data and ensure its accuracy so that these potential lost revenues aren't realized. Moreover, data sharing between retailers and manufacturers builds trust, strengthens partnerships, and ultimately allows suppliers to better meet retailers' needs. With accurate POS data, manufacturers can better understand promotional effectiveness and demand patterns to better forecast and ensure on-shelf availability (FMI/GMA 2015).

Even when given access to this POS data, not all suppliers use this data. A study found that only 57 percent of suppliers use provided POS data. While POS data is generally accepted to be the most pure, and therefore accurate, due to the disparity of data formats and increased complexity for suppliers to integrate the data into their planning and forecasting, only 57 percent

of suppliers are attempting to incorporate it in a meaningful way (FMI/GMA 2015). Due to timing gaps, data complexity and difficulty with integration, these suppliers often rely on shipment data as a key production and planning forecast input instead.

When used effectively, the potential for POS data is broad and limitless. It can help companies understand customer response to promotions, and new product introductions. Moreover, the nature of demand can be better understood to make more informed production decisions regarding future capabilities and inventory of new or promoted products.

Future opportunities still exist to merge collected lost sales history with sales history to more closely represent true demand, therefore creating better forecasts (Greun 2007). Moreover, many companies have become more involved with competitive intelligence, an approach used to make informed business decisions using information or data. POS data is critical in this field. It feeds into the data gathered by companies which is then analyzed and manipulated to identify risks and opportunities. To aid in this process tools such as the MarketAnalyzer, "an interactive visual analytics system designed to allow vendors to increase their competitive intelligence" have been adopted by many companies struggling to use POS data effectively (Ko 2012). Systems such as MarketAnalyzer enable the aggregation of point of sale data to provide analysts with a detailed understanding of what is being sold and where. According to Ko, analysts can even export the impact of regional demographics and trends (Ko 2012).

Another popular enabling technology is complex event processing (CEP). This technology works to combine data from multiple sources to infer events or patterns that suggest more complicated circumstances. The goal of complex event processing is to identify meaningful events and respond to them as quickly as possible. This type of software can aggregate massive amount of POS data, understand trends and outliers, then target these outliers,

deliver alerts with recommended solutions or take action automatically to fix problems. “For example, CEP software might note a halt in the regular sales of a stock-keeping unit (SKU) at Wal*Mart store #1289, indicating a potential stockout. With CEP, the system automatically calculates estimated on-hand inventory, reviews recent shipments of that SKU, and applies rules to automatically determine that the root cause of the halt in sales is failure to replenish the promoted endcap display in that store” (TIBCO 2011).

It is generally agreed that the use of POS data will continue to undergo profound transformation in the next several years due to the transition of office systems to the cloud, growing presence of mobile and handheld devices, as well as the rapid changes in consumer behavior. However, the focus of this study will be to compile current industry standards of POS use, and understand their differences. Best in class strategies will be discussed and analyzed. While many studies and companies alike focus POS data use exclusively for short term replenishment, the focus of this paper will remain on how customer data can impact long term forecasts to prevent out of stocks.

Additionally, unlike the many general high-level papers and studies conducted on POS data use and its attributes, one specific corporation’s use of POS data through all channels will be investigated and analyzed. By studying the timing, format, communication, and use of customer information as it flows from the customer back through the supply chain a better understanding of its capabilities can be developed and improvements can be suggested.

Chapter 2

Methodology

The methodology used in analyzing current and potential POS data use in driving more accurate forecasts and long term demand planning is twofold. First, a summary of current and best known POS data usage as gathered through interviews conducted with individuals at many different companies using the interview guide included in Appendix A will be provided. The individuals interviewed for this portion of the thesis are those who see and use POS data in their jobs everyday and could help communicate the nuances of POS data use depending on industry, business structure, and business need.

The second portion of this thesis will be dedicated to POS data usage within one specific consumer package goods manufacturer, referred to as Company ‘A’. Interviews with over 20 individuals of many different roles, titles, and functions within Company ‘A’ were conducted to gain an in-depth understanding of Company ‘A’’s demand development forecasting strategy as well and the flow of POS data within that demand development. In addition, future opportunities and POS data usage were investigated so recommendations could be made.

Chapter 3

Discussion

Best Known Methods

Five separate industry professionals, from four different companies doing business in various industries were generous enough to donate their time to the pursuit of knowledge in regards to best known methods of POS data usage (See Appendix A). While the challenges of incorporating this data varied depending on interviewee, the areas of use for POS data within each organization was almost identical. Furthermore, all agreed on the value of POS data as it is the truest and most accurate reflection of a supply chain's state. All other information and data can be muddied by many factors such as inventory policies or shipment strategy. In general, the knowledge gained through these discussions supported the findings in the background and literature review. More specifically, the conversations reiterated the idea that few in industry have learned how to harness the potential of this POS data and make it meaningful for more than just short term replenishment and demand decisions. Throughout my investigation all agreed this data has potential to make long term demand planning more accurate, however few have been able to flow the data back that far into the supply chain. Instead the current main focus and use of POS data is short term and centered around on shelf availability.

POS data is used in most major organizations today in many different departments. Many of these departments evaluate POS data every day. Most commonly these departments investigate issues such as how much of a product was sold yesterday, how much is still on hand,

how much was received. Sales and demand planning were most often the topic of discussion as they use the data most commonly. In general, the sales teams analyze this data everyday to understand trends, track internal performance, and drive external decisions. Demand planning teams view this data as the truest and most accurate way to understand what is being bought and where. Therefore, this POS data is a driving factor in creating a consumption based forecast. This data also drives raw material and production planning and store level replenishment decisions. Moreover, this data can help forecasters to better evaluate their past plans. By comparing the POS data, which represents actual demand to prior years, forecasts and projections, demand planners can gain valuable insight into consumer behavior.

Industry professionals belonging to larger organizations emphasized the use of POS data in the realm of finance. Finance departments use this important customer data to understand if the company is making and selling as much as projected. Moreover, this data can be valuable in measuring important metrics such as units, dollars, dollar per transaction, average dollar spent, and the shipment to consumption ratio. Companies also use this data to understand retail growth as compared to competitors to calculate their current market share. All of these statistics are then often compared to past months and years to better understand the market, their product and what their best strategy moving forward might be.

POS data is also used to better understand market share of a particular product. The POS data, or actuals, for a previous week or month can be compared to what the market sold to calculate the market share of a product. This allows companies to better understand their own retail growth and compare their business to that of their competitors.

Marketing was another department in which POS data is very commonly used to understand and plan future promotions. The success of a particular promotion can be evaluated

and analyzed through this data. Moreover, though less common due to organizational capabilities, through any type of loyalty card a marketing team can better understand the buying behavior of their customers. This information helps to drive important marketing campaigns and cross promotions. It also allows organization to better target promotions to the audience and location in which they believe they will get the best response.

Moreover, multiple organizations mentioned that POS data is a major driver to understanding trends and consumer buying behavior. When issues arise, whether an out of stock or excessive inventory, production staff tracks the problems back through the system and to the POS data in an attempt to find the root cause. Through this practice companies can better understand their successful and unsuccessful forecasts and revise them accordingly.

Almost all companies are viewing this POS data at a very granular level, by SKU down to the store level. Moreover, almost all companies gain access to this data only through a third party data provider or they buy it from the retailer themselves. Most companies today are encountering three distinct types of retailers. The first type are generally large retailers who understand the mutual value and benefit of POS data and therefore both collect the data and are willing to share it. The second type of retailer collects the data, but pairs with a third party data provider who cleanses the data and then sells it to the organization in a more meaningful format. The third distinct group of retailers doesn't have the capability to collect the data, doesn't recognize its value, or is unwilling to give it out for a variety of reasons.

The above defined three types of retailers' commonly dealt with by most organizations demonstrates the common challenge to effective POS data use, lack of control. Because this POS data starts with the retailers, they play a huge part in this process. As mentioned above, this POS data plays a major role in forecasting and demand planning efforts. However, it is almost

impossible for organizations to gain access to 100 percent of this customer data and therefore the forecast still includes some statistical component to account for this lack of information.

For example, some organizations through vendor managed inventory (VMI) systems have the ability to put employees at sites in certain retailer stores and therefore gains access to POS data on-site. Other retailers that aren't VMI often want to regulate their own stores performance and are resistant to give that same organization access to store level data. In these circumstances, less reliable and accurate data such as data from distribution centers must be relied on instead. Moreover, for those organizations that can place employees in customer stores with eyes on the shelf, there is less of a push to invest in POS data with that customer because they have an employee present at the store with oversight into the system.

For those stores that opt to have their customer data sent to a third party provider, such as Nielson or Market 6, these stores have the sovereignty to decide which third party provider to engage in business. The organization then must do business with this third party provider and the format of this data is often determined by the third party provider's capabilities. Organizations, therefore, have little control over this data collection and formatting process and instead accept whatever POS data they can receive or buy in the format in which it is given.

This lack of control was often brought up in discussion as a huge barrier to the aggregation of data from different customers. Organizations find it difficult to aggregate the various types and formats of data in a way that allows them to make meaningful demand planning and forecasting decisions. While some organizations receive the data from a third party in excel sheets which makes the data easy to analyze, edit, manipulate, and combine in a central warehouse of information which can then feed into business operations software such as SAP. Many others receive the data in different formats depending on their customer or product.

Moreover, forecasters, demand planners, and marketers alike are often overwhelmed by incredible amounts of data to filter through, some of it being incomplete or difficult to interpret. Therefore they are instead forced to keep this data separate depending on retailer or third party data provider. Ultimately, many organizations voiced their frustration with the effectiveness of using POS data to drive national forecasts and decisions due to these limitations. Companies cannot receive enough meaningful customer data to drive these decisions, and the accuracy of the data they do receive is often questioned.

The accuracy of this data depends heavily on the organization and diligence of these retailers. For example, imagine a customer is purchasing 10 yogurts for a special price of $10. It is up to the individual retailer to train their employees to scan each of these 10 yogurts as opposed to scanning 1 and multiplying it by 10 as this could result in inaccurate POS data.

This lack of control also extends to the accuracy of retailer regulation of inventory. Different touch points in the supply chain often define out of stock differently which can cause inconsistencies in POS data and confusion. According to retailer data a company could believe their product to be in-stock; however the physical product could actually be sitting in the back room not on the shelves. Therefore, the inventory and therefore POS data can only ever be as good as the retailer measures it.

Another challenge to ensuring the accuracy and usefulness of this POS data is its timing. Different third parties report the data not only in different formats but at different time intervals. The data is often seen as more meaningful and accurate when it is updated real time and can be obtained daily. Many third party data providers do report and update data on a daily basis, but some such as Nielson are scheduled with a one week lag.

In some cases, though, there was obvious successful use of POS data to impact high level demand planning. For these companies, POS data was regularly analyzed by category/brand to best understand the nature of demand. This then allowed the organization to build buffer tanks based on this knowledge. Moreover, POS data is utilized during a product change or new launch to understand the public demand for the product. The POS data is analyzed consistently for these new or changed products to understand how to best facilitate its supply chain, such as ramping up capabilities or inventory.

Commonly, it was found that POS data plays a major role in evaluating past projections and forecasts. On the operational side, POS data is evaluated monthly and compared to shipment and consumption forecasts. Key learnings are highlighted, discussed and incorporated into future projections. Moreover, different algorithms can be developed to better predict future demand with the use of POS data. For example, algorithms can calculate shipment based on the rate of growth of a specific SKU in the prior month. To do this, of course, an organization has to be sure it has plenty of good reliable data. On the divisional side, POS data is validated through a review in consensus meetings a collaboration of marketing and sales.

When asked what could be improved to allow more accurate and pervasive use of POS data in demand planning, industry professionals highlighted the development of relationships and communications with their customers, retailers, and field teams. The input of those who have a physical presence at the product location can provide the most insight into interpreting the nature of POS data and its impact on long term planning.

Further research into forecasting methods related to POS data revealed a new method in which companies augment POS data with real live customer reviews to improve forecast accuracy. Using this approach, a forecast is based on around 80 percent historical POS data, with

an influence of 20 percent related to a customer's buying behavior. Customer's buying behavior is learned through in-depth interviews conducted by retailers with the help of the larger supplier. These interviews probe the questions surrounding why shoppers behave the way they do. Customers are asked questions related to their buying behavior, the establishment of their preferred brands, and their reaction to certain item stock outs or promotions. These customer behaviors can help companies produce better informed and more accurate forecasts.

Moreover, buying behavior can be predicted depending on the type of shopper, and therefore the type retailer. Ultimately retailers must choose an ultimate goal or pursuit. This results in five different types of retailers focused on five different types of end goals: price, service, product, experience or access. Each retailer has one of these five goals as a primary attribute meaning that they dominate in that realm. Moreover, each retailer also has a secondary attribute and in that realm it is hyper competitive. For example, Wal-Mart dominates the price category and is hyper competitive in product. On the other hand, IKEA produces the ultimate customer experience and dominates that realm. This distinction in types of retailers is important because the type of retailer dictates the type of shopper it attracts. Moreover, the type of shopper dictates buyer behavior such as the customer reaction to a stock-out. While this type of forecasting method ultimately relies mainly on accurate and available POS data, the customer reviews which supplement the data add another layer and type of demand insight to forecasting.

Chapter 4

Case Study

Analysis

To best understand how POS data impacts the demand planning and forecasting of Company 'A', their demand planning strategy was first investigated. Essentially Company 'A' has a six-step demand planning process as shown in Figure 1. Step 1 is the preparation of data where the raw data concerning shipments, product dimensions, etc. are collected. This data is then scrubbed and extraneous data is removed. Step 2 is the creation of a forecast. This baseline forecast is based primarily off a statistical process which looks to past history and adjusts for onetime events and known changes. Step 3 is deemed collaboration. At this stage sales teams, as well as customer teams collaborate to improve the accuracy of the baseline forecast created in Step 2 by adding additional information not captured by shipments such as promotional events.

A separate national forecast is created in Step 4 at the headquarters' level. This step, called the consensus, is a step in the Sales & Operations' Planning process, which creates a forecast driven by the input of many different functions such as sales, marketing, and finance at the national level. This high level forecast attempts to predict future monthly demand, specifically volume, to drive a forecast for the next two years. This consensus forecast reconciles all the cross functional inputs. Outside data, including consumption, distribution, market and category trends from sources such as from Nielson are taken into account. But each function brings in the best information about trends, business growth expectations, future programming,

risks, and opportunities to create the best forecast at a national level to be used to manage the business and send to supply planning. Step 5 finalizes the operational forecast for a product. At this step the forecast created at Step 3, and Step 4 are compared, and analyzed so that a compromise and final forecast can be reached and properly cascaded down to the individual product level.

Often the collaborative forecast created in Step 3 is much different than the national forecast created in Step 4. At Step 5, forecasters attempt to close this gap, though often the national forecast is favored. The last step, Step 6, is considered most critical as it evaluates the forecasting formulas to measure error and improve future forecasts.

Figure 1. Demand Planning Process

So where and how does POS data impact this finalized forecast? After thorough research and discussion with individuals internal to Company 'A' the flow of POS data was developed (Figure 2). Initially, POS data is gathered at store register by SKU. This data is then sent to a pre-determined 3rd party data provider. There are various 3rd party data providers with different capabilities, accuracy, features, and reporting schedules. Additionally, some retailers, such as Wal*Mart, develop their own internal data analysis software and capabilities which analyze and cleanse the data. It is the retailer that makes the decision of which 3rd party data provider to

partner with. Furthermore, the amount and detail of the data made available by the 3rd party for purchase is up to the discretion of the retailer.

Third party data providers scrub and clean the data to make it more accurate and meaningful. For example, a common 3rd party data provider chosen by retailers is RSI, Retail Solutions Inc. RSI takes the retailer direct data and cleanses it so that it can then be filtered by different categories for sales and customer teams in real time. Various 3rd party data providers were contacted to better understand their capabilities, functions, and impact on this process. Unfortunately, this type of information was deemed confidential and therefore could not be shared.

Other popular data providers include Market 6, Atlas, EYC, and Nielson. Often retailers and Company 'A' will subscribe to combinations of two or even three data providers due to their unique capabilities. For example, RSI is often used to manage stock and is used to read inventory by store with only a one-day lag time. On the other hand, while still using SKU level data per store, EYC tracks customer purchases in their entirety so they can be used to plan promotions, though the data has a week lag time. Moreover, Nielson offers weekly updates each month but incorporates competitor information which can be valuable when analyzing sales.

For the field input process, Customer Teams manage a specific account. These teams purchase POS data for their account from the associated data provider. The format of this data varies by provider and is often presented in interactive tools to allow it to be manipulated by the user. Regardless of data provider, Customer Teams most often use the data to track out of stock items, seasonal items, new items, and promotions. Promotions make up a majority of the business of Company 'A' so it is important to understand the performance of past and future promotions. The Customer Team analyzes the data daily at the store level by SKU. They

summarize which items are doing well, highlight internal issues such as shortages, and study past demand to improve future forecasts. Moreover the data gives these teams insight to better understanding the lift a promotion provides, and therefore better forecast upcoming events. Moreover, the timing of takeaway during a promotion can be analyzed to better pace future demand. Lastly, the customer teams study and analyze general trends.

After analyzing the data to track performance and identify imminent issues, the Customer Teams then report the data to the Demand Planning Team. This process can be seen in Figure 2.

Figure 2. Existing Flow of Customer Information that Exists Within Company 'A'

This data drives the creation of Customer Planning Worksheets (CPW). Each Customer Team has their own individual CPW which lays out their yearly plan of both promotional and non-promotional weeks by promoted cluster (i.e. brand). Market Demand Planners, who work with the Customer Teams, can then aggregate these individual CPWs to develop a forecast based on the customer make-up of their location. Market Demand Planners, which make up the field portion of the Demand Planning Team, are each responsible for a specific number of selling locations. For each location a full year plan and forecast is statistically generated. Market Demand Planners use these CPWs, to capture anticipated promotional pacing and volume, and develop the forecast for the coming year. They can do this through the use of individual CPWs based on the customers around their location, or they can use a consolidated CPW which contains promotional and non-promotional activity for all customers. This consolidated CPW

contains the yearly plan for all major customers and can be filtered using tabs for each promoted cluster (brand).

Either way, the resulting worksheet or forecast incorporates promotional activity reported from sales teams, a baseline forecast based entirely off of shipment information, and data from Customer Teams, or POS data. This forecast is the promotional forecast created in Step 3 of Company 'A''s demand planning collaboration process. As such, POS is a key input into the Market Demand Planning detailed SKU level forecast. However, the POS data only filters into forecast in this way for customers from which Company 'A' can obtain meaningful and accurate POS data with enough critical mass.

The headquarters process, creating the national forecast, "Step 4," which may ultimately win out as the finalized forecast created in Step 5, also incorporates POS data in at least two levels. First, the numerous functional groups bringing input to future forecasts, such as Marketing and Sales, are influenced by market data provided by the Consumer Insights team, who analyze the POS data provided. This consumption information helps the teams predict promotional impact, distribution information, and pacing which is used to improve future forecasts, particularly when merged with overall market trend data.

Second, the Market Demand Planners' input, from "Step 3," is part of what the HQ Demand Planners use since it brings detailed customer information into the forecast. Because the Market Demand Planners use POS information to reach their conclusions, it's indirectly capturing the consumption knowledge as part of the HQ Demand Planning input as well as capturing the correct location splits and pacing of the national forecast. Therefore it becomes clear that the POS data once filtered through Customer Teams, impacts the forecast of Demand

Planners in the field or promotional forecast and the HQ national forecast. And the finalized forecast is a product of this promotional and national forecast.

Unfortunately, there exist many barriers to the ultimate goal of using POS data to more accurately and effectively drive long term demand planning for Company 'A'. First and foremost, is Company 'A''s lack of control. Company 'A''s customers, mainly retailers, have the control to limit Company 'A''s access, and ultimately determine the format in which they access the data. Therefore, as many retailers' use different 3rd party data providers, Company 'A' has difficulty aggregating the purchased data of different format and detail. Company 'A' has set a long term goal to aggregate 65 percent of customer data on one database to drive forecasts, to align with the industry report that 65 percent of critical mass is needed to impact product forecasting.

However, as discussed previously, currently Company 'A' has the capability to aggregate only 37 percent of customer data in a meaningful way due to limitations. Company 'A' only works with POS data from a certain customer if it is willing to collaborate, has the ability to provide this data, and Company 'A' recognizes an opportunity and potential return on investment in collecting this data. In certain scenarios, Company 'A' has adequate oversight and capability to generate a relatively accurate forecast based on information available to them aside from POS data. In these circumstances, Company 'A' may often choose not to purchase this data from third party data providers and instead rely on their own data and analytical capabilities. Interestingly, however is that this 37 percent is supported by 3 different data providers. This demonstrates some future capability to create meaningful data banks from multiple data sources with different initially formatting.

In order to leverage this data broadly and truly integrate it into any demand planning process formally, there needs to be the capability to pull the data from one Data/Demand Signal Repository (DSR) and not multiple tools. Many within Company 'A' see this goal of building one true internal DSR, demand/data repository system as extremely beneficial to the future of forecasting. Data is now more widely available, more accurate, and timely so the potential to synchronize this data to demand planning is relevant and could make a huge impact on supply chain efficiency and performance. This ideal DSR would bring together data from Market 6, RSI, Atlas and Nielson to create a data bank with all customers' sales histories, trends, past performance, and even syndicated competitive information. Therefore, in addition to using the data for store operations and execution POS data could flow back through the supply chain and have an obvious role and effect in customer demand planning.

Another challenge has been the availability of retailer data. While more retailers are providing this information now, some still are not, and data is not uniform. Some of this gap has been related to technology, but some of the resistance to information sharing stems from the retailers' lack of understanding of the potential value of this shared data. For example, increased data visibility into the supply chain can help suppliers and retailers collaborate sooner to improve supplier on shelf availability (OSA). There also exists much frustration from both suppliers and retailers due to inaccurate interpretation of the POS data which results in forecasting and replenishment mistakes. Similar to all big data, POS data is often overwhelming as there is so much data and information. Supplier and retailers need to work together to better understand what the data is, and how it can be useful and accurate. As suppliers and retailers collaborate on uniform measures such as OSA and see longer term improvement in that area as a result of better planning, the amount of sharing and use of this data is expected to increase. The joint benefits of

customer satisfaction and revenue growth are certainly sufficient incentive for both retailers and suppliers.

Ultimately, the current integration of POS data into the business practices of Company ‘A’ is centered primarily on replenishment in store. Moreover, the data is used widely in short term forecasting and promotional planning. The impact of POS data in long term demand planning is convoluted, indirect, and limited to the 37 percent of customers for which Company ‘A’ uses this POS data.

Recommendations

For future improvements in the use of this POS data, it is recommended that Company ‘A’ define the boundaries and requirements for which it is willing to invest in the POS data of its customers. These requirements should be related to three basic themes: the customer’s willingness to collaborate, the customer’s ability to provide the data, and the return on investment in the data for Company ‘A’. Moreover, it should actively work to increase awareness and understanding of the benefits of the use of POS data in demand planning and forecasting among its customers. Therefore, encouraging all customers to develop their capabilities and practices to grow to fulfill the requirements Company ‘A’ has defined for its investment in POS data use.

This could be achieved in a concrete way by an evaluation of each customer’s future potential for POS data collaboration. This evaluation could include a look into the current methods and inputs into forecasting and the historical accuracy of that forecast among other factors. After the evaluation, Company ‘A’ can determine with which customers there exists an

opportunity for improved supply chain management and therefore a return on investment in the POS data of that customer. These identified customers can then be targeted for increased communication and collaboration with Company ‘A’ to help them meet the other defined requirements related to a willingness to collaborate and ability to provide the data. Ultimately, by targeting the customers for which POS data integration could have a meaningful impact on improving supply chain management with the customer, Company ‘A’ will get closer to its goal of aggregating 65 percent of customer data to impact product forecasting.

Company ‘A’ would significantly benefit from better connecting this POS data back through the supply chain to move towards a more demand driven supply chain. The potential exists to use POS data to connect the demand signal back through the supply chain to production. It is recommended that Company ‘A’ develop some type of central data repository. As the system exists now, retailers have the power to invest in whichever third party data provider they choose, or even filter the data through their own data analysis software. However, Company ‘A’ could make more meaningful use of the data it does gain access to by developing a central data bank into which all shared data can be entered. This would require a reformatting of all received into a standard format.

To do this Company ‘A’ should predefine necessary data parameters and requirements for it to be meaningfully applied and used. All received data from third party data providers, or the retailers themselves should include at least these minimum parameters or requirements. All extra information received could be included as additional information. Moreover, no data should be entered into the database that does not meet the minimum parameters and the retailer and third party should be notified and encouraged to include or collect the missing parameters.

Moreover, the data in the repository should have the capabilities to be filtered based on these critical parameters such as location, store, date, retailer, brand etc. Lastly, select individuals from all departments involved in the creation of forecasts and other demand planning activities should have access to the data bank. Therefore, all functions within the group have immediate access to the same data through this repository.

The data bank should be automated to pull the data as it is received from third parties or retailers themselves. While data is reported with different timeliness depending on the provider or retailer, these differences should be highlighted within the system so that there is clear understanding of when the data was collected and when it was received into Company 'A''s system. Moreover, all third parties and retailers should be encouraged to share the data as frequently as possible so that the data bank can be an accurate depiction of demand.

There is an argument that POS data isn't needed to measure sales. A manufacturer already knows exactly what they shipped to each retailer and when. However, shipments are far removed from consumer behavior; so much can happen from the time a product is shipped to when it is bought on the shelf. Moreover, POS data is needed to understand how much a shopper paid for an item, exactly when they bought it, and what type of in-store promotions influenced the sale. POS data is so valuable because it measures actual behavior, not what people think or feel. It is specific. It communicates what specific product was purchased in a specific store at a particular moment under a specific set of market and competitive conditions.

On the other hand, POS data focuses on products in a single retailer. It alone doesn't tell anything about competing stores, or competing products. In order to make more general learnings, or compare across retailers, syndicated market data must be used. Syndicated data can be purchased from providers such as Nielsen, IRI, and SPINS. Currently, Company 'A' employs

the use of syndicated data to make conclusions and assumptions when POS data isn't received from retailers. Syndicated data can capture all products in most major categories. Moreover, it generally includes and aggregates stores in a geographic market or channel. Syndicated data offers the capability to analyze competitor's sales, adjacent categories, and other sales trends.

While syndicated data can be expensive, since Company 'A' has existing subscriptions to access the data it is recommended to incorporate that data into the central data repository as well. This would allow all functions of Company 'A' another resource for analyzing past demand and forecasting future demand. Moreover, it simplifies and streamlines the ability to access and use this data as all pertinent data is in one place. Moreover, the data could be filtered to only access POS data, or syndicated data depending on the intentions and goal of the user. See Figure 3 below which depicts the recommended flow of POS data within the Company.

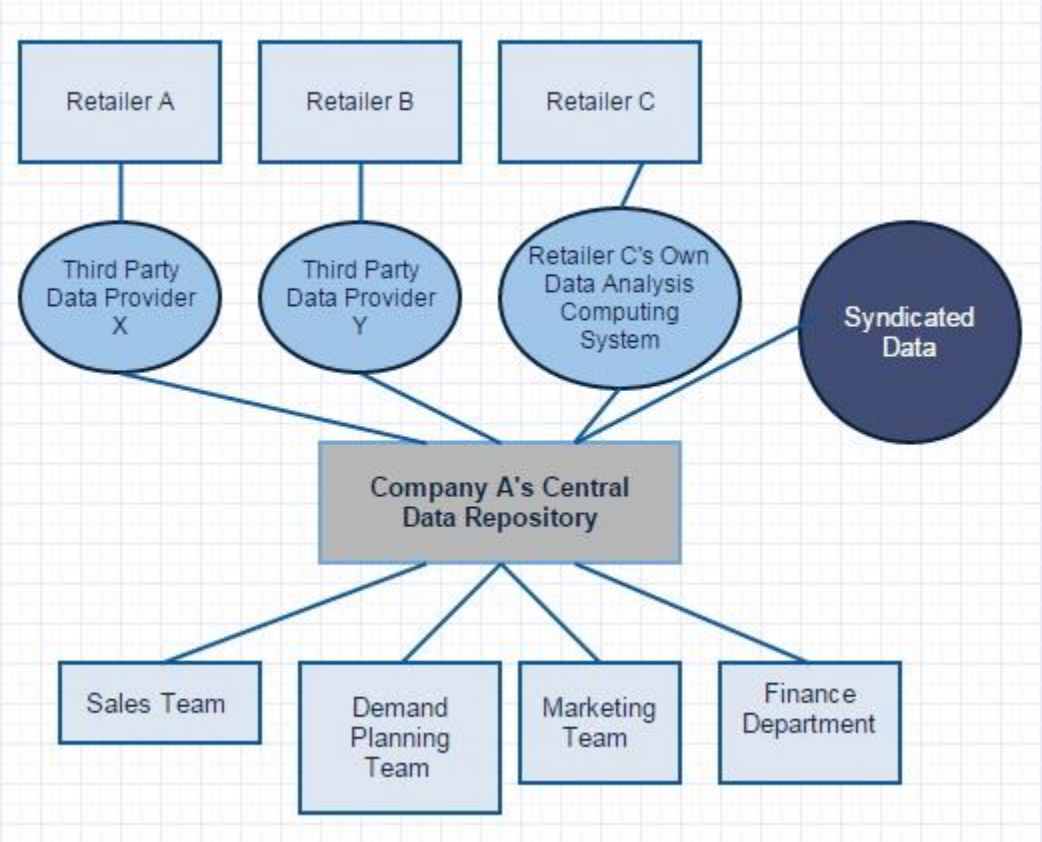

Figure 3. Recommended Flow of POS Data within Company 'A'

Moreover, the use of this central data repository and its capabilities could prove valuable data not only to the functional department of Company 'A' but also to its high level supply and demand reviews as well as headquarters reviews and forecast development. There is potential for this POS data to be used in a more meaningful way throughout the supply chain and building some type of central data repository internal to Company 'A' would be the next step in developing this potential.

Appendix A

Overview of Companies Involved

Each company will be identified by industry and size, with a "large" company having revenues of greater than 25 billion dollars, a "medium" company having revenues of over 15 billion and less than 25 billion, and a "small" company having revenues of less than 15 billion dollars.

	Title of Contact	***Revenue***	***Industry***
Company 'A'	*15 Contacts at various levels and in various functions*	*Large*	*Consumer Package Goods*
Company B	*Business Development Manager*	*Medium*	*Personal and Health Care*
Company C	*Flow Planning Director*	*Small*	*Fashion Retailer*
Company D	*Director of Collaborative Planning, Forecasting, and Replenishment*	*Large*	*Food Processing*
Company E	*Demand Planner*	*Large*	*Personal Care*
Company E	*Demand Planning Manager*	*Large*	*Personal Care*

Appendix B

Phone Interview Guide

1. Where in your organization is customer (POS) data used?
    a. What customer information is included
    b. What does it look like (in what form do the branches of your organization see this data)?
    c. Where does the data flow?
    d. How is the data communicated back to branches/DCs/supply planning?
    e. What is the timing of this communication?

2. Do you use customer data to influence high level supply and demand planning (not just short term replenishment)?
    a. How does your organization aggregate data from different customers, and third party data provides to make meaningful so can impact planning?

3. Is your company's current use of POS data effective?
    a. Where do you see room for improvement?

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ACADEMIC VITA

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EDUCATION **Bachelor of Science in Industrial Engineering**
Schreyer Honors College
The Pennsylvania State University, University Park, PA
Anticipated Graduation: May 2015

GLOBAL EXPERIENCE **Study Abroad in Cape Town, South Africa** Spring 2014
The University of Cape Town

- Enrolled in a full semester of 4 courses including Electrical Circuits and Business Analytics
- Taught math concepts to a class of 27 4th grade students weekly for 15+ weeks

Study Abroad in China Summer 2012
The Pennsylvania State University

- Investigated impact of globalization on engineering design methods and processes in Chinese engineering firms and manufacturing plants

PROFESSIONAL EXPERIENCE **Ernst & Young,** New York, New York
Valuation and Business Modeling, Capital Equipment Intern Summer 2014

- Built a market curve for computer equipment which improved accuracy of valuations and will be used in future valuations by capital equipment valuation team
- Developed and calculated a valuation analysis of an acquired company's 5000+ item asset listing based on financial, accounting, and engineering data
- Analyzed specialists calculations in valuations and computed sensitivities to authenticate specialists' methods

Intel Corporation, Chandler, Arizona
Capital Planning Quality Intern Summer 2013

- Investigated, interpreted, and analyzed 10+ core supplier continuous quality improvement processes and tools to leverage best known methods and improve overall supply chain management
- Developed alternative models for supplier assessments along with a cost model of savings which resulted in a hybrid assessment pilot with the potential to reduce costs by 33%
- Identified and evaluated potential supplier evaluation process waste utilizing critical path analysis and time studies and proposed changes to improve efficiency

LEADERSHIP

President, Penn State's Institute of Industrial Engineers (IIE) 2014

- Organized and led student body meeting for 50+ students each month to

communicate upcoming social and professional opportunities

- Collaborated with executive team of 10 IIE students to develop and execute new events
- Managed professional events including: Industrial Engineering Career Fair, Annual Banquet, and Family Day

Liason, Scholar Advancement Team (SAT), *Schreyer Honors College* 2013-14

- Directed 10+ information sessions and gave tours to prospective families
- Engaged with 100+ alumni, donors, and honored guests as a Schreyer Honors College representative at all Schreyer special events
- Coordinated 25+ member schedules including advisors, administration and Schreyer faculty to plan all Schreyer events

Career Envoy, *Penn State College of Engineering* 2012-14

Mentor & Rover, *Penn State Women in Engineering Program Orientation* 2012-14

HONORS

Evan Pugh Scholar Award	2014
Recipient, Life Technologies Scholarship	2013
Finalist, New York Times Public Speaking Contest	2013