

IMPROVING THE SUPPLY CHAIN FLOW FOR UTILITIES
THE NORTH AMERICAN ASSOCIATION OF UTILITY DISTRIBUTORS

Capstone Project

by

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ABSTRACT

A major problem in utilities is the shift in the relationship between revenue and cost. Utility company revenue is consistently decreasing, while operational costs continue to increase. The North American Association of Utility Distributors (NAAUD) seeks to alleviate this problem by answering the question: How can organizations within the utilities supply chain achieve better control over the market?

Information flow within the supply chain of the utilities industry is one of the key factors to answering this question. Currently, many roadblocks exist in the supply chain between utilities, distributors, and manufacturers; one of which is information flow. In this paper, NAAUD requested an examination of the problems pertaining to information flow within the utilities industry. Additionally, the NAAUD is seeking recommendations to eliminate the identified information flow problems based on research and analysis.

The paper begins with an overview of academic research from the last two decades that outlines possible solutions to lagging information flow in the supply chain. Followed by an explanation of the research as it is applied to supply chain coordination efforts in various businesses models from today's markets. Next, an overview and examination of the four key areas of recommendation that were extrapolated from the research and analysis, including: contract flexibility, customer relationship management, demand management, and blockchain technology. Each area will be discussed in detail, along with figures, current business models within various markets, and suggested implementation methodologies. Additionally, the paper touches on interviews conducted

during the research process, all of which support the need for implementing some of the recommendations to improve information flow throughout the supply chain.

DEDICATION

This paper is dedicated to my wife, Casi, for her support and encouragement throughout this process.

ACKNOWLEDGEMENTS

Thank you to my friends, colleagues, the department faculty, and the university staff for making my time at Texas A&M University a memorable experience. Thank you, Wendy, for your help. Finally, thanks to my mother and father for their encouragement, and to my wife for her patience and love.

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1. INTRODUCTION/PROBLEM STATEMENT:

Given utilities have finite dollars to spend, distributors and manufacturers need to understand how utilities will prioritize spending. To align with and support utilities, distributors and manufacturers can redesign and refocus their supply chain through coordination in the following areas: contracts, vertical integration, trust, and information. By improving current supply chain coordination efforts, distributors and manufacturers can expect to adapt to market changes, respond effectively to utilities' needs, and increase profitability over time.

The North American Association of Utility Distributors (NAAUD) is an organization of select distributors who specialize in supplying products and supply chain services to the electric utility industry (NAAUD, 2018). Distributors from NAAUD are not receiving accurate information from the utilities, resulting in unexpected demand, longer lead times, and an increase in mistrust in the provided data. Members recognize this problem and want to improve the coordination in the utility industry's supply chain through better information flows.

2. PROJECT METHODOLOGY:

Information used to create the recommendations is established on two methods of information collection: a review of industry research and interviews with NAAUD members and other stakeholders in the utility industry.

Supply chain models and trends were gathered from multiple sources to create a baseline of current industry knowledge and best practices. Sources for the research included Google Scholar, Texas A&M University course materials, industry

publications, and case studies. Articles were selected based on their relevancy to supply chain distribution, including topics on supply chain coordination, contracts, customer relationship management, demand management, forecasting, and blockchain technology. To ensure the material was applicable, only publications from the last two decades were used.

Interviews were conducted with representatives from various participants in the utility supply chain – manufacturers, distributors, and utilities. The interviews included all thirteen NAAUD members, a sample based on the types of utilities NAAUD services which included two Investor-owned utilities (IOUs), one municipal utility, and one Electric Cooperative (co-op) utility, and three manufacturers. A set of questions was developed for each organization type in order to understand their business interactions, internal operations, and supply chain needs. Based on data collected in research and interviews, information was organized and analyzed to determine the pain points for the industry across all stakeholders.

Recommendations were developed with a focus on improving supply chain coordination for the electric utility industry through better information flows. This required a qualitative review of the existing research, analyzing and comparing the information from each interview, identifying best practices, and combining the recommendations into viable solutions focused on possible gaps existing within the supply chain.

3. LITERATURE REVIEW:

Over the last two decades, several researchers have studied supply chain, contracting, demand planning, logistics, and service within the utility industry. Predominately, researchers have found the utilities industry is encountering revenue challenges in the face of rising costs, creating the possibility of future deficits. To overcome these challenges, researchers have put forth various recommendations as outlined below.

Two men, T.H. Willis and C.R. Huston, published “Vendor Requirements and Evaluation in a Just-In-Time Environment” in the *International Journal of Operations & Production*. The article focused on implementing a Just-in-Time (JIT) strategy in supply chain management, with an important discussion on the attributes that a supplier should possess to be in a JIT environment. Additionally, the authors evaluate the prospective of JIT suppliers, and how to assist in the selection process—a strategy that is still considered useful in today’s utilities market.

Additionally, A.A. Tsay and W.S. Lovejoy tackled the same problems facing businesses regarding supply chain management in an article titled “Quantity Flexibility Contracts and Supply Chain Performance.” Their method, unlike Willis and Hudson, did not focus on time management strategies via streamlining vendor partnerships, but rather improving flexibility within vendor partnerships by coordinating materials and information in the supply chain under a rolling-horizon plan. They call their module Quantity Flexibility (QF) and provide guidance on how to structure supply relationships using QFs.

Lee, So, and Tang, authors of “The Value of Information Sharing in a Two-Level Supply Chain,” point out one of the most significant aspects of the supply chain – information sharing. In their article published in *Management Science*, they address the benefits of sharing demand information, and most importantly, how to quantify the benefits of sharing demand information between retailers and upstream suppliers. They note that the value of sharing information increases over time as demand correlates with the data, an important point when considering implementation of any information sharing module along the supply chain in the utilities industry.

Another major set of researchers in the early parts of the decade, Croxton, Lambert, Garcia-Dastugue, and Rogers, published research on the demand management process. They develop a framework for implementing an effective demand management process within a firm. They provide a background of supply chain management processes and identify interfaces for corporate functions, making recommendations and outline possible uses, which can be applied across the utilities industry.

In the early years post 2000, research focused heavily on technological applications, including Customer Relationship Management (CRM). Bob Leach, along with Boulding, Staelin, Ehret, and Johnston, study different uses of CRM. Leach questions whether or not CRM systems are valuable, and what benefit they provide to firms. He describes the potential measurable benefits and creates four categories – creating new demand, capturing market share, improving margins, and lowering the costs of production. However, unlike Leach, Boulding, Staelin, Ehret, and Johnston suggest a total of eleven propositions about what is known about CRM, the potential

pitfalls, and unknowns, which face a firm when implementing CRM. Both research endeavors suggest that CRM can vastly improve outcomes in various aspects of a business regardless of the potential pitfalls.

In 2006, Kouvelis, Chambers, and Wang reviewed the manuscripts focused on Supply Chain Management covering topics such as the bullwhip effect, contracts, supply chain coordination, and supply chain design. The authors highlighted important issues addressed in recent supply chain management research and provided an excellent overview of the state of supply chain management.

Moving into the modern era, issues of trust, CRM implementation, and forecasting dominate the research. In 2010, the researchers Laeequddin, B.S Sahay, V. Sahay, and Waheed developed a conceptual framework to measure supply chain partners' risk, using a risk perspective and characteristics. They then translate the risks into terms of trust perspectives, assisting companies in risk mitigation along the supply chain through the lens of trust within a partnership.

In 2012 Darlene Lin tackled the problems with the now widely used CRM. She provides an example of the implementation of CRM by Cigna Health Insurance and the pitfalls of the implementation process, along with possible ways to avoid negative outcomes. Similarly, a researcher by the name of Watkins addresses issues behind Sales Forecasting and Demand. This was a pivotal time in research and brings us to today, where new technologies are being applied at unprecedented rates, forcing researchers to look at common malfunctions, pitfalls, and uses of various software systems.

In 2016, Steven Norton gave an introduction about what blockchain is and how blockchain allows the removal of “the middleman.” He provides a set of challenges for blockchain technology. One of the main challenges is that currently, there are not clear standards on how to govern or implement blockchain. Along with Norton, Ben Dickson discussed blockchain potential. Dickson believes blockcahing may be able to revolutionize the supply chain through transparency and security. He also shows how blockchain technology usage will result in a safer and more reliable environment, promoting trust between partners and clients.

In 2017, Marco Iansiti and Karim R. Lankhani wrote an article about blockchain technology for the *Harvard Business Review*. Iansiti and Lankhani discuss how blockchain is going to solve the problem of regulating and upholding administrative control. There is also discussion about the framework of adopting blockchain as well as explanations on how to approach investing in blockchain technology.

4. SUPPLY CHAIN COORDINATION:

Supply chain coordination can be defined as the practice of aiming to improve performance through the alignment of plans and objectives of individual enterprises (IGI Global, 2018). A focus is placed on inventory management, as well as ordering decisions in distribution settings (IGI Global, 2018). Four mechanisms create the central pillars of supply chain coordination – contracts, vertical integration, trust, and information.

Contracts:

Contracts are formal expectations from end-user to distributor on how services will be rendered. Contracts form a basic relationship between two organizations on how they

will achieve their goals. From a utility-distributor point of view, the two contract types are short-term (spot buys) and long-term (blanket purchase orders) contracts. Short-term contracts are those considered less than six months and serve new customers and budgetary or regulatory constraints. However, long-contracts are ideal for their stability and lack of disruption in operations.

Contracts can be established with limited integration, trust, and information. Negotiations over contract terms are often done with a high degree of uncertainty, leading to potentially unfavorable future demands and conditions. A growing obstacle for distributors in contracting is the use of financial repercussions for delays and other changes outside of the control of the distributor. By using supply chain coordination to help build proposals for contracts, distributors can minimize the risk in contract negotiation. For example, incentives could be included in the contract terms as motivation to deliver on time, rather than penalties for missed delivery times (Kouvelis, Chambers, and Wang, 2006).

Vertical Integration:

Vertical integration is the combination of two or more stages of production in a company, normally operated in separate companies (Amadeo, 2018). For example, during the interviews, it was discovered Electric Utility Distribution Associations (EUDAs), a buying association for multiple co-ops, is used to distribute and sometimes manufacturer items, such as wooden utility poles, for the co-ops. This vertical integration allows these co-ops to purchase product at a potentially lower price, and in theory, increases efficiency in both economies of scale and supply chain integration. An

organization's decision to vertically integrate directly correlates with its ability to maintain levels of service. Costs are reduced within the supply chain by reducing steps (Loaddelivered, 2015).

Vertical integration can start at the distributor and then move downstream or upstream to either the manufactured goods or the retailer for the goods distributed. The main driver for firms to vertically integrate is a determination of the transactional costs either gained or lost from having third-party contracts, rather than conducting in-house. To vertically integrate, there are a few different methods a distributor can use. One way is to use forward integration - when a manufacturer decides to skip "the middle man" and distributes its own product (Loaddelivered, 2015). An example of forward integration would be farmers selling their goods at a farmer's market to consumers, thereby eliminating the middleman sales model, and possibly increasing profits, while decreasing time to market. Another way a distributor can integrate is using backwards integration - when a company acquires a supplier. An example of backwards integration, would be McDonald's, who not only retails its food, but also grows its own potatoes (Loaddelivered, 2015). As is shown by the examples, an organization can achieve economies of scales and capture additional market share through vertical integration.

When a distributor is vertically integrated, information is shared more easily due to the distributor performing two or more stages of production. An example would be the distributor seeing point-of-sales data through its operating system data, which the distributor can share with the manufacturers. Additionally, with real-time access to data, the distributor can respond with greater success to trends in the market.

One type of information within the supply chain is demand information which is information regarding the demand of the product. An example of demand information sharing is Wal-Mart's Retail Link program, providing on-line summary of point-of-sales data to manufacturers, such as Johnson and Johnson (Lee, So, and Tang, 2000). By collecting and analyzing point-of-sale data by manufacturer, Wal-Mart can increase inventory conversion cycles, as well as reduce the safety stock inventory. This example can be directly linked to utility distributors who provide multiple products to utilities. The utility distributors can use this point-of-sale data by manufacturer to increase the inventory conversion cycle and forecasted demand.

It is apparent that having the ability to share and receive information from partners within the supply chain increases the accuracy of information across all stakeholders, which results in increased accuracy and lowers risk when making decisions about demand. The most common method for information sharing is through programs with the capability to share data, such as an inventory management system like SAP or Oracle (Lee, So, and Tang, 2000).

Trust:

The mechanism that is the most difficult to cultivate in the supply chain is trust. It is the single most important aspect of any relationship and is applicable to all parties. Trust occurs when one party believes that another party will not exploit its vulnerabilities. Therefore, trust can be used as a governance mechanism. Companies can measure trust in terms of uncertainty and risk. With greater risk, the need for both parties to have more trust is heightened, especially for intrinsic trust. Every conception of risk

implies there is an uncertainty about the outcomes, and this certainty can be measured with a mitigation plan if the risk is known (Laequddin, B.S Sahay, V. Sahay, and Waheed, 2010).

Within business, including utilities, trust can be measured by how much information is being shared within the supply chain. To build trust within supply chain coordination, an increase in the flow of information is needed. Where transparency and information sharing are avoided, trust decreases because parties must enter into a contract without valid information. Furthermore, as trust increases, the flexibility of the contracts can expand, which can provide opportunities to move the utilities to mechanisms that increase coordination within the supply chain. Trust is an aspect of a relationship which is difficult to measure and preserve, but not impossible to apply within supply chain coordination.

Information:

Within supply chain coordination, the value of information – data or knowledge – is what flows continuously throughout the supply chain. By increasing shared information between parties, companies can increase supply chain coordination. In fact, sharing information has become a strategy to counteract the “bullwhip effect”, the phenomenon of demand variability amplified across the whole supply chain from manufacturers to utilities (Lee, So, Tang, 2000). The “bullwhip effect” leads to excessive and/or inaccurate demand forecasts in response to uncertainty (Kouvelis, Chambers, and Wang, 2006). In other words, inventory swings upward in response to a false belief in customer demands for a lack of information along the supply chain.

An example of the “bullwhip effect” within utilities occurs when utilities or distributors predict larger forecasts for fear of stocking out. This creates problems, such as inaccurate demand forecasts, excessive inventory, and poor customer service, all of which could be prevented through information sharing along the supply chain (Kouvelis, Chambers, and Wang, 2006). In short, if companies would implement more consistent and accurate information sharing, the “bullwhip effect” could be minimized or avoided.

5. INTERVIEWS:

As part of the methodology of determining the current state of the supply chain, interviews were conducted within the utility industry from October 2017 to March 2018. The first interviews conducted were with the 13 official North American Association of Utility Distributors (NAAUD) members.

To prepare for these interviews, a list of questions was generated to include the areas of operations, sales, management, and customer interaction. Additionally, the interviews requested background information, such as geographical output, location, employees, revenue, and what type of utility market the affiliate participated in. The focus of the interview questions was to understand the nature of the supply chain within the utilities industry, and how the distributors interacted with the manufacturers and utilities.

In the interviews with the NAAUD members, some overall themes were discovered based on their pain points. When the topic of supply chain coordination came up in the interviews, the NAAUD members stated a desire for contract flexibility, an increase in collaboration, and a decrease in unexpected demand. The members discussed

the desire to have blank purchase orders due to the current conditions of utility job quoting. In addition, the members want to increase the collaboration of information from the manufacturer to the utility in order to provide the best possible products and services.

To gather more background information and understand the trends in the utility industry, attendance to the DistribuTech Conference in San Antonio, Texas, in January 2018, before the second round of interviews, was done in order to research possible recommendations. At the conference, there were a variety of different panel discussions about emerging market trends and technologies. These panels focused on utility to consumer relationships, which was not the focus of the objective for NAAUD. However, individuals at the conference were interviewed about some of the trends and technologies. Requests for additional interviews with the individuals were made, but due to timeframe and lack of individuals' responsiveness, no further interviews were conducted to include these conference attendees.

After the conference, the next round of interviews conducted was with utilities from February 2018 to March 2018. There were two investor-owned (IOU) utilities, one municipality utility, and one co-op utility interviewed. Each was interviewed through private interviews over the phone with a set of preview questions sent before the interview.

The first category of utilities interviewed was investor-owned (IOU), which is a business organization providing a product/service regarded as a utility, which is managed as a private enterprise. IOUs report to investors and are determined to be on the forefront of cost-effective measures to maximize accountability and profitability. One of

the practices IOUS have implemented in order to achieve this goal is weekly score carding. IOUs are performing weekly score carding on all distributors, which is a way to measure and track the performance of a distributor, manufacturer, and/or internal team. The scorecard data has helped open up conversation about expectations and results. By having open communication through scorecarding, all parties understand the performance and expectations.

Other business practices revealed in the interviews by the IOUs pertain to their purchasing models and partnerships. IOUs buy directly from manufacturers and distributors. They also ask the distributors to hold the inventory. Additionally, the IOUs are open to contracting non-core business components, such as inventory management or virtual management in warehousing to the distributors. The IOUs establish flexible contracts with distributors because there is an expectation on distributors to recognize order trends and make blanket purchase orders. Additionally, IOUs want distributors to guarantee lead times, collaborate, and provide more efficient, innovative ways to decrease inventory ordering, while still meeting contractual obligations. Overall, the interviews with IOUs revealed the benefits of strategic alliances and flexibility within the supply chain. By strategically aligning themselves with distributors, the IOUs can focus on their core business, while streamlining inventory management and lowering costs.

The next interview was with a municipality utility. One of the primary discoveries was how much regulations and laws impact the ability of municipalities to conduct long-term business. This discovery is vital information when considering

partnerships between distributors and municipalities. The distributors must understand the limitations of municipalities based on local, state, and national regulations and laws.

During the municipality interview, another important finding was discovered. The municipalities want to have concrete lead times from distributors. For example, some municipalities work within small time frames on projects due to seasonal restrictions. When lead times are pushed into the future, municipalities then must reach out to other distributors to solve problems. Forging new business partnership during a project window may cause the project timeline to extend into the next year based on seasonal restrictions costing the company a significant amount of time and money.

Another significant hurdle for this municipality involves outdated technology. The municipality interviewed currently does not have an updated inventory system due to regulations; and therefore, they must use a manual approach to manage inventory. This gap in technology needs to be taken into consideration by the distributor. If regulations would allow it, municipalities could maintain a virtual inventory, which would reduce inventory and carrying costs. By implementing a virtual inventory system, the municipalities could coordinate more easily with the distributor. As it stands, distributors must allow for lag time in data.

The final problem discussed in the interview with the municipality was the transition from individual purchase orders to blanket purchase orders with distributors. Like IOUs, municipalities desire contract flexibility with distributors when regulations allow it. Flexibility within contract purchasing allows municipalities to secure better rates during negotiations.

Next, the co-op utilities were interviewed. In these interviews, the co-ops revealed they are price sensitive, meaning the price of the product determines their purchasing behavior. Due to their price sensitivity, distributors have to increase value-added services to offset the price of the product. It was also found that groups of co-ops participate in regional buying and distribution associations called Electric Utility Distribution Associations (EUDAs). By participating in EUDAs, co-ops maximize their purchasing power, especially in a downturned market. In cases where co-ops are not solely purchasing through EUDAs, they may prefer to work with fewer or even one distributor at a time, which is more beneficial for smaller purchasing power.

The last round of interviews included one small and two large manufacturers. Forecast accuracy, information sharing, and loyalty programs were the main topics discussed in the interviews. However, due to the small sample size of the manufacturers and the high-level information shared, the ability to deep dive into the needs was not possible within the allotted timeframe. The most noteworthy data from the small manufacturer focused on day-to-day priorities and lead times. The small manufacturer requires a maximum lead-time of four days due to producing niche items. Additionally, both small and large manufacturers expressed a desire to collect more data, participate in fair and balanced loyalty programs with distributors, forge strategic partnerships, and increase the flow of information within the supply chain.

One of the priorities that emerged from the interviews was preparation for natural disasters. In the utility industry, emergencies can generate additional lead-time due to unexpected demand. Another challenge is that each region of the country has a different

set of regulations and laws, which increases the demand for non-standardized parts, as well as the price-per-part. Some of the distributors and utilities account for seasonality in their forecasts, especially during specific times of the year, such as hurricane season, which inevitably increases lead-time and the cost of goods sold. If these disasters do not happen, there will be a surplus of inventory. This is a challenge for distributors and manufacturers to overcome. They must reduce the peaks and valleys of emergency demand, which can be mitigated with an increase in supply chain coordination.

Using the information from the interviews, along with the discovery of challenges, research was then conducted to provide the best practice recommendations to increase supply chain coordination.

6. RECOMMENDATIONS:

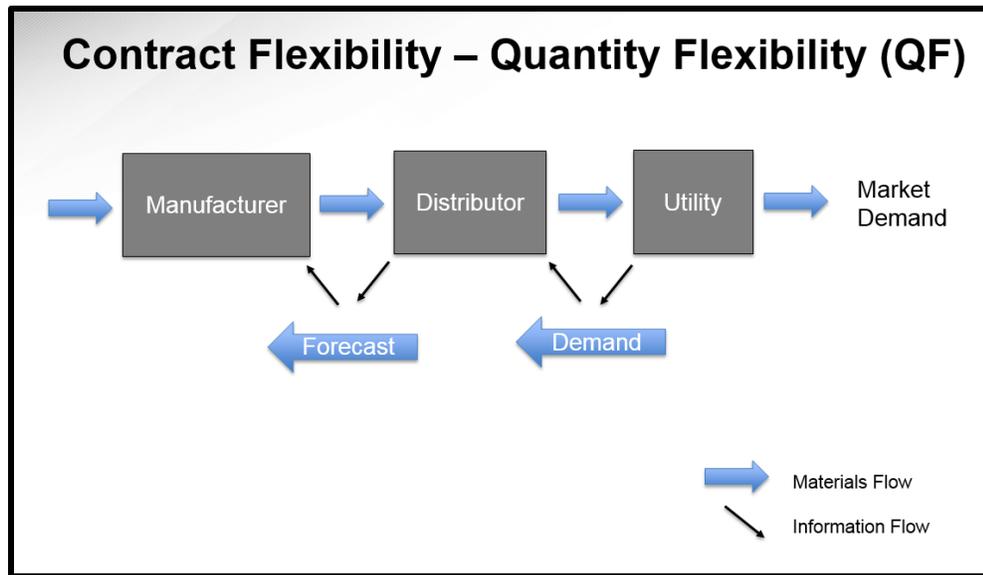
After organizing and analyzing the information and data from the interviews, trade journals, and Texas A&M materials, four recommendations to help increase supply chain coordination emerged. Each of the four recommendations hit all the mechanisms of supply chain coordination – contracts, vertical integration, trust, and information. By increasing supply chain coordination efficiencies, there will be an increase in profitability for the manufacturer, distributor, and utility.

Contracting Flexibility:

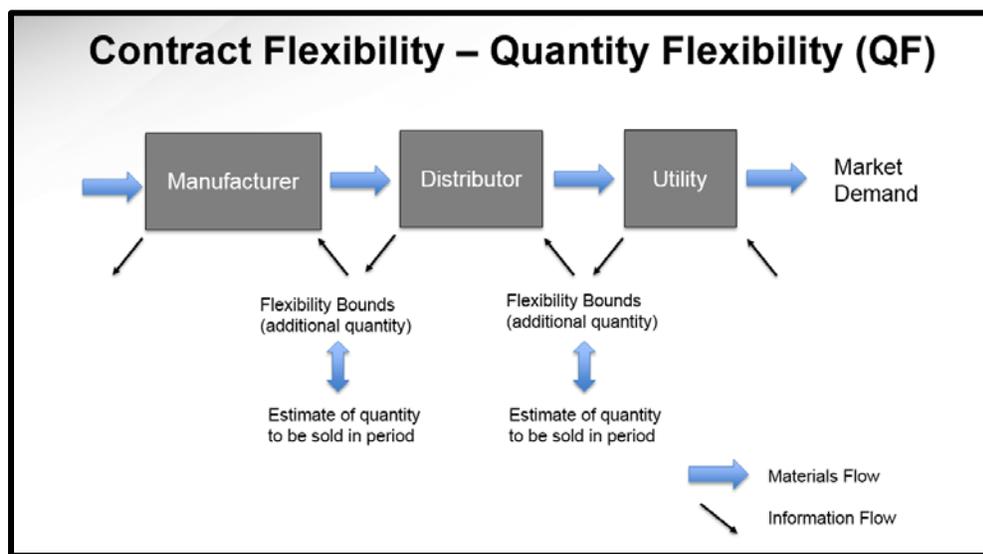
Currently, the method some utilities use for procuring product is based only on an “as needed” purchase order, also known as a spot order, which must be officially signed by the customer. Some distributors do not include these jobs into the forecast given to the manufacturers, which results in a decrease in the accuracy of historical

forecast data, inaccurate availability, and increased lead-time. Additionally, the price of the product increases due to costs associated with expediting the product order. Along with the price increase, there is a decrease in customer service stemming from failed product delivery times, increasing the overall timeline of the project and undercutting the relationship between utilities and customers. As a result, customer loyalty decreases, all from a lack of information sharing and inaccurate forecasting.

Contract flexibility can alleviate many of the above-mentioned problems by increasing supply chain coordination. When a contract includes flexibility, the company can make adjustments as needed, based on real-time data. An example of such a contract type is a Quantity Flexibility (QF) contract, a method used to coordinate materials and information within a supply chain that is operated under a “rolling-horizon” planning approach (Tsay and Lovejoy, 1999). The “rolling-horizon” planning is part of the standard operations for incorporating new information coming in over time intervals determined by the distributor. For example, a utility for each period creates a forecast of uncertain market demand (e.g. 100, 120, 110...) to the distributor (Tsay and Lovejoy, 1999). The 100 is the current demand, while 120 is an estimate of the demand for the next period (Tsay and Lovejoy, 1999). The utility then provides the distributor a schedule of desired replenishments (e.g. 50, 150, 90) where the numbers might differ from the market forecast (Tsay and Lovejoy, 1999). The distributor takes this schedule and supplements the forecast to increase accuracy. This is represented in Figure 1 below (Tsay and Lovejoy, 1999).



QF contains a degree of commitment to forecasts by installing constraints on the buyer’s ability to make modifications over time (Tsay and Lovejoy, 1999). The flexibility for modifications is defined in percentages, which vary depending on the number of periods away from delivery (Tsay and Lovejoy, 1999). By having established intervals where the demand is more accurately reflected, this will increase supply chain coordination. This can be shown in Figure 2 below (Tsay and Lovejoy, 1999).



By maximizing information sharing between players in the supply chain, distributors can implement a more transparent rolling horizon forecast with the manufacturer, which decreases the historical ‘silo’ nature of the industry and increases accuracy. With a rolling forecast, the distributor can serve the utilities with greater efficiency. For example, by holding monthly sales and operations meetings, unexpected trends can be identified, such as an increase in quotes for items. Then, the data can be given to the purchasing team and used to adjust forecasts.

Another recommendation would be to implement the blanket purchase order concept. Blanket purchase orders are multi-year contracts between an organization and distributor with an agreed upon dollar amount. This type of contract also has the option of being renewed. The purchase contract terms need to include specific quantities and schedule of items, which are large scaled (Willis and Huston, 1990). For items, which are small scaled, such as consumables, there is no need for specific quantities, and instead, the amount can be managed based on a total cost of consumables (Willis and Huston, 1990). Creating flexibility in contracting can help resolve some issues with demand forecasting and how information flows within the supply chain.

When implementing contract flexibility, there are some drawbacks to consider. One drawback is the ability to only change the quantity at specific times. When a necessity for an item arises, the utility may not be able to change the quantity until the agreed upon time, and the distributor may have too much or too little inventory. Another drawback would be the ability for pricing to be changed. When the quantity changes, the distributor will have to evaluate the price to determine if it needs to be changed as well.

For example, if the utility is not demanding a product as frequently, the distributor will need to increase the price because the product has less demand. By having a decrease in the product, the distributor will receive an increase in price from the manufacturer for the product. This would need to be carefully evaluated and negotiated through the contracting phase. Additionally, if the term of the contract is longer or rigid, manufacturers will err on the side of caution, i.e. price higher to protect against potential for future cost increases.

However, even with drawbacks, contract flexibility has the potential to assist with supply chain coordination. Contract flexibility will help distributors adjust forecasts based on demand and increase the flow of information regarding requirements throughout the supply chain, ultimately benefiting everyone involved.

Customer Relationship Management:

The relationship between an organization and its customers is decided by the customer experience that the organization creates. Studies have shown that customers are interested in the total experience, not just cost (Boulding, Staelin, Ehret, Johnston, 2005). Customer retention, purchase activity, and engagement are all impacted by the customer experience. A Customer Relationship Management (CRM) system is an application to manage the customer experience and interactions with current and potential customers (Rouse, 2018).

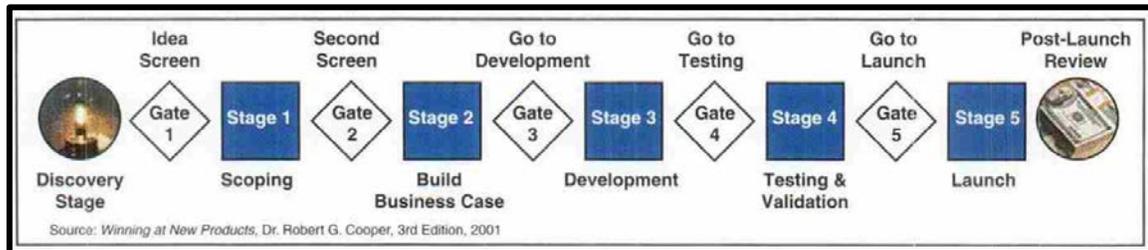
An integral part of any CRM system is monitoring and tracking customer interactions with the organization. Unfortunately, many distributors in the utility industry are not actively pursuing customer relationship data. Without data to report for

customer interactions, opportunities to improve customer retention or target customer segments are not exposed. To retain and increase customers, distributors need to actively engage customers and analyze the information provided by them. This is possible through a CRM approach.

Marketing and sales teams are usually associated with CRMs; however, it can be used as an integration tool in supply chain coordination. Since the purpose of a CRM solution is to create value for the customer, both the organization and the customer share the benefits. These systems work to find specific elements in the exchange process, which produce value, whether for the customer or company (Boulding, Staelin, Ehret, Johnston, 2005). CRM solutions enable firms to capture and analyze information to target audiences with personalized communications, product recommendations, and improved service efficiency.

Measurable benefits exist for initiating CRMs within electric utilities companies such as creating new demand, capturing market share, improving margins, and lowering costs of production (Leach, 2003). CRMs have the capability to help the firm increase profitability by identifying underserved segments and nurturing them (Leach, 2003). In smaller firms, where the target customer is a niche market, utilizing a CRM can help analyze customer information and determine the actual level of demand (Leach, 2003). For larger firms, which provide a wider variety of products, a CRM helps track customer behaviors for each of the products and helps to manage the lifecycle of the product portfolio (Leach, 2003).

Along with creating new demand, a firm can use CRM to help capture market share. However, there needs to be an understanding of the competitive dynamics within the industry (Leach, 2003). To help with this analysis, a firm can use Porter's Model of industry structure relating to business strategy show in Figure 3 (Leach, 2003).



Given most firms operate in competitive environments, it is doubtful that an information technology (IT) system, such as a CRM system, will permanently shift market share from one competitor to another (Leach, 2003). Even if an IT project could cause a shift in market share, it would be easy for the losing competitor to respond with a comparable project. In a worst-case scenario, a competitor might respond by lowering prices, which could affect some exit barriers (Leach, 2003).

Through monitoring of customer behavior, a CRM solution can identify customers willing to pay a higher margin on products (Leach, 2003). Once the favorable customers are identified, organizations can capitalize by tailoring processes or product attributes to maximize the opportunities (Leach, 2003). This information helps a firm to quickly adapt to changing markets and negotiate contracts accordingly. When customers are given the facts about the savings generated by a firm's offer versus its competitor's offer, the firm has more power in the negotiation process than before (Leach, 2003). However, it should be noted that customers could abuse this knowledge during

negotiations. To quash such abuses, the firm needs to avoid being ignorant of information the customer may have during negotiations (Leach, 2003).

CRM systems can provide organizations with a more comprehensive view of the customer and their needs. The combination of analytics and automatic workflow allow the system to provide precise insight and help the customer in the right way at the right time. Integration of the intelligent automation improves the productivity of support services lowering the cost of labor as well as resulting in better service due to having consistent, real-time information (Leach, 2003).

While CRM solutions can greatly benefit an organization, the implementation process is not without risk. For a successful implementation, the whole organization must adopt new perspectives on how to conduct their business. CRM forces the organization to take notice of each customer's experience. This could involve documenting business processes, auditing data, and increasing accountability across all levels of business (Boulding, Staelin, Ehret, Johnston, 2005). In addition, most organizations do not consider the possibility of losing personnel and shrinkage of customers into the risks of implementing a CRM solution. An example of this came from one of the interviews with a utility distributor. The utility distributor discussed using a quote analysis tool like a CRM implementation. For the quote analysis tool to be success, there needed to be 100% buy in, which was achieved through a one-strike policy across the organization. The one-strike policy stated an employee receives a warning if not using the tool along with training. After the second warning, an employee would be asked to leave the company. The organization understood the possibility of

losing personnel, but weighed the losses against the company's long-term strategic goal, which was utilizing CRM for quotes across the board. If the organizations' culture and members are unable to accept the changes, not only will the benefits of the solution not be realized, but also a negative customer impact can occur, including a loss of trust.

Another case of CRM gone wrong is the major failure at Cigna Health Insurance in 2002 (Lin, 2012). Cigna took the initiative to overhaul their current technology infrastructure system. The main goal the update was to improve enrollment, eligibility, and claims processing with integration into other company systems (Lin, 2012). When the new system was launched, Cigna customers were not able to access information about their coverage, resulting in a dramatic increase of inquiries, which overwhelmed Cigna's customer service department (Lin, 2012). Impacts were felt immediately as customer membership fell from 13.3 million to 12.5 million, causing an estimated net loss of \$398 million. Cigna acted hastily when they migrated the new infrastructure and CRM applications without proper preparation, training, and communication. Cost of the endeavor was underestimated in addition to an overestimation of how quickly the new system could be put into production (Lin, 2012). To avoid a similar scenario, a firm needs to analyze and evaluate the best way to implement a CRM system within their company's structure. If a similar scenario befell a distributor, its utility customers would not be able to trust the company and possibly make the assumption that their data is being used for exploitative purposes.

Despite the pitfalls of troubled implementation, the benefits of a CRM solution far outweigh the risks. Distributors can use CRM for integrating all processes and

activities across the organization with improvements for both the firm and its customers. By extending the integration along the supply chain and integrating the activities across the network of firms, it is possible to generate customer value, while creating shareholder value for the firm (Boulding, Staelin, Ehret, Johnston, 2005). CRM is an excellent business tool to use with supply chain coordination in order to gain customer insights and improve the quality of service.

Demand Chain Management:

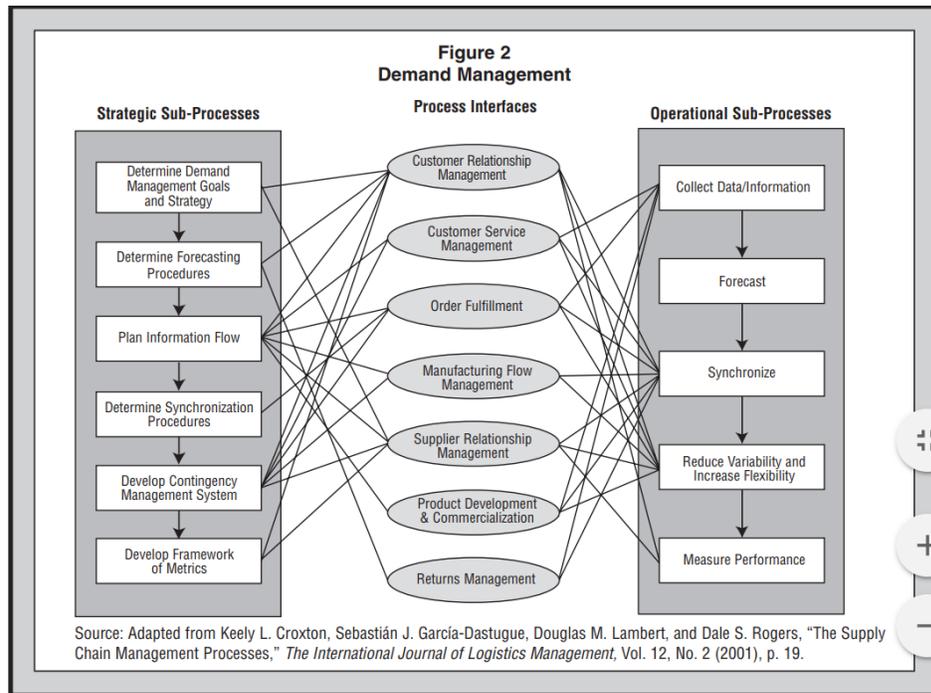
With the use of spot buys in the utility industry, there is a lack of insight regarding future demand. So, how can distributors gain more insight with the demand generated from the utility, and move downstream to the manufacturer to generate an accurate demand? Demand management, or the practice of balancing the customer's requirements with capabilities of the supply chain, can help distributors to answer this question.

Demand management will help increase the information regarding demand in the supply chain, as well as increase the flow of information throughout the supply chain. Forecasting is not the only element of demand management. Within demand management, the practice of synchronizing supply and demand also increases flexibility, as well as reduces variability. In addition, demand management helps improve operational flexibility, which results in consistent planning, reduced costs, and an increase in the ability to be responsive.

As with all other recommendations, demand management has its own set of challenges, including customer-driven variability. However, one of the goals of demand

management is to eliminate management practices that increase variability, and instead, put into place practices fostering smooth demand patterns (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002). This plays along with the practice of developing and executing contingency plans when there are disruptions to operational plans (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002). All these practices connect to the overall goal – meeting customer demand in the most effective, efficient way possible (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002). In addition, demand management processes need to be aligned with the strategic and operational goals of the firm. The strategy needs to be implemented throughout the supply chain as well as incorporated into the operational processes executing the day-to-day activities (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002).

Below is Figure 4, which shows how the strategic and operational processes in demand management interface with the information flowing from each sub-process (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002).



To execute demand management effectively, the firm's implementation team needs to fully understand the firm's strategy, the customers' needs, the manufacturing capabilities, and the supply chain network. Only then can the team determine the goals and focus of the process, which can include various priorities (Croxton, Lambert, Garcia-Dastugue, and Rogers, 2002).

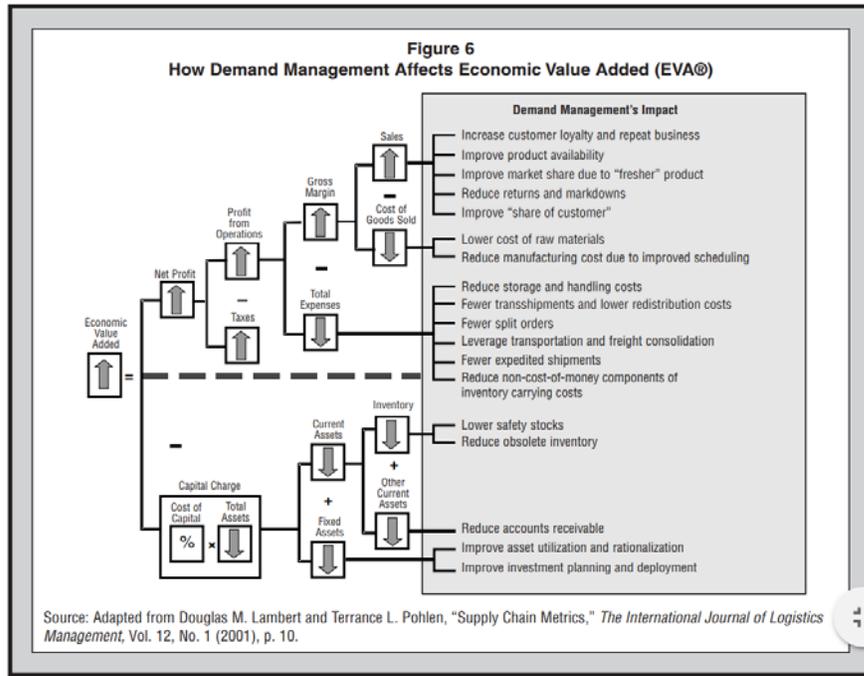
Next, the team needs to select the most appropriate forecasting approach, as well as determine the levels, forecast timeframes, data sources, and procedures for each forecast (Croxton, Lambert, Garcia-Dastugue, and Rogers, 2002). This includes defining forecasts for new products and limited-time offers. Once the team observes the level of demand for a period (e.g weeks, months), a reasonable, accurate forecast for future demand can be generated. It is important to make sure these decisions about the number of forecasts used are collectively made by the management team with the result of the

forecasts being coordinated within the firm's processes (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002). There could be multiple forecasts used in the firm, which makes the need for consistency paramount. If each function's management develop forecasts independently and do not consider forecasting across the firm, the firm will experience a loss of control over the entire forecasting process (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002). Without properly facilitating the information, the forecast will not be realistic, resulting in customer demand issues (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002).

In addition, the firm also needs to determine how to synchronize the demand management processes. The ways of synchronization need to match the demand forecast to the supply chain's manufacturing and logistics capabilities (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002). This is also referred to as sales and operations planning (S&OP). Synchronization requires coordination with all players. When synchronization is executed, the customer demand is examined, and requirements are determined. This requires an in-depth understanding of the demand and the product velocity needed at each point in the supply chain (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002). The output of the synchronization process is an execution plan, which will balance the needs and costs of the firm. Additionally, there needs to be an understanding of the firm's capacity and flexibility at key points along the supply chain (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002). The firm needs to determine the long-term planning requirements, such as high seasonality, longer-term changes, and/or sustained growth (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002).

At times, there can be an unbalance of supply and demand of products. To respond to this imbalance, the firm must develop contingency plans. An example would be: How should the firm react if a manufacturing facility is shut down unexpectedly (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002)? Determining how to react to these situations prior to them happening will allow for a quick response times. With utilities, this is important to implement due to the frequent occurrence of emergencies, such as blizzards, hurricanes, and other environmental changes (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002).

So, how is the firm going to measure and monitor the performance of the demand management process and set goals for performance improvement? To track the performance of the demand management process, the firm will need to develop a framework of metrics to help measure and monitor the process (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002). The firm will need to understand how demand management influences the key performance metrics that directly affect the financial performance (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002). Figure 5 provides a framework for examining the relationships, as well as displaying how demand management can impact sales, cost of goods sold, expenses, etc... (Croxtan, Lambert, Garcia-Dastugue, and Rogers, 2002).



These metrics can be used to improve internal processes, determine customer profitability, and visibly display what is occurring in the supply chain in order to make better decisions (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002). When the best practice processes are in place, management will be able to match supply and demand in a proactive manner, and execute the plan with few disruptions (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002). The information gathered from implementing demand management practices will help to increase the information flow, resulting in more accurate demand predictions (Croxtton, Lambert, Garcia-Dastugue, and Rogers, 2002).

Another method used in demand management is forecasting, which determines what the customer wants, how much the customer needs, and when the customers wants the product. To be successful, the product needs to be delivered in the requested amount

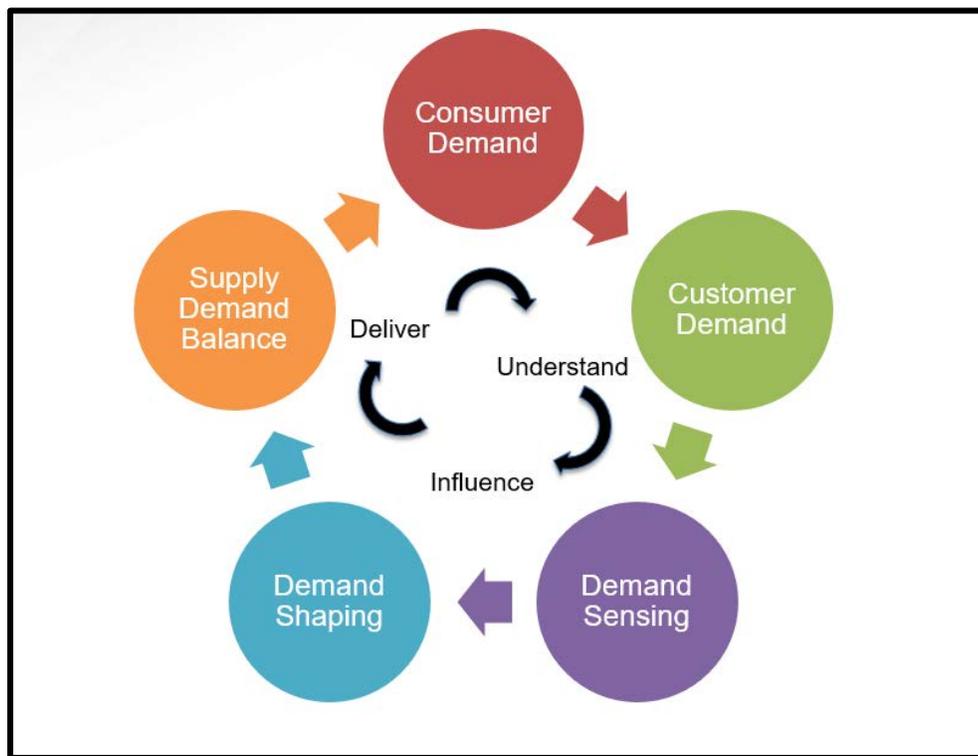
at the requested time. Demand management tools can help see trends, such as higher demand for items currently in the forecast. Without accessibility to trends information, stock out becomes a real possibility. Forecasting gives an organization the visibility required to fulfill future orders and meet the need for orders requested in a shorter than normal timeframe.

A forecast is simply a best guess of what is expected for the future (Watkins, 2014). Manufacturers need to forecast in order to procure materials, determine capacity, and manage other resources. Without accurate forecasting, manufacturers may not meet demand. It is important to note a forecast doesn't have to be 100% correct; however, second-guessing should be avoided, along with unrealistic targets (Watkins, 2014). A forecast is "a formal request to the Supply Management function from Sales and Marketing to have the product, materials, and capacity available according to the quantity and at the time they anticipate the demand will occur" (Watkins, 2014). In other words, a forecast is a formal process involving multiple elements, which the organization chooses to include.

The two most important elements of a good forecast are demand sensing and demand shaping. Demand sensing is using the tools available to analyze what is occurring in the market to identify the trends and determine what will occur in the future market (Watkins, 2014). In addition, there is also the need to understand the demand coming from the customer, while having an effective relationship with the customer. Demand shaping is using the tools to ensure the business receives the most profit from the sales and marketing efforts, including optimizing capacity, pricing, promotion, new

product development, and distribution (Watkins, 2014). This also involves comparing the statistical forecast and the current trends gathered from the demand sensing activity, and then shaping the demand in response to the data. Below, Figure 6 shows the overall process the business should follow in sensing and shaping the demand in response to what is occurring in the market place (Watkins, 2014).

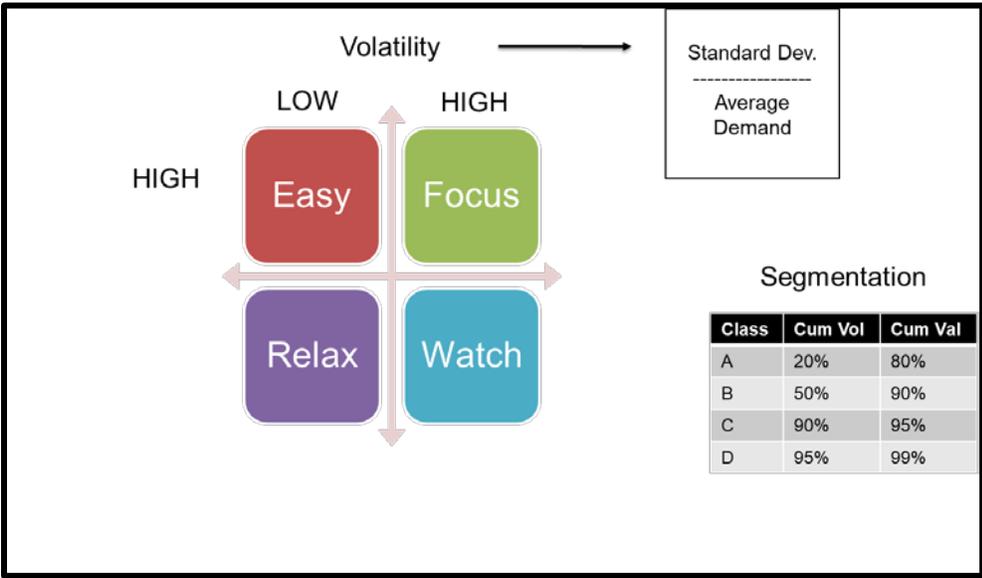
Demand Driven Supply Chain



After the forecast demand goes through the sensing and shaping process, the stakeholders need to review the forecast at the agreed upon time. The first step is to capture the actual data – what the customer ordered – by the required date for delivery. The forecast should then be reviewed for accuracy and compared to the correct basis of the forecast (Watkins, 2014). During this review of the forecast, the smoothing method

is used to adjust the statistical outliers in the forecasted demand. Last, use the plans to adjust the forecast where necessary. This step should be done with the consideration of new product plans, pricing changes, changes in customers, promotional plans, responses to competitive threats, external economic factors, and regulations (Watkins, 2014).

To avoid spending too much time on forecasting, performing segment forecasts with the lines of the value and variability of the demand can be useful. Value can be measured high-to-low in terms of revenue and gross margin (Watkins, 2014). Variability can be measured high-to-low in terms of a ratio of error for the monthly forecast to average monthly demand. It is low if it is below 50% and high if it is above 50%. The matrix in Figure 7 can be followed to help identify the value and variability of demand (Watkins, 2014).



In Figure 7, each segment needs to be reviewed at standard intervals to avoid missing information about forecasts of products. For example, items that are in the Watch coordinate might need to be moved to the Focus coordinate due to a shift in

market needs. The Easy coordinate is for items that are easier to forecast, like commodities. Items that are low volume and volatile can be removed from the forecast models and placed in the Relax coordinate (Watkins, 2014). The Focus coordinate is for items that need careful attention due to high volatility and value (Watkins, 2014). Evaluating these segments helps determine if the balance of supply and demand is in alignment with the customer's requirements, which is the practice of demand management.

Within demand management, determining if the forecast is accurate is necessary in order to provide the product to the customer. To determine if the forecast is accurate, the Mean Absolute Percentage Error (MAPE) is commonly used. The advantage of using MAPE is the display of the size of the deviations across all the products instead of just one (Watkins, 2014). Figure 8 shows the calculations for some product groups: The 'Abs Error' is known as the absolute error, which is the difference between the forecast and actual, whether it is plus or minus (Watkins, 2014). Figure 8 shows how MAPE is used in forecast accuracy (Watkins, 2014) (Kim & Kim H., 2016).

$$MAPE = \frac{1}{N} \sum_{t=1}^N \left| \frac{A_t - F_t}{A_t} \right|,$$

Forecast Accuracy Report - MAPE

Group	Product	Forecast	Actual	Abs. Error	% Error
Product Group A	Product 123	100	120	20	20
	Product 456	200	150	50	25
	Product 789	300	330	30	10
Total		600	600	100	17
Product Group B	Product 345	200	300	100	50
	Product 567	500	300	200	40
	Product 890	600	700	100	17
	Product 678	200	400	200	100
Total		1500	1700	600	40

It is known that forecasts have a degree of inaccuracy, and it is important to have a strategy for meeting non-forecasted demand. One of the factors distributors must take into consideration is the high need of safety stock required. Each organization implements some type of safety stock needed to satisfy unexpected demand. The amount of safety stock must be tied into the analysis of the following: forecast accuracy, lead-time, customer service levels, and replenishment frequency implied by order quantities (Watkins, 2014). With this, there should be a document supporting the analysis, to avoid assumptions, specifically whether or not there is enough stock to support the un-forecasted demand.

Below, in Figure 9, are “The Ten Rules of Forecasting” provided by Delos Partnership, which can be used to establish ground rules for forecasting within a firm. (Watkins, 2014)

The Ten Rules of Forecasting

1. A forecast is never going to be right
2. A forecast is necessary for planning supply, supporting financial and business plans
3. Accountability for the forecast rests with Sales and Marketing
4. A forecast is wrong because the assumptions were wrong
5. Forecasting needs an application of intelligence
6. More accurate forecasting comes from your customers' customer
7. Forecasts at an aggregate level are more accurate than the detail
8. Effective management of demand is key to managing forecast inaccuracy
9. A written policy for managing flexibility is essential
10. Measuring forecast accuracy will improve the process

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These ground rules should be implemented across all parties involved in forecasting. Additionally, these ground rules can help prevent implementation complications and inconsistency of demand planning.

By applying demand management processes, such as synchronization and forecasting, distributors can decrease the amount of time spent shifting from new trends to forecast adjustments. This allows for the customer's voice to be heard while the forecast is being implemented. Demand management is not only a tool, but also a way of making decisions based on the customer demand. When demand management practices are implemented, supply chain coordination improves, because information regarding demand is readily available and transparent throughout the entire supply chain.

Blockchain Technology:

In the modern world, companies are facing new challenges when it comes to data management. The utilities industry is no exception to these trials, specifically when it

comes to sharing information across parties regarding supply coordination. Can we overcome this communications roadblock, and if so, how? Research suggests that blockchain technology is an avenue worth exploring.

Blockchain is essentially an open, distributed ledger, which records transactions between parties in an efficient, verifiable, and permanent way (Iansiti & Lakhani, 2017). The ledger can be programmed to trigger transactions automatically (Iansiti & Lakhani, 2017). With blockchain technology, businesses can embed contracts in digital code stored in transparent, shared databases with protection from being deleted, tampered with, or revised. In business structures with blockchain technology, every agreement, process, task, and payment would have a digital record with a signature that can be identified, validated, stored, and shared (Iansiti & Lakhani, 2017).

Within the last few years, blockchain technology has emerged as a way to make and verify transactions on a network in real time without needing a central authority. Today, there are more than forty top financial institutions, as well as a growing number of companies across multiple industries that are experimenting with blockchain technology (Norton, 2016). These companies want to use this technology as a secure and transparent way to digitally track the ownership of assets, which has the possibility to make transactions quicker, reduce costs, and lower the risk of fraud (Norton, 2016). Some companies are researching blockchain technology to track the movement of assets throughout the supply chain, electronically initiating contracts, and enforcing contracts (Norton, 2016). In addition, blockchain architecture allows a distributed network of computers to come to an agreement without the need of a central authority or a “middle-

man” that houses the data (Norton, 2016). This can increase the mechanism of vertical integration within supply chain coordination, as well as increase the flow of information.

As a distributed ledger able to ensure both transparency and security, blockchain technology shows promise as a possible fix for current problems within the utilities industry supply chain. Applying a simple application of the blockchain paradigm to the supply chain would create the capability of identifying parties, price, data, location, quality, state of the product, and other relevant information to manage the supply chain (Dickson, 2016).

Several efforts are being pursued to leverage the power of blockchain within supply chain management. For example, IBM now offers a service allowing customers to test blockchains in a secure cloud and track high-value items through complex supply chains (Dickson, 2016). This service is also being used by Everledger, a firm trying to use blockchain technology to push transparency throughout the diamond supply chain, in order to repair a market fraught with forced labor and violence (Dickson, 2016). Another firm, Provenance, located in London, plans to use blockchain to build trust across the supply chain from the source to the end-customer (Dickson, 2016). In general, blockchain technology enables companies to be more transparent, making it a viable option for improving information flow within the utilities’ supply chain.

As with every new technology, there are challenges surrounding implementation, and questions regarding the effects on the market. One of the challenges blockchain faces is agreement on a common protocol by participants (Norton, 2016). There are no clear standards on how to govern blockchain implementation. The continuing

development of blockchain will bring regulatory obstacles and potential cyber security threats, leaving many questions unanswered (Norton, 2016). However, it appears the use of blockchain technology will eventually revolutionize supply chain coordination.

Blockchain can enhance the flow of information across the supply chain, as well as make information more readily available, accurate, and transparent.

7. CONCLUSION:

These recommendations of contract flexibility, customer relationship management, demand management, and blockchain technology have the capability of improving information flows throughout the supply chain. They all improve the supply chain in different ways and offer various benefits to the parties within the supply chain.

The findings indicate that the easiest recommendation to implement would be demand management. This process doesn't require any, or very little, additional cost to the distributor during implementation. The most time-consuming aspect would be coordinating a consistent schedule of forecasting, demand shaping, demand sensing, and synchronization.

Additionally, the research shows that the most challenging recommendation to implement would be blockchain technology. This technology is still in its' early stages with too many unanswered questions and moving variables. Also, blockchain technology would be the most costly to implement, as there will be a need for encryption. However, the benefits for blockchain technology over time will outweigh the implementation costs, especially concerning the improvements in transparency and trust throughout the supply chain.

Within this paper, these recommendations present different ways of improving information flows within supply chain coordination. Every recommendation uses different techniques to achieve an increase in information flow and promote trust. To continue to be responsive and efficient, distributors in the utility industry need to evolve, especially in regard to supply chain management.

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