Applied Project
Supply and Demand Misalignment

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Abstract

Supply and demand alignment in supply chain management is a critical aspect, as many, if not all activities are based on the planning figures derived from the forecasts. Supply and/or demand inaccuracies could potentially be driving many undesirable activities in supply chain management, and has serious repercussions when misalignment exists. The misalignment is increasing the pressure on supply chain managers to deliver service, while minimizing inventory and costs. Any large or significant deviations from the original base line numbers will likely result in: increases to supply chain costs, increases to inventory, and/or a decrease in service. When an imbalance occurs, this will result in sub optimal performance of the entire supply chain. In supply chain management, forecasts/demands are used in many long term strategic and short term tactical decisions. The quality and integrity of such information is paramount and a driving force for supply chain managers to consider in their pursuit of supply chain excellence.

The main topic of this research paper will be to explore: what effect does supply and demand misalignment have on supply chains and their effective management within the consumer packaged goods industry at both the strategic and tactical level. The secondary data will entail an industry assessment of the various alignment and integration issues supply chains are facing, and what are the root causes and effects within the consumer packaged goods industry. The literature was grouped into 2 distinct sections: strategic, and tactical/operational in order to drive into sufficient detail on both levels. The 2 different levels and analysis will provide the various effects the misalignment issue will have on the organization and management, while trying to maintain service, costs, and minimal inventory.

Properly determining the nature of demand and selection of the appropriate supply chain strategy is pivotal in aligning supply and demand. Products can be classified as being either functional or innovative, with each requiring its own supply chain strategy and approach - lean supply chain vs. responsive supply chain. The supply chain strategy adopted by an organization can take the form of being a forecast driven enterprise and a push supply chain strategy, and demand driven enterprise with a pull supply chain strategy. The use of pull system is the ideal approach to align supply and demand. The use of collaborative relationships will better align supply and demand, and would be instrumental in creating higher levels of alignment. Supply chain integration and information sharing is seen as indispensible to success in supply chain management. The use of Collaborative Planning, Forecasting and Replenishment as a tool to manage collaboration efforts, is designed to bring supply and demand into alignment. The ultimate goal of the approach is to share information and use it to:
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forecast needs, establish and alter promotion timelines, and determine when stock or supplies need to be replenished.

When considering Information Technology and the various systems and methodologies used in supply chain management, the systems employed will play a pivotal role in facilitating alignment between supply and demand and integrating supply chain partners via information sharing. Sales and Operations Planning process entails striking a balance between demand and supply, and can become the one place where Marketing and Supply Chain/Operations can collaborate and strategize. Enterprise resource planning provides a means for companies to improve their performance by enabling them to seamlessly share data among departments and with external business partners. Another cause of supply and demand misalignment can be attributed to the bullwhip effect which impacts upstream supply chain nodes. Some of the causes of the bullwhip effect are: demand forecast errors, long lead times, lot sizing, price fluctuations and promotions, and rationing and shortage gaming. Demand forecasting is one of the key causes of the bullwhip effect in supply chain management. In particular, the bullwhip effect on product orders can lead to misguided capacity plans and missed production schedules. Focus and improvements to the demand planning function has a major impact to supply and demand alignment, as demand planning functions serves as the vital link between Marketing/Sales and the rest of the supply chain.
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Introduction

In the field of operations management there are many issues facing supply chains in today’s competitive market place. As the global economy expands and the emerging markets become more prominent throughout the world, globalization will have the effect of increasing competition for all supply chains - regardless of market or home base of operations. The importance and role of supply and demand alignment in supply chain management cannot be understated, as many, if not all activities are based on planning figures derived from the forecasts/demand plans. Supply and/or demand inaccuracies could potentially be driving many undesirable activities in supply chain management. These activities and subsequent repercussions are increasing the pressure on managers to deliver service while minimizing inventory and costs.

When considering supply and demand misalignment, any large or significant deviations from the original base line numbers will likely result in: increases to supply chain costs, increases to inventory, and/or a decrease in service. The consequences of the misalignment are to a large extent driving supply chains to build collaborative relationships and endeavours with supply chain partners. The collaborative partnerships are needed in order to minimize the risks associated with demand and supply uncertainty.

The consumer packaged goods (CPG) and the related industries that comprise it, is defined as a type of good that is consumed every day by the average consumer (Investopedia 2014). The goods within this category are ones that have high turnover and need to be replaced more frequently, compared to goods that are used over extended periods of time which are considered durable goods. The CPG industry represents a market that is highly competitive due to high market saturation and low consumer switching costs (Investopedia 2014). The industry and its related profit margins are relatively small, (this is more so for retailers than manufacturers) and generally requires a low margin and high volume approach with a cost leadership competitive strategy. Power retailers such as Walmart and Costco however are tipping the scale, and are driving down manufacturer’s margins due to their size and supply chain reach. The various products that comprise the industry cover: soft drinks, toiletries, grocery items, cosmetics, household products, and some electronics. The global leaders in the CPG industry include: Johnson & Johnson, Colgate-Palmolive, Henkel, Kellogg’s, S.C.Johnson, Mars Inc., Heinz, Nestle, Unilever, Procter & Gamble, L’Oreal, The Coca-Cola Company, General Mills, PepsiCo, and Kraft Foods. In 2013, the sales of the CPG industry in North America are estimated to be $2 Trillion (Investopedia 2014).
Research purpose and research questions

In supply chain management (SCM) forecasts are the life blood of supply chains (SC) in that, many long term strategic decisions and short term tactical decisions are based and made from this information. The ultimate goal for SCM is to align demand and supply in order to minimize cost and inventory, while maintaining service. When an imbalance of one or the other occurs, this will result in sub optimal performance of the SC. When demand exceeds supply, out of stocks will occur and result in lost sales from customers, along with costly air freight and expediting. When supply exceeds demand, excess inventory is a result, as well as discounted sales/promotions, and inefficient and idle resource utilization which will all impact SC costs. The goal of an organization will then be to take necessary steps to bring supply and demand into alignment to optimize total SC costs. The quality and integrity of such information is paramount and a driving force for SC managers to consider in their pursuit of SC excellence. A thorough focus for SC managers should be placed on supply and demand alignment and it how it can impact the SC strategy, cost, and ultimately profitability. The purpose of this research paper is to explore what effects does misalignment have on SCM, and what are some of the outcomes and consequences of the condition being absent (i.e. alignment) within the SC.

The scope of this research paper will be conceptual, where I will not use primary data but instead complete a thorough literature review and synthesis. The review will cover what effects does supply and demand misalignment have on supply chains and their effective management within the consumer packaged goods industry. The literature review will detail a two level evaluation and analysis covering: strategic and tactical/operational (execution) aspects of SCM, and the impacts supply and demand misalignment will have on supply chains and their effective management.
Supply and Demand Misalignment

The focus of the paper will centre around the below research questions:

**Research question** - The main topic of this research paper will be to explore: what effect does supply and demand misalignment have on supply chains and their effective management within the consumer packaged goods (CPG) industry?

**Sub question** - What effect does supply and demand misalignment have on supply chain management at the strategic level within the CPG industry?

**Sub question** - What effect does supply and demand misalignment have on supply chain management at the tactical/operational level within the (CPG) industry?

Some assumptions made in the paper are centered on the triad of service, inventory, and costs having an indirect relationship per the table below. Improvements to one area will be at the expense of the other, and trade-offs will occur.

(APICS 2007)

<table>
<thead>
<tr>
<th></th>
<th>Service Impact</th>
<th>Inventory Impact</th>
<th>Cost Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service increase</strong></td>
<td></td>
<td>Will require an increase in inventory investment to support and buffer all forecast errors required to maintain service level beyond a certain threshold</td>
<td>Will likely result in an increase in cost as it pertains to expediting, transportation costs, and smaller run sizes</td>
</tr>
<tr>
<td><strong>Inventory decrease</strong></td>
<td>Will impact and decrease service level due to forecast error and necessary inventory required to maintain service level up to a certain threshold</td>
<td></td>
<td>Will impact and increase costs in terms of ordering and setup costs, as inventory turns increase - more frequent changeover/setup costs are required</td>
</tr>
<tr>
<td><strong>Transportation costs and manufacturing unit costs decrease</strong></td>
<td>Will impact and decrease service level as setup times and expedited transportation are more prominent concerns as longer/bigger lot sizes are employed</td>
<td>Will require an increase in inventory investment to amortize setup costs over long run sizes, along with increased pipeline stock to minimize transportation cost</td>
<td></td>
</tr>
</tbody>
</table>

In addition, I also assume a certain level of information sharing is present as normal business and SC practice, meaning that customer and suppliers share forecast information to improve SC visibility.
Supply and Demand Misalignment

Literature review and review of related theory

Strategic
Supply chains are defined as a series of events that cover a product's entire life cycle, which include design to disposal of a given product or service (Blanchard 2010). All supply chains compete through a combination of the following performance objectives; quality, speed, dependability, flexibility, and costs (Slack, Chambers, & Johnston 2010). While competing on these performance objectives, SCM will also need to maintain service, while minimize cost and inventory. Deploying a one size fits all supply chain is doomed to failure (Blanchard 2010). Taking such an approach to SCM can possibly contribute to the issue of supply and demand misalignment.

Supply Chain Strategy
Development and selection of a suitable supply chain strategy is also necessary to ensure proper alignment with company strategy. An important first step in aligning supply chain strategy is to review the product line being sold in order to better understand the nature of demand within the industry (Fisher 1997). The next step would be properly selecting the supply chain model/strategy that is best suited to the product. Building an adaptive and responsive supply chain is an important first step in today's global market place, and starts with developing a supply chain strategy via scenario planning (Harvard Business Review 2003). This approach will enable operations to mitigate any risks associated with the environment and deal with uncertainty swiftly and appropriately; for both demand and supply variables in their respective supply chains. The success of the supply chain and its respective goal of creating customer value while also creating financial value will in large part be attributed to proper strategic planning in the areas of: organizational design, supply chain processes, systems and technology, people, and supply chain metrics (APICS 2007). All of the aforementioned areas all will have an impact on how SCs are able to line up and maintain supply and demand alignment.

When formulating and reviewing supply chain strategy, supply and demand misalignment can have an adverse effect on supply chain strategy and ultimately company strategy. The strategy used will dictate how it supports competitive position within the industry. Operations/SC's strategic role as it pertains to business strategy can range from implementing business strategy, to supporting business strategy, to driving business strategy, with each subsequent level representing an increasing level of contribution from operations (Slack, Chambers, & Johnston 2010). Empirical studies as conducted by Florian (2013), demonstrate that when supply chain strategy and integration is employed, SC performance is 1.21 times higher for organization that
communicate customers' future strategic needs throughout the supply chain than companies that do not when comparing key performance indicators. In addition, SC performance is 1.34 times higher for companies that search for new ways to integrate SCM activities, oppose to companies that do not when comparing key performance indicators.

The external environment in which the organization competes in will in large part determine what SC strategy the organization will need to employ (APICS 2007). The first step in devising an effective supply chain is to consider the nature of demand for the product as it pertains to: produce life cycle, demand predictability, product variety, market standards for lead time, service, and demand filled from in stock goods (Fisher 1997). Products can be classified as being either functional or innovative, with both requiring it own SC strategy and approach. Functional products have predictable demand, longer life cycles, low margins, and low variety. Innovative products can be considered the opposite of functional products and have unpredictable demand, short life cycles, high margins, and high variety (Fisher 1997). Both categorizations will require different SC and company strategies associated with each product/approach. Products within the CPG industry can be both functional and innovative classifications. An example of a functional product with the CPG industry is Campbell's chicken soup. An example of an innovative product within the CPG industry is L'Oréal's Paris Magic Lumi Light Infusing Primer.

**Demand Characteristics**

<table>
<thead>
<tr>
<th>Functional</th>
<th>Innovative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low demand uncertainties</td>
<td>High demand uncertainties</td>
</tr>
<tr>
<td>More predictable demand</td>
<td>Difficult to forecast</td>
</tr>
<tr>
<td>Stable demand</td>
<td>Variable demand</td>
</tr>
<tr>
<td>Long product life</td>
<td>Short selling season</td>
</tr>
<tr>
<td>Low inventory cost</td>
<td>High inventory cost</td>
</tr>
<tr>
<td>Low profit margins</td>
<td>High profit margins</td>
</tr>
<tr>
<td>Low product variety</td>
<td>High product variety</td>
</tr>
<tr>
<td>Higher volume per SKU</td>
<td>Low volumes per SKU</td>
</tr>
<tr>
<td>Low stock out cost</td>
<td>High stock out cost</td>
</tr>
<tr>
<td>Low obsolescence</td>
<td>High obsolescence</td>
</tr>
<tr>
<td>Create a lean supply chain</td>
<td>Create an agile supply chain</td>
</tr>
</tbody>
</table>

When considering functional products, a cost leadership approach and company strategy with an efficient/lean supply chain will be required in order to drive SC effectiveness. When considering innovative products, this will require a differentiation approach and company strategy with a responsive supply chain in order to be effective.
When applied to a supply and demand misalignment perspective, having any misalignment within a functional product and SC, and would greatly impact profitability and operations. When viewed from an innovative product perspective and SC, by design the model would look to create a certain level of misalignment or hedge in terms of capacity and/or inventory to deal with the market requirements and demand uncertainty. Given the nature of demand and supply uncertainties of different products, different supply chain strategies are needed for each product (Lee 2002). With predictable demand patterns and a stable supply process, companies should strive at improving supply chain efficiency so that the cost of providing the product to the customers is the lowest possible (Lee 2002). With highly unpredictable demand, excessive inventory may result and the cost of inventory for innovative products can be significant, since the product life cycles are short. Companies with such products should pursue strategies with a "responsive" supply chain rather than focusing on accurate forecasting and inventory planning (Lee 2002).

The SC strategy adopted by an organization can take two different forms, with the first one being a forecast driven enterprise associated with push SC strategy. This SC strategy is characterised and driven by forecasts and the pushing of inventory along the supply network. The alternative to this can be to create a demand drive enterprise, which can be considered a pull supply chain strategy. In this SC strategy, the main characteristic of the approach is when customer demand pulls inventory through the supply network. Both approaches have a trade-off and exposure in terms of risk to increased inventory in the case of the push strategy, and increased stock outs associated with a pull supply chain strategy (Kim, Fowler, Shun, & Pfund, 2012). Within the context of supply demand misalignment, both SC strategies will differ in their approach to maintaining supply and demand alignment. This misalignment problem would likely be more prominent in a push SC system as there will be delay in forecast error and feedback to demand planning system, and could have a timing delay and result in excess and obsolete inventory (Cachon 2004). On the other hand the very nature of a pull system looks to sync both supply and demand to reasonable similar levels, and any misalignment will likely result in outs of stocks and/or idle resources. Long term resource planning will be equally important within both SC systems but will likely have more serious implication in a pull system in terms of out of stock, where a push system can buffer any misalignment with inventory (Marquès, Lamothe, Thierry, & Gourc 2012). Industry executives increasingly acknowledge that moving from a push environment, where suppliers have relative control over their inventories, to today’s pull environment, where customers dictate inventory, adds extra volatility to their ERP and SCM systems (Davis 2014).
Information technology
In SCM, simply getting the best technology in place and then sitting back and watching processes run smoothly and savings roll in, is not enough (Harvard Business Review 2003). A thorough understanding of the role and importance systems and technology plays in addressing misalignment for supply and demand will be imperative. When considering Information Technology (IT) and the various systems and methodologies used in SCM, the systems employed will play a pivotal role in facilitating alignment between supply and demand, and integrating SC partners via information sharing. SC integration and information sharing is seen as indispensable to success and the measure of SC excellence (Childerhouse & Towill 2010). Conversely improper selection can also potentially be the cause of the misalignment and/or can contribute to misalignment to some degree. IT can serve as facilitator to integrate with external partners and systems, and help in alignment of supply and demand through visibility and analysis. The further supply chain partners can see through functional walls and also upstream and downstream into the activities taking place, the better chance they have of synchronizing their operations to produce value for the customer (APICS 2007). According to several authors, information sharing is just one aspect of SC integration, and coordination is needed to further improve and achieve significant performance improvements (Danese & Romano 2012).

Collaborations and integration
Another possible opportunity to address misalignment between supply and demand can be associated with the level or intensity of collaboration and integration between supply chain nodes (Blanchard 2010). The level of intensity and collaboration in place with supply chain partnership usually depends on the strategic importance of product and/or supplier, complexity of the SC, number of suppliers available for a product, and the uncertainty in the environment (APICS 2007). Collaboration or lack thereof can also be another factor contributing to supply misalignment via sub-optimization, conflicting goals, working with competitors, bottlenecks by weak competitors, technology, power based relationships, understanding benefits, and culture conflicts. Within the collaboration realm, levels of communication and collaboration will need to be determined, as it pertains to the four levels of communication: transactional with information sharing, shared processes and partnership, shared vision and strategic alliance, and backward integration. Also of importance will be to monitor the inter company relationships and alignment of the supply and demand network, at both the operational and relationship/behavioural levels. This will uncover the dynamic issues affecting supply chain management as it pertains to collaborating supply chain partners. For supply chain managers, these findings indicate that a strategy for achieving supply chain responsiveness requires a dual-pronged approach that aligns increased visibility with extensive information processing capabilities from internal integration (Williams, Roh, Tokar, & Swink 2013).
The impact to service at a strategic level would be determined by how much service level - percentage of dollars ordered vs. dollars shipped - is appropriate for the company and industry, in terms of building competitive advantage or maintaining competitive parity. When considering inventory at the strategic level, a determination of how much inventory and where it is located will be needed. This determination should be performed in dollars to assess the financial impact such a commitment will have on the company and its respective balance sheet and stock price/investor confidence. Lastly costs will also be a key factor in how the supply chain is designed in order to reduce unit costs, in addition to the level of operational efficiency or redundancy that is built into the supply chain for responsiveness and speed.

**Tactical/Execution**

In looking at supply and demand misalignment from a tactical/execution level, the impact to the supply chain will have an undesirable effect for management to contend with. Some of the costs associated with misalignment will materialize and manifest in inventory carrying cost, markdown cost, and stock out cost (Van der Merwe 2013). Conversely, efforts should also be focused on better demand forecasting, improved production and inventory planning, increased production capacity, setup time reductions, and transportation lead-time reduction per Van der Merwe (2013). Some of the symptoms of misaligned supply and demand will be: low sales forecast accuracy, poor customer service, and increased aged inventory.

**Sales and Operations Planning**

A process employed by many organizations is to adopt a sales and operations planning (S&OP) process/meeting which is defined as enterprise wide, collaborative, cross functional process of balancing unconstrained demand and constrained supply (Iyengar & Gupta 2013). Unconstrained demand is defined as pure customer demand and the quantity that could be sold if no constraints such as lack of inventory/stock, production delays, or delivery issues were present. Demand should be considered as unconstrained to represent true customer demands, and should be the goal of any supply chain to satisfy in order to maximize profit. The S&OP process is designed to address the gaps between supply and demand, by creating alignment between supply chain partners both internally and externally. Based on research from Iyengar & Gupta (2013), too often, however, the S&OP process in reality is nothing more than a pure Sales & Marketing meeting, in which supply and demand will likely be misaligned. The integrative process has SC toeing-the-line and Finance playing little or no role at all. This in turn will sub-optimize the entire process and will not meet the essential objectives of the tactical tool. The below data represents the research conducted by Iyengar & Gupta (2013), via conversations with clients, professional networks, and secondary research and summarized into some key points.
Process Ownership issues
- Misalignment between Organizational Strategy and S&OP Process
- Gross inaccuracies in forecasting & myopic planning horizons
- Flawed metrics driving undesirable behaviours
- Disconnect between organizational objectives and employee objectives
- Lack of standardized reports
- Poor Master Data Management for reference data, transactional data, and analytical data

In today’s ever increasing competitive marketplace, Burrows (2007) states that there is a general change in direction as companies are becoming demand based. This change will require some critical steps in the S&OP process to transform and alter its approach in order to make the shift. The demand in the new economy is vastly more volatile because customers are demanding a larger variety of items. Becoming demand-based requires embracing forecast variability, new operations management logic, and planning systems built on actual transactional data that have been generated through the ERP system, thereby shedding light on demand (Burrows 2007). Using a demand based approach, the critical balance between demand and supply can be planned, and S&OP can become the one place where Marketing and SC/operations can collaborate and strategize. However, the collaborative effort and strategizing must focus on how to create (and measure) value for customers, and focus on how to hit metrics of relevance only to the company’s operations (Burrows 2007). The supply plan must be flexible enough to adapt to demand while keeping the resultant operational change costs in line.
Demand Planning

In addition to employing and assessing the S&OP process, a thorough review of the demand planning function and forecasts will be needed in order to address any gaps that may exist between supply and demand. Many factors will affect the demand planning process in terms of information technology, lead-time horizon, and the number of materials to be forecasted (Szozda & Werbińska-Wojciechowska 2013). Demand is often (if not always) a moving target, varying for many reasons - some predictable and some not (APICS 2007). There are several aspects of demand planning that will impact supply and demand alignment: supply chain dynamics, forecasting, collaborative demand planning, and the role of marketing. In looking at the aspects of SC dynamics, there are several factors and sources in which demand can become variable. Some of the sources of variability are: competition, seasonality, product life cycle, external environment, promotions, disasters, and the bullwhip effect.

In looking at demand planning from a forecasting perspective, the principles of forecasts are: that they are always wrong, should include an estimate of error, forecasts for groups/family of items are more accurate than for single items, near term forecasts are more accurate than long term forecasts, along with the various forecasting techniques.

### TABLE 4
DEMAND-BASED VS. ERP-BASED S&OP

<table>
<thead>
<tr>
<th>Function</th>
<th>Management System (DMS)</th>
<th>Benefit</th>
<th>Current Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand planning</td>
<td>Families</td>
<td>Relates demand and supply in events</td>
<td>Focuses on forecast for demand only</td>
</tr>
<tr>
<td>Trend analysis</td>
<td>Capacity balancing</td>
<td>Stabilizes production using rates</td>
<td>Not related to production</td>
</tr>
<tr>
<td>Production</td>
<td>DMS</td>
<td>Balanced to demand within constraints</td>
<td>Assumes capacity is available immediately</td>
</tr>
<tr>
<td>Inventory Deployment</td>
<td>Inventory standards</td>
<td>To demand rates using simulation</td>
<td>To statistical forecasts at a SKU level</td>
</tr>
<tr>
<td>Inventory management</td>
<td>Simulation</td>
<td>Allows inventory to float in a range</td>
<td>Safety stocks that act as hard floors</td>
</tr>
</tbody>
</table>

(Burrow 2007)
Supply and Demand Misalignment

and approaches used. Demand planning and the impact from a collaborative perspective, would revolve around, information sharing (quick response), continuous replenishment, vendor managed inventory (VMI), and Collaborative Planning, Forecasting, and Replenishment (CPFR). Lastly, Marketing plays an important role in demand planning process as it pertains to: market research, finding and analysing markets, refining the product, new product introductions, educating customers and SC partners, the 4 Ps (price, product, promotion, and place), branding, and product management. There are many factors both internally and externally that can effect supply and demand alignment. The model of collecting information from the market will also have an impact, and play an important role in the demand planning process (Szozda & Werbińska-Wojciechowska 2013). Information Technology (IT) and its role in data collection and collaboration should also be explored in terms how it will impact demand planning and then ultimately supply and demand alignment.

Information Technology

In looking at IT from a tactical/operational level when considering misalignment of supply and demand, IT’s role can be seen as a means to provide: an operational level information system, operational awareness, and operational responsiveness (Turban and Volonino 2011). The intermediate horizon associated with tactical planning looks to provide support to the organization’s mission, objectives, strategy, and entails providing control and setting goals (Turban and Volonino 2011). IT enables SCs by moving more data that could be reasonably handled via manually methods (APICS 2007). Timeliness and availability of relevant data are key to the responsiveness of a SC and can reduce lead-time and costs.

The use of IT in the SC can essentially assist SCM with:

- Gathering, storing, and analysis of unprecedented amounts of data
- Facilitate planning at all levels through data analysis and sharing
- Gather, integrate, and analyse logistical data to streamline local and global SCs
- Orchestrate the flow of demand, supply, and cash
- Assist in creating and maintaining global partnerships

Enterprise systems provide a means for companies to improve their performance by enabling them to seamlessly share data among departments and with external business partners (Turban and Volonino 2011). The various systems should be explored and reviewed to see what impact and role they play in aligning supply and demand. Some of the systems to be explored would be: enterprise resource planning, supply chain management, and collaborative planning, forecasting, and replenishment (CPFR) systems.
Enterprise resource planning (ERP)
ERP describes a modularized suite of business software applications that are seamlessly integrated to provide automated interactions and a common source of data for a company (APICS 2007). ERP systems are further described as software that ties together manufacturing, sales, distribution, and finance by collecting data from each area and using it to plan a company’s resources - ranging from employees, to raw materials, to production (Blanchard 2010). Typical ERP systems attempt to organize supply and demand signals with de facto sequential optimization—a process that leads to inflated demand forecasts and stock overages at numerous points in the supply and manufacturing chains (Davis 2014). The prevailing theory suggests that integration between SC and Marketing should in large part be reduced or nonexistent with an ERP system. ‘Demand Signal Delays’ is when an ERP system’s sequential supply chain approach responds to changes in demand signals by adjusting inventory levels, but because there is no visibility into downstream demand signals, delays can occur in inventory level corrections further up the chain (Davis 2014). The delays can have huge effects on upstream SC nodes, creating large amounts of stock, when unanticipated drops in demand aren’t recognized until too late and creating obsolete inventory. Some of the older ERP system issues revolved around: system inflexibility, manual processes, and order promising (APICS 2007). Leveraging the ERP system and new advancements will be key for SCM to help align supply and demand and raise the level of SC performance.

Collaborative Planning, Forecasting, and Replenishment
Collaborative Planning, Forecasting, and Replenishment (CPFR) is defined as a process the enables supply chain partners to share historical data and develop plans to manufacture and distribute a product (Blanchard 2010). The ultimate goal of the approach is to share information and use it to: forecast needs, establish and alter promotion timelines, and determine when stock or supplies need to be replenished. The nine step process model (www.vics.org) is:

1. Develop Front End Agreement between retailer and manufacturer
2. Create the Joint Business Plan
3. Create the Sales Forecast
4. Identify Exceptions for Sales Forecast
5. Resolve/Collaborate on Exception Items
6. Create Order Forecast
7. Identify Exceptions for Order Forecast
8. Resolve/Collaborate on Exception Items
9. Order Generation
Supply and Demand Misalignment

VICS CPFR Model

<table>
<thead>
<tr>
<th>Retailer Task</th>
<th>Collaboration Task</th>
<th>Manufacturer task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy and Planning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vendor Management</td>
<td>Collaboration agreement</td>
<td>Account Planning</td>
</tr>
<tr>
<td>Category Management</td>
<td>Joint Business Plan</td>
<td>Market Planning</td>
</tr>
</tbody>
</table>

**Demand & Supply Management**

<table>
<thead>
<tr>
<th>Point of Sales forecasting</th>
<th>Sales forecasting</th>
<th>Market Data Analysis</th>
</tr>
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<tbody>
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When looking at Strategy and Planning within the CPFR model, the purpose of the activity is to establish rules for the relationship, define the mix of products, and develop plans for upcoming events. The two main tasks for this aspect of CPFR, requires a collaboration arrangement as it pertains to business goals, scope of the collaboration, roles and responsibilities, and checks and escalations. In addition to the arrangement, joint business planning is also required in order to manage promotions, inventory policy changes, product introductions, and the increase/decrease in the number of stores.

The demand and supply management activities entail both partners projecting demand at the point of sale and determining order and shipment requirements. The two main tasks associated with these activities are sales forecasting and order planning/forecasting. Sales forecast revolves around the manufacturer analysing market data, while the retailer forecasts point of sale data. Order planning/forecasting entails demand planning for the manufacturer and replenishment planning for the retailer.

The execution activity within CPFR involves placing orders, preparing and delivering shipments, receiving and stocking merchandise at the retailer, recording transactions, and making payments. The task of order generation for the manufacturer includes production and supply planning while the retailer conducts activities associated with buying. The second task of order fulfillment involves logistics and distribution management for both parties.
The last activity within the CPFR model is the analysis portion, in which supply chain partners monitor planning and execution activities to identify exceptions and alerts. Results are aggregated and key performance metrics are calculated, in addition to sharing insights and adjustment of plans for continual improvement. The task of exception management involves execution monitoring for the manufacturer, and store execution by the retailer. The last task associated with analysis is the performance assessment in which the manufacturer and retailer both compile scorecards to assess the performance of the other party in order to drive improvements.

Bullwhip Effect
Another cause of supply and demand misalignment can be attributed to the bullwhip effect which impacts upstream supply chain nodes. The bullwhip effect can be defined as how a small disturbance at the downstream end of a supply chain, which can cause increasingly larger disturbances, errors, and volatility as it works its way upstream (Slack et al 2011). Some of the causes of the bullwhip effect are: Demand forecast errors, lead times, lot sizing, price fluctuations and promotions, and rationing and shortage gaming (APICS 2007). Demand forecasting is one of the key causes of the bullwhip effect in SCM. In particular, the bullwhip effect on product orders can lead to misguided capacity plans, missed production schedules, and inactive transportation from upstream businesses (Ma, Wang, Che, Huang, & Yu 2013). In other words, the bullwhip effect on product orders mainly contributes to upstream costs, while inventory oscillations motivate high levels of safety stock and make downstream large inventory costs unavoidable. The bullwhip effect on inventory may lead to larger inventory costs for downstream businesses and generate depressed customer service levels (Ma, Wang, Che, Huang, & Yu 2013).

Some of the counter tactics that can used to minimize the bullwhip effect center around (APICS 2007):

- Avoiding Multiple Forecasts
  - Information sharing
  - Electronic data interchanges (EDI)
  - Vendor managed inventory
- Reducing Lead times
  - Supplier selection based on speed
  - Cross docking of deliveries
  - EDI
- Reduction of lot sizes
  - Better forecasting
  - EDI
  - Transportation planning
  - Outsourcing
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- Maintaining stable pricing
  - Reduce wholesaler discounts
  - Maintain everyday low pricing
- Preventing shortage gaming (over ordering and buffering during supply shortages)
  - Share information
  - Collaborate on advance orders
  - Penalize short gaming
  - Use of historical data

Supply Chain Metrics
Forecast error and capacity utilization can be considered SC metrics that help determine a SC`s level of alignment and ultimately its level of flexibility. Flexibility refers to the ability of an organization to adapt to change, and being flexible in manufacturing operations mean more agility to move with customer needs and respond to competitive pressures (Elrod, Murray, & Bande, 2013). The faster an organization can adapt to change, the more opportunities it has to capitalize on demand. Flexibility metrics on which SC can be measured center around: range of product and services, capacity utilization, volume flexibility, delivery flexibility, labor and equipment flexibility, and expansion flexibility.

Also of importance will be to examine what effects demand uncertainty and forecast error have on unit costs and customer service levels in the supply chain, including Material Requirements Planning (MRP) type manufacturing systems (Fildes & Kingsman 2011). The quantitative estimates of improved accuracy were found to depend on both the demand generating process and the forecasting method used, and is more pronounced when there is demand uncertainty in which size of error does play a key role. The quantitative differences depend on service level desired and also the form of demand uncertainty. The SC unit costs for a given service level increase exponentially, as the uncertainty in the demand data increases (Fildes & Kingsman 2011). In those manufacturing problems that have high demand uncertainty and high forecast error, improved forecast accuracy should lead to substantial percentage improvements in SC unit costs due to reduced inventory levels.

When looking at forecast accuracy, the SC metric permeates throughout a company’s multi faceted functions and ultimately impacts the top line sales revenue, along with the bottom line profit margin (Singh 2013). The impact of forecast accuracy and its effects on increasing revenue, by matching and shadowing demand increases and decreases which improves service levels, product strategy and execution. In addition, forecast accuracy also positively impacts and effects costs via reduction in: expediting costs, cost of working capital and obsolescence, logistics and fulfillment costs, along with
Supply and Demand Misalignment

reduced component costs (strategic buys). Forecast accuracy also has a direct relationship and impact on service level, inventory, and ocean shipments all leading to reductions in SC costs (Singh 2013).

When looking at supply and demand misalignment from an operational standpoint, the supply chain model selected will directly impact manufacturing in terms of the operational environment needed to meet customer demand. Some of the possible operational environments are: make to stock, make to order, engineer to order, along with mass customization environments (Martinez-Olvera 2010). This will directly impact operations as their demand fulfillment will be dictated from the tactical and strategic direction set, as demand will either be fulfilled from inventory or capacity (Martinez-Olvera 2010). Supply chains can run into problems when incentives and measurements are not aligned between departments and companies in SCM (Lundin & Norrman 2010). From an operational standpoint, aligning incentives throughout the SC will be important to prevent any misalignment between the various stakeholders. A misalignment can be interpreted as an occurrence in a system when its parts are designed in such a way that they counteract or do not support each other (Narayanan and Raman 2004). This in turn can lead to unintended or unwanted performance of the system and poor service, and ultimately to supply and demand misalignment.

The impact to service at a tactical/operational level would be determined by how much service level - in a percentage - is appropriate at each supply chain node (plant and distribution centre). When considering inventory at the tactical/operational level, a determination of how much and where inventory is located in units and type will need to be determined, along with any delayed differentiation strategy. Lastly cost will also be a key factor in how the supply chain is managed and how the various cost tradeoffs are handled, along with how expediting and reactionary efforts will be needed to align supply with demand.

Simangunsong, Hendry, & Stevenson (2012) identify the following sources of uncertainty:

- Product characteristics - Product life cycle, packaging, perishability, mix, or specification
- Process/manufacturing - Machine breakdowns, labour problems, process reliability, etc.
- Control/chaos/response uncertainty as a result of control systems in the supply chain, e.g. inappropriate assumptions in an MRP system
- Decision complexity - Uncertainty that arises because of multiple dimensions in decision-making process, e.g. multiple goals, constraints, long term plan, etc
- Organization structure and human behavior E.g. organisation culture
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- IT/IS complexity - The realization of threats to IT use in the application level, organizational level and inter-organizational level, e.g. computer viruses, technical failure, unauthorized physical access, misuse, etc.
- End customer demand Irregular purchases or irregular orders from final recipient of product or service
- Demand amplification of demand due to the bullwhip effect
- Supplier performance issues, such as quality problems, late delivery, etc.
- Parallel interaction - the situation where there is interaction between different channels of the supply chain in the same tier
- Order forecast horizon/lead-time gap. The longer the horizon, the larger the forecast errors and hence there is greater uncertainty in the demand forecasts
- Chain configuration, infrastructure and facilities
- Environment - E.g. political, government policy, macroeconomic and social issues, competitor behavior
- Disruption/natural uncertainties - E.g. earthquake, tsunamis, non-deterministic chaos, etc

They also identify supply chain management strategies for reducing and/or coping with uncertainty (Simangunsong, Hendry, & Stevenson 2012)

Reducing

- Lean operations – By making a process leaner, it becomes a simpler process with less inherent uncertainty
- Product design
- Process performance measure
- Good decision support system - Refers to the use of decision-support systems as a problem-solving strategy for complex decision-making situations
- Collaboration
- Shorter planning period
- Decision policy & procedures
- Information, Communications, and Technology system – A strategy to use application software, computer hardware and communication technology
- Pricing strategy
- Redesign of chain configuration and/or infrastructure

Coping with

- Postponement – Delaying activities or processes until the latest possible point in time makes it possible to make things according to known demand rather than to forecast demand
- Volume/delivery flexibility
- Process flexibility
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- Customer flexibility
- Multiple suppliers
- Strategic stocks
- Collaboration
- Information, Communications, and Technology system - The availability of a computer based information system to provide information transparency between supply-chain partners
- Financial risk management
- Quantitative techniques – Employing operations research techniques, e.g. forecasting, simulation, and mathematical modelling, to reduce the impact caused by a source of uncertainty

Research design and data collection

The research design for my applied project will be conceptual where I will not use primary data, but instead use secondary data and complete a thorough literature review. The paper will look into what effects supply and demand misalignment have on supply chains and their effective management within the consumer packaged goods (CPG) industry? In addition, what effect does supply and demand misalignment have on supply chain management at the strategic level? Lastly, what effect does supply and demand misalignment have on supply chain management at the tactical/operational level? Due to the conceptual design of the paper, I will not submit an ethics application. The secondary data will entail a cross industry assessment of the various alignment and integration issues supply chains are facing, and the root causes and effects for supply chain managers. I want to take a broad approach, and summarize common threads and look for any universal cause and effect, in addition to any sub-industry or product specific concerns.

I will be using the AU library to search through the various sources of literature to complete the analysis. The key search words that I will be initially using are ‘supply and demand misalignment’. I will consider literature going back 10 years only, unless it is compelling. I will also use the key search words ‘supply and demand alignment’ within the last ten years, so as to compare and contrast both with the condition being absence and present, and how it effects supply chain management. Both search methods yielded well over fifty sources. Each sources’ abstract was then reviewed to determine how relevant it was to supply and demand misalignment, and then the entire source was reviewed in detailed for key information. I also used various supply chain and operations text books, in addition to learning materials from professional supply chain associations to further supplement the research. American Production and Inventory Control Society (APICS) and Voluntary Interindustry Commerce Standards (VICS) were
two such associations used. This should provide different viewpoints and give a complete and thorough review of the literature and body of knowledge.

I will attempt to review and group the literature into 2 distinct sections: strategic, and tactical/operational in order to drive into sufficient detail on both levels. The 2 different levels and related analysis will provide the various effects the misalignment issue will have on the organization and management, and help develop tactics around possible actions while trying to maintain service, costs, and minimal inventory. Some of the key related topics will entail researching additional literature and case studies on following systems: forecasting and demand planning, push and pull systems, collaboration, integration, S & OP, the bullwhip effect, CPFR, and ERP systems. Within each key related topic, I will attempt to apply and search for, aspects that relate back to supply and demand misalignment and how certain case studies went about addressing the issues. The literature should look to see how the various misalignment and integration issues manifest and apply to the CPG industry, and how these issues were addressed and resolved. The various literature documents reviewed should provide some general and common threads on how the problem is being addressed within SCM. In addition to being applicable to the CPG industry, a thorough review on what are current approaches used to deal with the issue across multiple industries should be explored.

The focus of SCM appears to have evolved over time from being one focused on driving efficiencies, to one that is more focused on being adaptable and responsive with a certain level of redundancy or buffer. The time period and focus of the literature reviewed should also reflect this focus or mind set change, and will need to be considered within the context of when the literature was published and results analysed or retrieved. The applicability comes into play as an earlier school of thought on/for SCM might have focused on an efficient SC, and placed greater importance on minimizing inventory and capacity utilization. On the other hand, newer publications will likely take a responsive and adaptive SC approach, as there will be a certain level of redundancy built into the SC, and supply and demand will never be aligned.

Results

Strategic

The research on the topic of supply and demand misalignment within the CPG industry yielded a wealth of information on the subject. The impact is felt at both the strategic and tactical/operational levels within the SC. When viewed from a strategic SC perspective, deploying a one size fits all supply chain is doomed to failure, and taking such an approach to SCM can contribute to the issue of supply and demand misalignment. Development and selection of a suitable supply chain strategy is also necessary to ensure proper alignment with company strategy. An important first step in
Supply and Demand Misalignment

aligning supply chain strategy is to review the product line being sold, in order to better understand the nature of demand within the industry. Properly selecting the supply chain model (strategy) that is best suited to the product and the nature of demand is important, but will also need to consider the following aspects: product life cycle, demand predictability, product variety, market standard for lead time, service, and demand filled from in stock goods. Products can be classified as being either functional or innovative, with both requiring its own SC strategy and approach. When considering functional products, a cost leadership approach, with an efficient supply chain will be required in order to drive SC effectiveness and supply demand alignment. When considering innovative products, this will require a differentiation approach, with a responsive supply chain in order to be effective.

SC integration and information sharing is seen as critical to success and the measure of SC excellence. The level of intensity and collaboration in place with supply chain partnership usually depends on the strategic importance of product being sold and/or supplied, complexity of the SC, number of suppliers available for a product, and uncertainty associated with the SC. Within the collaboration realm, levels of communication and collaboration will need to be determined and aligned as it pertains to information sharing, shared processes and partnership, shared vision and strategic alliance, and/or backward integration.

A thorough understanding of the role and importance systems and technology plays in addressing misalignment for supply and demand will be imperative. When considering Information Technology (IT) and the various systems and methodologies used in supply chain management, the systems employed will play a pivotal role in facilitating alignment between supply and demand and integrating SC partners via information sharing.

**Tactical/Operational**

There are many factors both internally and externally that can effect supply and demand alignment at a tactical/operational level. The intermediate horizon associated within tactical planning looks to provide support to the company's mission, objectives, strategy, and entails providing controls and setting goals. When viewed from a tactical/operational level, some of the costs associated with misalignment will materialize and manifest in inventory carrying cost, markdown cost, and stock out costs. Some of the symptoms of a misaligned SC will be: low sales forecast accuracy, poor customer service, and increased aged inventory. The demand in the new economy is vastly more volatile because customers demand a larger variety of items, which requires embracing forecast variability, new operations management approaches, and planning systems built on actual transactional data that have been generated through the ERP system.
Supply and Demand Misalignment

Using a demand based approach, the critical balance between demand and supply can be planned, and S&OP can become the one place where Marketing and SC/operations can collaborate and strategize. Demand is often a moving target, varying for many reasons, and there are several aspects of demand planning that will impact supply and demand alignment: supply chain dynamics, forecasting, collaborative demand planning, and the role of marketing. Within the supply chain dynamics, there are several factors and sources in which demand can be become variable. Some of the sources of variability are: competition, seasonality, product life cycle, external environment, promotions, disasters, and the bullwhip effect.

Enterprise systems provide a means for companies to improve their performance by enabling them to seamlessly share data among departments and with external business partners. ERP systems are further described as software that ties together manufacturing, sales, distribution, and finance by collecting data from each functional area, and using it to plan a company's resources. Typical ERP systems attempt to organize supply and demand signals with sequential optimization. Within the CPG industry, in a recent example Del Monte Foods utilized a Cloud ERP system to reap the benefits associated with an ERP system. An Cloud ERP system is set up and uses remote servers hosted through on the internet to access hardware and software needed to run the operating system. Del Monte explored a new corporate ERP systems for one of their subsidiaries, because their current system was complex, difficult to upgrade and costly to deploy to new lines of business (Consumer Goods Technology 2014). The company was looking for a new solution that would facilitate rapid integration of new acquisitions, and provide a solid platform for business growth. One of the reasons why Del Monte selected an ERP system, is that it can easily adapt to business changes such as new acquisitions, while offering enterprise-class capabilities. Del Monte plans to realize several benefits from the ERP deployment including better visibility through a single source of data and the elimination of many manual processes (Consumer Goods Technology 2014). The ERP system should enable the company to better alignment supply and demand to capitalize on the growth. They also expect that the ERP system will help enhance productivity in shipping, receiving, quality management, and production. This case study demonstrates the ability of ERP systems to help and align supply and demand by migrating to one system and streamlining processes.

CPFR is defined as a process that enables supply chain partners to share historical data and develop plans to manufacture and distribute a product. The ultimate goal of the approach is to share information and use it to forecast needs, establish and alter promotion timelines, and determine when stock or supplies need to be replenished. Within the CPG industry, an example of one such endeavor was a CPFR arrangement between Black & Decker Hardware and Home Improvement (HHI) with big box retailers Lowes and Home Depot. A CPFR strategy backed by enabling technologies and an
Supply and Demand Misalignment

aligned business/information system team allowed the manufacturer to realize benefits beyond improved collaboration at retail (Ackerman & Padilla 2009). Forecasts were compared along with shipment history as well as point of sale and order history, and as a result saw a 10.4% improvement in forecast accuracy. This tool leverages forecast and end-consumer demand signals to create an optimized, multi-level replenishment plans down to the store level. Now with full visibility into its supply chain operations, Black & Decker HHI has built truly collaborative relationships with its retail customers. With process improvements, including transformed sales & operations planning as well as the realignment of the supply chain organization along category lines. Black & Decker HHI has realized the following improvements: 60 percent reduction in forecast creation cycle time, 50 percent reduction in supply plan creation time, 80 percent reduction in monthly production cycles (Ackerman & Padilla 2009). The use of CPFR helps SCs attain supply and demand alignment.

Another cause of supply and demand misalignment can be attributed to the bullwhip effect which impacts upstream supply chain nodes. Some of the causes of the bullwhip effect are: demand forecast errors, long lead times, lot sizing, price fluctuations and promotions, and rationing and shortage gaming. Demand forecasting is one of the key causes of the bullwhip effect in SCM. In particular, the bullwhip effect on product orders can lead to misguided capacity plans, missed production schedules, and inactive transportation from upstream businesses. Within the CPG industry a possible approach to deal with the bullwhip effect would be to employ a vendor managed inventory (VMI) program. Procter and Gamble employs VMI with its customers and has shown that it improves: product availability for the consumer, increases inventory turns for the retailer, and boosts sales for both the retailer and supplier (Consumer Goods Technology 2014). Proctor and Gamble and its VMI program allows for more rapid response to customer demands, synchronize the supply chain to increase service to the customer, and order management to reduce transportation costs. Based on the Proctor and Gamble case study, it can be concluded that employing a VMI program will help with supply and demand alignment and reduce or remove the bull whip effect in SCM.

Forecast error and capacity utilization can be considered SC metrics that help determine a SC's alignment and ultimately its level of flexibility. Flexibility refers to the ability of an organization to adapt to change, and more flexibility in manufacturing and operations means more agility to move with customer needs and respond to competitive pressures. Also of importance will be to examine the effect of demand uncertainty and forecast error on unit costs and customer service levels in the supply chain, including Material Requirements Planning (MRP) type manufacturing systems. When looking at forecast accuracy, the SC metric filters throughout a company's multi faceted functions and ultimately impacts the top line sales revenue, along with the bottom line profit margin.
Supply and Demand Misalignment

Some of the possible operational environments are: make to stock, make to order, engineer to order, along with mass customization environments. This will directly impact operations as their demand fulfillment will be dictated from the tactical and strategic direction set, and demand will either be fulfilled from inventory or capacity.

Below is a top nine tips towards a more aligned supply chain:

1. Properly determining nature of demand so as to align the SC strategy to suit the product - lean vs. responsive SC
2. Use of a pull SC strategy in order better align supply and demand (push vs. pull)
3. Use collaborative relationships to better align supply and demand
4. Use of CPFR as a tool to manage collaboration efforts
5. Focus and improvements to the demand planning function
6. IT through systems and technology
7. Use a demand driven Sales and Operations Planning process for alignment
8. Implementation of an ERP system to build a platform in which create SC integration
9. Bull whip effect reductions

Analysis

Strategic

Supply Chain Strategy

In looking at supply and demand misalignment from a strategic perspective within the CPG industry, the SC strategy selected can be seen as the key to success. The performance objectives of the supply chain will impact how the SC is able to maintain supply and demand alignment, as it pertains to quality, speed, dependability, flexibility, and costs. Any attempt to apply a generic approach to SC strategy could in large part be the underlying reason for supply and demand misalignment. An important first step in SC strategy development is to review the product line being sold in order to better understand the nature of demand within the industry (Fisher 1997). Fisher goes on to mention that when devising an effective supply chain strategy, in addition to considering the nature of demand for the product, one should also consider: product life cycle, demand predictability, product variety, market standard for lead time, service, and demand filled from in stock goods.

In looking at the product life cycle and the SC, each distinct stage will likely have different order winners and order qualifiers (Slack et al 2010). The SC strategy and performance objectives used in the introduction and growth stages will likely need to be a responsive SC, and stress the importance of quality, speed and flexibility. On the
other hand, when a product is in the maturity and decline stages, the SC strategy selected will likely need to have quality, dependability, and cost as the main performance objectives. When looking at SC strategy from a demand predictability perspective, it would stand to reason that there is a direct relationship with the amount of volatility in demand and the amount of responsiveness a SC should have built in. When demand is a moving target, SC costs will be hard to maintain. Reactionary efforts are needed in order maintain supply demand alignment, without having any lapses in service level - in terms of dollars ordered vs. dollars shipped. Some of the reactionary efforts will come in the form of expediting and freight/transportation costs, over time, outsourcing, and out of stock costs.

In today’s business environment, consumers are demanding increased product variety along with wanting products to be available immediately. This will impact a SC’s effectiveness and possibly cause supply and demand misalignment. An approach to handling the increased amount of product variety demanded by consumers is to employ a delayed differentiation or mass customization strategy. Mass customization is the ability of manufacturer to produce products in high volume, yet vary their specifications to the needs of the individual customer or types of customer (Slack et al, 2010). The strategy allows the SC to delay the customization to the last minute which should preserve SC costs, while allowing the SC to cater to the wide variety of products being demanded by customers. Lastly an effective SC will also depend on market standard for lead time, which is how long the customer is willing to wait as benched marked to competitors, along with service level, out of stock tolerance/frequency, and demand filled from in stock goods.

When looking at supply and demand misalignment, having any misalignment within a functional product and SC, would greatly impact profitability and operations due to high volume and low margins generally associated with the approach. The goal of the SC would be to build a lean SC, and drive out any unnecessary costs in order to be more competitive in the marketplace. Functional products will require a cost leadership strategy, and having any level of responsiveness within the SC might not align to the needs of the market. When viewed from an innovative product perspective and the associated SC, by design the model would look to create a certain level of misalignment or hedge in terms of capacity and/or inventory to deal with the market requirements. Innovative products and their respective SC will have high demand uncertainty, low volume, and high profit margins to content with which is associated with the classification. The goal of the SC would be to build a responsive and adaptive system, so companies are able to quickly react to market changes and avoid high inventory obsolesce or excess costs associated with a differentiation company strategy.
Given the different nature of demand and supply uncertainties of different products, different supply chain strategies are needed for different products (Lee 2002). With predictable demand patterns and a stable supply process, companies should look to improving supply chain efficiency so that the cost of providing the product to the customers is competitive or lower than competitors. With highly unpredictable demand, excessive inventory may result and the cost of inventory for innovative products can be significant, since the product life cycles are short and erratic. Companies with such product classification should pursue strategies with a "responsive" supply chain rather than focusing on accurate forecasting and inventory planning (Lee 2002). All of the aforementioned areas will have an impact on how SCs are able to line up and maintain supply and demand alignment within the CPG industry.

Another major implication for supply and demand misalignment when considering SC strategy, would be whether or not the organization is adopting a push or pull SC approach. Push SC strategies are characterised and driven by forecasts and the pushing of inventory along the supply network to meet customer demand and can be classified as a made to stock environment. This SC strategy exposes the organization to the build up of inventory all along the SC, in addition to being exposed to the bullwhip effect. The alternative to this can be to create a demand drive enterprise and a pull SC system. This system is characteristic by when customer demand pulls inventory through the supply network, and can be classified as make to order or assemble to order environments. The risks associated with the pull SC approach centre around increased exposure to out of stocks, but will reduce inventory and possibly minimize or eliminate the bullwhip effect. Both approaches have a trade-off and exposure in terms of risk, to increased inventory in the case of the push system, and increased stock outs associated with a pull SC strategy. The alignment problem would likely be more prominent in a push SC system as there will be a forecast error and then feedback to demand planning system, and could have a timing delay and result in excess and obsolete inventory (Cachon 2004).

By contrast to a push system, the very nature of a pull system looks to sync both supply and demand to reasonable even levels and any misalignment will likely result in out of stocks and/or idle resources. The risks associated with pull system is that customer orders will come in above capacity, and all along the SC there will be expensive activities in terms of running over time, expedited transportation, and/or substituting a different product. This problem would also be a concern in a push system, but the use of safety stock within the supply network would reduce the effects. In order to transition from a push system to a pull system, SCM will need to address the following aspects: access to real demand data along the SC (visibility), trust and collaboration with supply chain partners, and agility. The decision to employ a pull system within the CPG industry should be considered, due to the benefits of reduced inventory costs and
possibly improved service, and can be the preferred or ideal SC strategy. However, consideration will still need to be placed on product life cycle, demand predictability, product variety, market standard for lead time, service, and demand filled from in stock goods in order for the pull system to be successfully employed within the CPG industry.

**Information Technology**

When considering supply and demand misalignment, a thorough understanding of the role and importance systems and technology plays in addressing misalignment for SC managers will be imperative. Information Technology (IT) and the various systems and methodologies used and employed in SCM, will play a key role in facilitating alignment between supply and demand. IT’s role can be seen as integrating and enabling collaboration and integration between internal and external SC partners. IT is also instrumental in providing visibility and the capability to analyse the entire SC, which are keys in trying to align supply and demand.

IT has a pivotal role in decision making process at the strategic and tactical/execution level, in terms of providing and facilitating information exchanges for management and supply chain partners. This is centered around transforming transactional and historical data into business information or business intelligence (BI) for the decision making process. BI is defined as gaining insight from data for the purposes of taking action and is closely tied to analytics, reports, alerts, dashboards, scorecards, and visual tools (Turban and Volonino 2011). When applying BI to supply and demand misalignment, the tools and analytics used would be invaluable in providing timely information in order to make adjustments in supply or demand variables. Supplier scorecard or distribution fill rate level can be used to gauge supply side delays or misalignment, and be applied to either ends of the SC. In addition, forecast attainment/error reports can be used to make adjustments to planning figures that result from changes in demand, and enable tactical changes to the plan quickly. BI and any related analytical tools would allow supply chain partners to see through functional wall, and also upstream and downstream into all activities along the SC. This would improve the chances for SC managers of synchronizing their operations and efforts to produce value for the customer.

**Collaboration and Integration**

When looking at supply and demand alignment, the level or intensity of collaboration and integration between supply chain partners and nodes will be another major factor to be considered. Close collaboration and integration should help bridge any supply and demand gap and create alignment, or imply that a certain level of alignment exists as this is the common goal of both parties. Various factors will determine the level of intensity and collaboration in place within a given supply chain partnership. The factors center on: the strategic importance of product and/or supplier, complexity of the SC, number of suppliers available for a product, and the uncertainty in the environment.
Supply and Demand Misalignment

Collaboration or lack thereof can materialize via sub-optimization, conflicting goals, working with competitors, bottlenecks by weak competitors, technology, power based relationships, understanding benefits, and culture conflicts. These aspects would have close ties to supply and demand misalignment and suggests a strong correlation exists between the level of collaboration/integration and supply and demand alignment.

Not all relationships will require close collaboration as commodity type materials are best purchased at arms lengths, so costs are minimized and little collaboration is required. The communication needed for this level of collaboration would entail transactional data with minimal information sharing. The next level of collaboration is the ongoing relationship which denotes bottleneck type materials (high SC difficulty low strategic importance), and requires an increased level of communication in terms of transactional data and information sharing. The next collaboration level, which is reserved for material of high strategic importance and low SC difficulty, will require communication that encompassed shared processes and partnership. The last level of collaboration which is reserved for direct/core competency materials (high strategic importance and high difficulty) requires a strategic partnership, with high communication and a high collaboration levels via shared vision and strategic alliance, and possibly backward integration. When applied to supply and demand alignment, certain relationships within the SC will not have close collaboration and alignment, and the use of inventory to buffer the gap might be needed as a result.

**Tactical/Execution**

When looking at supply and demand misalignment from a tactical/execution level, the impact to SCM will come in the form of inventory carrying cost, markdown cost, and stock out costs. The symptoms of a misaligned SC being: low sales forecast accuracy, poor customer service, and increased aged inventory. Efforts to improve demand forecasting, production and inventory planning, increasing production capacity, setup time reductions, and transportation lead-time reduction should be pursued to improve the SC’s effectiveness.

**Sales and Operations Planning**

S & OP is a specifically designed process to address the gaps between supply and demand, and looks to create alignment between supply chain partners both internally and externally. The importance of the S&OP function will be relevant in ether push or pull systems. The emphasis in a push system will need to include an inventory based measure due to the nature of the system. Within a push system, the S&OP process will need to become a sales, inventory, and operations planning (SIOP) process due excess inventory concerns. The emphasis of the S&OP process in a pull system, should center on long term capacity planning and how the SC will be able to meet customer demand. The S&OP process will also need to determine how much flexibility is needed in the system to handle any demand fluctuations. Regardless of which system the process is
employed with, the theory behind this tactical tool seems to support the use to address any misalignment in supply and demand.

Based on the literature review, the alignment issues seem to allude to SC managers for various reasons. Transitioning to more of demand based SC, will require some fundamental changes to be addressed in terms of accepting forecast variability, new operations management logic, and planning systems built on actual transactional data. When using a demand based approach, the critical balance between demand and supply can be planned, and S&OP can become the avenue in which Marketing/Sales and Supply Chain/Operations can collaborate and strategize. The key to the success will be how the collaborative effort and strategizing must focus on creating (and measuring) value for customers, and how to hit metrics of relevance only to the company’s operations (Burrows 2007). Any misalignment on the metrics employed, will likely cause sub optimization within the SC, and will possibly undermine the process and should garner close attention by managers. The supply plan must be flexible enough to adapt to demand while keeping the resultant operational change costs in line.

**Demand Planning**
The role and importance of demanding planning and forecasting in supply and demand misalignment is an obvious opportunity in which to address the management issue. However, demand is often a moving target, varying for many reasons and is sometimes predictable and sometimes not. So if the generally accepted theory is that forecasts are always wrong, the question becomes how much emphasis should be placed on this aspect in order to address supply and demand misalignment. There are many aspects in SCM that will affect the results of the demand planning process - supply chain dynamics, forecasting, collaborative demand planning, and the role of Marketing. The demand planning function will not be able to remove demand variability in SCM, it will however be able to lessen the extent and provide a fighting chance for the SC to align supply and demand. The key to demand planning will be to add intelligence to the decision making process as it pertains to an estimate of forecast error, aggregate forecasts at the family level, and time horizons (near vs. far term). In addition to the SC collaboration, demand planning is also a key link to the front end of the business and the Marketing department. Good collaboration and integration with both departments can play a pivotal role in addressing supply and demand misalignment as it pertains to: new product introductions, the 4 Ps (price, product, promotion, and place), branding, and product management.

**Information Technology and Visibility**
In looking at IT from a tactical/operational level and considering misalignment of supply and demand, the intermediate horizon associated with tactical planning looks to provide support to the organization's mission, objectives, strategy, and entails providing control and setting goals. Timeliness and availability of relevant data are key to the
responsiveness of a company for change, and can reduce lead-time and costs. IT can provide visibility throughout the SC as it provides: an operational level information system, operational awareness, and operational responsiveness. The use of IT in the SC can essentially assist SCM with gathering, storing, and analysis of unprecedented amounts of data which are all essential in providing visibility for SC managers. IT at the tactical level can also improve SC efficiency, and facilitate planning at all levels through data analysis and sharing by gathering, integrating, and analysing logistical data to streamline the SC. IT’s role can also assist in the orchestrating the flow of demand, supply, cash and assist in creating and maintaining global partnerships.

**Enterprise Resource Planning**

In looking at ERP systems, the use of such a system tool should help to improve any gaps that might occur in supply and demand misalignment. The very nature of the system looks to seamlessly integrate and provide automated interactions, and a common source of data for an organization. The software looks to tie together the various departments of manufacturing, sales, distribution, and finance by collecting data from each area and using it to plan a company’s resources. In addition to tying together the various inter-company departments, an ERP system will also require companies to standardize their business processes in order make the technology successful. This approach could remove any unique differentiators the company may have, and/or require customization of the ERP system which is costly to implement and maintain for any ERP upgrades.

Based on the literature review, there are some concerns related to inflated demand forecasts and ERP’s stock overages at numerous points in the supply and manufacturing chains. The theory suggests that integration and collaboration between SC and Marketing should be improved and any barriers should in large part be reduced or be nonexistent. The ERP system as a standalone process does have some deficiencies as the demand signal delays will have huge effects on upstream SC nodes. ERP can also create large amounts of excess stock, when unanticipated drops in demand aren’t recognized until too late and creating obsolete inventory. Leveraging the ERP system and new advancements will be key for SCM to help align supply and demand and raise the SC’s level of performance. Although an ERP system alone will not resolve the management issues, they are absolutely required to build upon to create or address any misalignment and work toward SC’s effectiveness.

**Collaborative Planning, Forecasting, and Replenishment**

Collaborative Planning, Forecasting, and Replenishment (CPFR) system is by its very nature designed to bring supply and demand into alignment. The CPFR process enables supply chain partners to share historical data and develop plans to manufacture and distribute a product. The ultimate goal of CPFR is to share information, forecast
needs, establish and alter promotion timelines, and determine when stock or supplies need to be replenished (www.vics.org).

Within the Strategy and Planning aspect of CPFR, the collaborative agreement between retailer and manufacturer as well as joint business planning will in essence provide the framework and communication paths to establish supply and demand alignment. Both aspects will in large part look to minimize some of the causes or symptoms of misalignment, by addressing the mix of product or variety, promotion planning, inventory policy changes, new products, and the number of distribution channels.

The demand and supply management activities within CPFR will require collaboration and agreement, on what will be the projected demand and order/shipment requirements. Making the activity collaborative will in essence perform the sales and operations planning process (S&OP) and facilitate input and create buy in from both parties. The analysis of both market data and point of sale data should ensure a thorough and robust approach to projecting demands. This is accomplished by both parties performing separate but key functions of; demand planning for the manufacturer and replenishment planning for the retailer.

The execution activity within CPFR involves placing orders, preparing and delivering shipments, receiving and stocking merchandise at the retailer, recording transactions, and making payments. The activity for the most part will be normal execution activities within SCM, but collaboration will still take place in terms of order generation and order fulfillment. By collaborating at the execution level, this should in large part reduce or nullify any bullwhip effect that might occur and prevent any short gaming.

The last activity within the CPFR model is the analysis portion, in which supply chain partners monitor planning and execution activities to identify exceptions and alerts. This portion of the process is the feedback loop, and is essential to continued success of the process in order to maintain service, reduce inventory, and reduce costs. The results are aggregated, and key performance metrics are calculated. In addition to sharing insights and adjustments of the plan, this activity will allow for continual improvement between both parties and create supply and demand alignment. The insights and adjustments derived from this activity are in essences the benefit of the overall program and the ultimate goal of the collaborative endeavor.

**Bullwhip Effect**

Another cause of supply and demand misalignment can be attributed to the bullwhip effect which impacts upstream supply chain nodes. Some of the causes of the bullwhip effect are: demand forecast errors, long lead times, lot sizing, price fluctuations and promotions, and rationing and shortage gaming. The small disturbances at downstream
end of the SC, cause larger disturbances/errors and volatility as it works its way up stream, and causes misguided capacity plans, missed production schedules, and inactive transport. The bullwhip effect will also impact the SC by: increasing upstream costs, higher levels of safety stock at downstream supply nodes, and poor customer service as capacity is being used on buffer stock/inventories.

While the bullwhip effect is manmade phenomenon, SC managers should look to counteract its effects. The first approach is to avoid using multiple forecasts, and having one unified and shared forecast thorough out the entire SC. This should in effect avoid any second guessing of the forecast and ensure all SC partners are working from the same plan. The use of vendor managed inventory will also in essence remove the bullwhip effect when employed at the FG and component level. There are limitations on how extensively this can be used on all components and supply networks, as long lead-time components (from overseas vendor) might make the approach prohibitive. Another counter tactic that can be employed is by reducing lead-time through quick turnaround suppliers, cross docking, and EDI. Lead time reduction will not eliminate the bullwhip effect, but should look to minimize the severity of the oscillations. Another approach to reducing the effects would be to reduce lot sizes, which are dependent and require better forecasting and transportation planning. Lot size reduction will increase the frequency of replenishment in the SC, thereby reducing severity of the bullwhip effect. Lastly the use of stable pricing should also assist in reducing the bullwhip effect, by reducing discounts to wholesales and maintaining everyday low pricing. Stable everyday low pricing should prevent any short gaming and over ordering by customers as they look to take advantage of the discount, and will bring more stability to the forecast/demand.

Supply Chain Metrics
SCs can run into problems when incentives and measurements are not aligned between departments and companies in SCM. From an operational standpoint, aligning incentives throughout the SC will be important to prevent any misalignment between the various stakeholders. SC metric/key performance indicators (KPIs) chosen by management will also be another key element that can cause misalignment. Measuring and pursuing the wrong KPIs can lead to unintended or unwanted performance of the system through poor customer service, increase inventory and cost, which indicates supply and demand misalignment.

When looking at supply and demand misalignment with the CPG industry, the first aspect that should be considered in addressing the misalignment issue is to properly ensure that the SC strategy selected is in alignment with nature of demand for the product. Placing the most focus in this area should pay the most dividends in addressing the issue and creating balance. In addition, SC managers should look to employ a pull SC system to address the misalignment issue - vs. a push system. The
next key aspect will be the use of collaboration and integration with key supply chain partners. By closely aligning with key partners, this should ensure that a majority of products within the SC are in alignment. The use of CPFR model would be the ideal approach, as it is designed to bring supply and demand into alignment through close collaboration between suppliers and customers. The next focus would be the demand planning function as this should help reduce gaps in forecasting and demand, and allow SC managers a reasonably accurate demand plan. In addition to the above elements, consideration should also be given to IT, S&OP, ERP, and the bullwhip effect reductions as these will all assist SC managers in bring supply and demand into alignment.

**Recommendations**

A thorough and in depth review will be needed to ensure that alignment exists between SC strategy and company strategy, while considering the nature of demand and/or product classification. Employing a one size fits all supply chain is doomed for failure, and SC managers should look to employ different SCs for each product classification. My recommendation would be that under the overall SC function, SC managers should look to sub divide each classification into separate SCs, and concentrate at product family level what is important for customers in that product segment. This review should take place once a year and look for changes that might occur at the product family level and its respective SC strategy. The review should analyse and adjust the strategy as it pertains to product life cycle evolution, or innovative products becoming functional ones and employing a responsive SC vs. a lean SC. Subdividing the SC into 2 different approaches will ensure that any supply or demand misalignment would minimal, and set up SC managers for success.

In looking at collaboration and integration within SCM, the use of close collaborative relationship would be instrumental in bringing supply and demand into alignment. Not all SC relationship will require, or should have a close collaborative relationship. My recommendation would be to have an in depth review to determine whether or not a close collaborative relationship is required. The review would consider the strategic importance and SC difficulty of the products being exchanged to make the determination. The yearly review should look at the volume and potential volume associated with the customer or supplier, and determine the level of collaboration required. Once determined, the use of customer relationship management (CRM) and supplier relationship management (SRM) systems can both be used to strengthen collaborative relationship at both ends of the SC, and further bring supply and demand into alignment.
Supply and Demand Misalignment

The impact demand planning has on supply and demand misalignment makes this an area that will need close scrutinizing. The demand planning functions serves as the vital link between Marketing and the rest of the SC, and can be instrumental in maintaining supply and demand alignment. Measuring forecast accuracy and forecast error are normal SC KPIs that many organizations employ. My recommendation would be to have demand planning as a key member of the strategic SC planning group, so as to acquire and use their feedback in the strategic SC planning process. The close/internal collaborative relationship with Marketing and the rest of the SC should ensure that the nature of demand and other variables are considered at the strategic SC level.

CPFR is designed to bring supply and demand into alignment. The process is structured in a formal manner which requires close collaboration between retailer and manufacturer. CPFR will drive and work towards supply and demand alignment, and will specifically address some of the causes of misalignment. My recommendation would be to implement a CPFR process in any relationship deemed appropriate and needing very close collaboration. The system and process would be the ideal collaborative arrange between two parties to align the SC.

IT enables collaboration between internal and external SC partners and provides visibility. In addition to providing visibility, it also presents the capability to analyse the entire SC, which are both key elements in trying to align supply and demand. IT has a pivotal role in decision making process at the strategic and tactical/execution level, in terms of providing and facilitating information exchanges for management and supply chain partners. My recommendation would be to employ business intelligence (system) as a means to align supply and demand elements. The tools and analytics used would be invaluable in providing timely information in order to make adjustment in supply or demand variables, and is key to creating alignment in the SC.

In looking at the S & OP process and considering supply and demand alignment, the tactical process is one that can be used to facilitate improvement. The S & OP function is a specifically designed process to address the gaps between supply and demand, and looks to create alignment between supply chain partners both internally and externally. My recommendation would be to employ the S&OP process as a means to create alignment, but use a demand based approach vs. a forecast based approach to address the alignment issue. When using a demand based approach, the critical balance between demand and supply can be planned, and S&OP can become the place where Marketing/Sales and Supply Chain/Operations can collaborate and strategize.
Supply and Demand Misalignment

An ERP system can be instrumental in bringing supply and demand into alignment as it seamlessly integrates and provides automated interactions, and a common source of data for an organization. The software brings all functional areas together in the planning of company resources, and would key in facilitating and enabling Marketing and the SC to build a close collaborative relationship. My recommendation would be to use an ERP system as a platform to build upon, to create supply and demand alignment internally and externally. The necessary changes in business processes should bring about best practice to all parts of the organization, and help bring supply and demand into alignment from a business process stand point.

Conclusion

There are many issues facing SC managers in today's competitive market place. As the global economy expands and the emerging markets become more prominent throughout the world, globalization will have the effect of increasing competition for all SCs. The importance and role of supply and demand alignment in SCM cannot be understated; many, if not all of the activities are based on planning data derived from the forecasts/demand plans. Supply and/or demand errors could potentially be driving many undesirable activities in SCM. These activities and subsequent repercussions are increasing the pressure on SC managers to deliver service while minimizing inventory and costs.

Forecasts are the life blood of SCs in that many long term strategic decisions and short term tactical decisions are based on and made from this information. The ultimate goal for SCM is to align demand and supply in order to minimize cost and inventory, while maintaining service. When an imbalance of one or the other occurs, this will result in sub optimal performance of the SC. When demand exceeds supply, out of stocks can occur, and results in lost sales from customers and/or costly air freight, expediting, overtime, etc. When supply exceeds demand, excess inventory is a result, discounted sales/promotions, and inefficient/idle resource utilization can incur which will all impact SC costs. The goal of an organization will then be to take necessary steps to bring supply and demand into alignment to optimize total SC costs. The quality and integrity of such information is paramount and a driving force for SC managers to consider and account for in their pursuit of SC excellence.

Merely accepting an imbalance or any misalignment in supply and demand makes the alignment issue increasingly difficult to contend with in today's competitive market place. SC managers have the option of trying to reduce the misalignment or finding ways in which to cope with the management problem. All too often, SC managers are caught in trenches, routinely finding ways to cope with the problem vs. finding ways to reduce or eliminate the problem. The misalignment problem comes down to cause and effect and
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dealing with the symptoms vs. the underlining issues. It would stand to reason that addressing the underlying reasons are the best approach to the issue, and can best be resolved at the strategic level.
Appendices

Glossary

Bullwhip Effect - as how a small disturbance at the downstream end of a supply chain, which can cause increasingly larger disturbances, errors, and volatility as it works its way upstream Forecast Accuracy

Collaborative Planning and Forecast Replenishment (CPFR) - a process that enables supply chain partners to share historical data and develop plans to manufacture and distribute a product

Customer Relationship Management (CRM) - a customer-centric strategy that uses software tools to optimize profitability, revenues, and customer satisfaction. It ties all of a company’s enterprise and supply chain system, with the goal of providing a complete view of a company’s operation

Enterprise Resource Planning (ERP) - a modularized suite of business software applications that are seamlessly integrated to provide automated interactions and a common source of data for a company

Forecast accuracy - a measure of the average difference between forecast value to actual value in percentage

Forecast Error - Difference between actual demand and forecast demand state as a value or percentage

Sales and Operation Planning (S&OP) - defined as enterprise wide, collaborative, cross functional process of balancing unconstrained demand and constrained supply

Sales, Inventory, and Operations Planning (SIOP) - defined as enterprise wide, collaborative, cross functional process of balancing unconstrained demand and constrained supply while also considering inventory

Service level - A measure of satisfying customer demand, expressed as a percentage of dollars order vs dollars shipped

Supply Chain Management (SCM) - The design, planning, execution, control, and monitoring of supply chain activities with the object of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply and demand, and measuring performance globally

Supply Chain (SC) - Supply chains are defined as a series of events that cover a product's entire life cycle, which include design to disposal of a given product or service
Supply and Demand Misalignment

Supply relationship Management (SRM) - a way in which relationships with suppliers are developed and maintained to meet the general goals of ensuring mutual profitability while meeting market place goals.

Vendor Managed Inventory (VMI) - Involves the supplier, rather than the retailer, taking responsibility for maintaining the retailer’s inventory levels based on transactional data shared by the retailer.
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References


APICS, (2007), APICS Certified Supply Chain Professional Learning System (Version 1.2)


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