Push Versus Pull Model

You can start the show...whenever you're ready

It has taken half a century and the advent of the third industrial revolution to take supply chain from the dark ages to the digital age. As businesses embrace everything the digital age has to offer, e-collaboration has enabled a mass technological evolution that continues to have a significant impact on supply chain strategy and what it can achieve.

With businesses moving toward a demand-driven supply chain, executives need the ability to plan top down and bottom up. The success of a business is measured largely by customer satisfaction, where the most significant factor is on-time-delivery to request (OTD-R). This OTD-R success can suffer at the expense of inventory. Striking that delicate balance is how companies can differentiate themselves.

So why does technology even matter when supply chain principles haven't really changed in decades? To find the answer to that question, we might look at the changing landscape in the television industry as an analogy.

The consumer today has endless choices at their disposal, from the high-definition digital receiver with digital video recording (DVR) capabilities, all the way down to analog rabbit ear aerial. We might think of TV programming as the product, TV networks as the suppliers, cable providers as distributors and your television as the packaging that brings it all together.

Ultimately, it is the product (the programming) that gives you satisfaction, not the box it came in. While you may have loyalty to a particular TV network, it is the program that will provide your entertainment.

When television was delivered through analog, you had two options: watch your program when it was scheduled to air, or spend hours figuring out how to set the time and day on your VCR. Needless to say, there was really only one option: watch what you want to watch, when the network wants to give it to you. Networks employ forecasting and know who is likely to watch what shows and when they are available to watch them.

But along comes the digital age and the world of TV entertainment is turned upside down. Or so you would think.

Does anyone actually watch TV as per the defined TV network schedule anymore? Surprisingly, many viewers still receive their programming via the push model and remain at the mercy of the traditional television schedule. There are complexities to taking advantage of technologies such as DVR and online streaming, as well as additional costs.

Similarly, when it comes to supply chain strategy, push strategy replenishment gets product from raw material to the consumer's door, and if the product is unique enough, of high quality, and captures the consumers' imagination, the product will be successful. However, this happens on the supplier's schedule, and not necessarily on the consumers'.

Push strategy enables planned material delivery so that production can meet a specified demand within a defined schedule. Product planning is optimized though the ERP system's ability to cascade independent demand down to the dependent levels through MRP. That dependent demand is then handed off to the next supplier as independent demand and the MRP cycle is repeated for as many nodes as are required to get down to the raw material. Each node's MRP is optimized independently, otherwise known as single-stage optimization.

Push strategy works wonderfully when demand is predictable, but there are challenges when forecast accuracy is poor, whether this is due to the customer's ever-changing mind or a failure in S&OP. The OEM's suppliers' performance also contributes to the misalignment of supply and demand. Capacity, material constraints, quality or delivery are all supply challenges. If it is a multi-echelon supply chain, the lag is associated with the flowing demand through the entire supply chain, particularly where there are many nodes or where nodes are made up of multiple companies in partnership. As each node optimizes its operation, any buffering done creates a larger gap for the node that supplies it, thus the potential for disconnection becomes an exponential risk. This is otherwise known as the Bullwhip effect ["Industrial Dynamics," Forrester, 1961].

Bullwhip Effect:

A supply chain phenomenon, first recognized by Jay Forrester in "Industrial Dynamics" in 1961. The concept is that as customer demand is considered at the node that makes contact with the end user, that node will tone up or down the demand the OEM plans for based on historical experience. When the next supplying node performs the same demand adjustment, the resulting modified demand is amplified, and this repeats as the independent demand flows as dependent demand through the supply chain. In extreme cases, the lack of actual demand compared with the forecasted demand will cause the opposite reaction on the next cycle, which causes a pattern similar to a bullwhip being lashed.

Multi-Echelon Supply Chain:

A multi-echelon supply chain is defined as a network of multiple tiers of supply nodes. It can be as simple as two tiers, one node at each tier, or as complex as several tiers with multiple nodes at each tier. Demand flows upstream from the end user through to the last supplier, and supply flows downstream from the last supplier through to the end user, with information ideally flowing in both directions.

Some of the risks inherent in this strategy are poor cash flow performance as capital gets tied up in unwanted inventory, incurred costs due to holding inventory (storage, scrap, errors and omissions claims, interest on borrowing), lost capacity due to production of undesired product and poor OTD-R performance (shortage of capacity and material to build for unplanned demand).

However, there are ways to keep supply and demand on the same path in a push environment. Excellent flow of communication between customer, OEM and suppliers; a tactical focus on exception management and; extra effort and overtime to manage the growing number of exceptions are all ways to combat the challenges and risks.

If the effects of the decoupling of supply and demand are not mitigated, the result can be missed sales opportunity and excess inventory. As well, in an effort to use up this unneeded inventory, product either needs to be "pushed" to the end customer at a margin loss when they do not really want it, or

inventory is left unsold and the business incurs costs to hold it. In a push model, throughput is controlled and inventory is observed.

Push Model:

- production approximation based on anticipated demand
- slower reaction to demand change
- higher inventory
- waste
- inventory management through firefighting
- on-time-delivery to request across all products low

The alternative to the push model is the "pull" model.

Going back to our TV analogy, with the advent of the DVR and online services, consumers now have the ability to watch what they want, when they want, where they want and to their heart's content. While the customer has the ability to "pull" what they want, the TV networks have been slow to embrace this change. Those who have grasped the innovation, both customer and supplier alike, are reaping the benefits of efficiency and convenience. In much the same way, advanced optimization tools have opened the door for pull systems to excel in today's fast-paced business environment, but industry has been slow to react.

A pull-driven supply chain functions using a series of pull signals to trigger replenishment of stock. Starting from customer order pull, it triggers a cascading set of pulls throughout the supply chain. Each node has a calculated reorder point (ROP), which includes a quantity to cover a defined going rate based on lead time as well as strategically placed inventory buffers to allow constraints to be scheduled. The size of the buffers complements lean manufacturing principles, correctly positioning buffer stock to manage the gate and better react to unplanned demand fluctuations.

Using an advanced inventory optimization application allows an entire supply chain to be sized in a synchronous optimization cycle, and great systems can complete the task so quickly that monthly or quarterly ROP resizing becomes a thing of the past. This is known as multi-echelon optimization. The system is agile enough to essentially adjust in real time to changing demand. Inventory liability is limited to the buffer sizing as unrealized forecast is perished as the reorder point prevents further production if demand reduces unexpectedly. The bullwhip effect seen in the push model is mitigated by the fact that buffers are optimized as a total system as opposed to independently, so small demand does not become amplified.

One of the challenges of the pull system is that companies have invested heavily in their ERP systems, and these systems do not handle ROP well without customization. Another challenge of using advanced optimization applications is that they require subject matter experts to fully optimize the system. Because the best of these applications are still relatively new, the expertise pool is limited. Businesses must enlist a good applications provider, and/or find a partner who has the expertise, or grow the skill in-house.

As with any system, identifying the risks in the system is paramount for success.

A "held up" trigger can pose a risk to OTD-R for a period equal to the signal delay if not managed effectively. When an issue arises that causes an order to go unfulfilled, the resulting pent-up demand can lead to an unnatural break in the normal consumption rhythm. If not counteracted, it can have a cascading effect on upstream nodes, as a required pull signal will be held up along the entire chain. The good news is that the remedy can be systematically applied. Regular sizing reviews and utilization of the single-use kanban (SUK) process provide early detection and require minimal effort to maintain the right beat rate.

Single-Use Kanban:

In a consumption-based pull model, there are instances when a reorder point is sized for a going rate where certain spikes are excluded as part of the sizing, or an unexpected spike in demand results, which the reorder point cannot handle. The single-use kanban (SUK) does as its name suggests and allows replenishment beyond the normal level for a defined period. This period is usually from the time the SUK is created to the moment consumption for that "spike" occurs. SUKs may also be used for managing very

infrequently ordered or special-order items where it is preferable to have the item planned via common strategy rather than held in stock.

Using a pull system in conjunction with an advanced optimization application provides improved service level and a reduction of overall inventory. This is because buffers are right-sized, based on a combination of historical forecast performance, statistical models, service level and product life cycle. It also more quickly and naturally reacts to changes in demand. As an added bonus, end-to-end sizing allows for visibility to liability of the entire supply chain. In a pull model, inventory is controlled and throughput is observed.

Pull Model:

- production precision based on actual consumption
- agile enough to keep up with changing demand
- lower overall inventory
- waste reduction
- inventory management through visual/systematic process
- on-time-delivery to request across all products high

Ultimately, each business needs to make a decision on replenishment strategy based on the maturity of their supply chain and relationships with their supply partners. Regardless of pull or push, there are key factors that allow the system to be successful.

Key Factors of Success

- Identify root cause of forecast accuracy issues – at the root of many inventory and on-time-delivery to request (OTD-R) issues is inaccurate forecast. A systematic, data-driven process for monitoring and improving performance is paramount

- Plan for every part – through proper segmentation, every item, from customer-facing product down to sub-assembly and component should have a supply strategy that drives to the right level of exception management

- Manage exceptions – processes need to be enabled that allow the supply chain team to plan the majority of the items with minimal intervention, allowing for strict focus on super A-class items, critical components and unplanned shortages

- Enable an agile supply chain – depending on the length of the S&OP cycle and the amount of time it takes to propagate demand from customer-facing node down to lower- tier suppliers, decisions made today may take weeks before they are realized at the lower levels of the supply network. Eliminating this lag enables a true demand-driven supply chain while optimizing inventory levels

In a perfect world, a single strategy should be able to handle a supply chain very well, and indeed most companies are forced to employ a single system. With the advancement of hardware technology and, more importantly, applications technology, the pull system has overtaken the push system in many ways. Many companies have embraced lean culture, which is a perfect complement to the pull system. In an environment where delivery and inventory are key indicators of success, having the ability to optimize the entire supply chain based on defined service level and acceptable cost of inventory, plan top down and bottom up, see the possible risks, and make quantitative and qualitative decisions based on those risks, it isn't difficult to see why pull strategy replenishment is on the rise across every industry.

The next time you sit down to watch your favourite show, ask yourself, am I watching this now because I am forced to watch it now, or because I choose to watch it now? If you are forced to watch now, you had better hurry, you may have missed the start of your program. If you choose to watch it now, press play whenever you are ready, and enjoy the show.

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Acting as a consultant, Robert provides valuable guidance on inventory optimization, utilizing industry-leading tools to facilitate the resolution of complex business problems.

Robert has been with Celestica for 16 years, taking on a variety of roles in operations, logistics and supply chain before assuming his current role in Supply Chain Managed Services as Process and Applications Advisor. Throughout his time at Celestica, Robert has gained over 10 years of experience spanning supply chain, planning and purchasing, inbound and outbound logistics, warehousing and materials replenishment.

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