Banishing the Myths about Demand Driven Supply Chain Management

With the recent emergence of the Demand Driven approach to planning and replenishment (1) (eg. see www.demanddriveninstitute.com), its adoption by some of the worlds most admired companies and its record of delivering transformational supply chain performance improvements (see below), it is inevitably starting to ruffle the feathers of those whose vested interest is in traditional ways of running supply chains. This applies to big consultancy groups, software companies and analysts and their response is to either dis-honestly co-opt the Demand Driven terminology for themselves or attempt to position Demand Driven as a minor niche in an attempt to prevent it undermining their own entrenched view (ie. revenue stream) of how supply chains should be managed.

The purpose of this paper is to clarify exactly what Demand Driven is, why it is so effective and to dispel the key myths that are being bandied about by those who wish to muddy the waters.

What is Demand Driven?

Demand Driven is, in effect, enterprise(s) wide Pull, and can be defined as:

"a segmented, multi-echelon supply chain re-order process characterised by multiple deliberately planned, but independent, inventory positions that are replenished, in an efficient and stable sequence, to a calculated stock target in line with real demand – not the forecast" (2)

The key definitions are:

Segmented – using the most appropriate replenishment technique for each item / echelon's demand profile (volume and variability – see below) and by never using the inaccurate forecast (or netted forecast) to directly drive replenishment

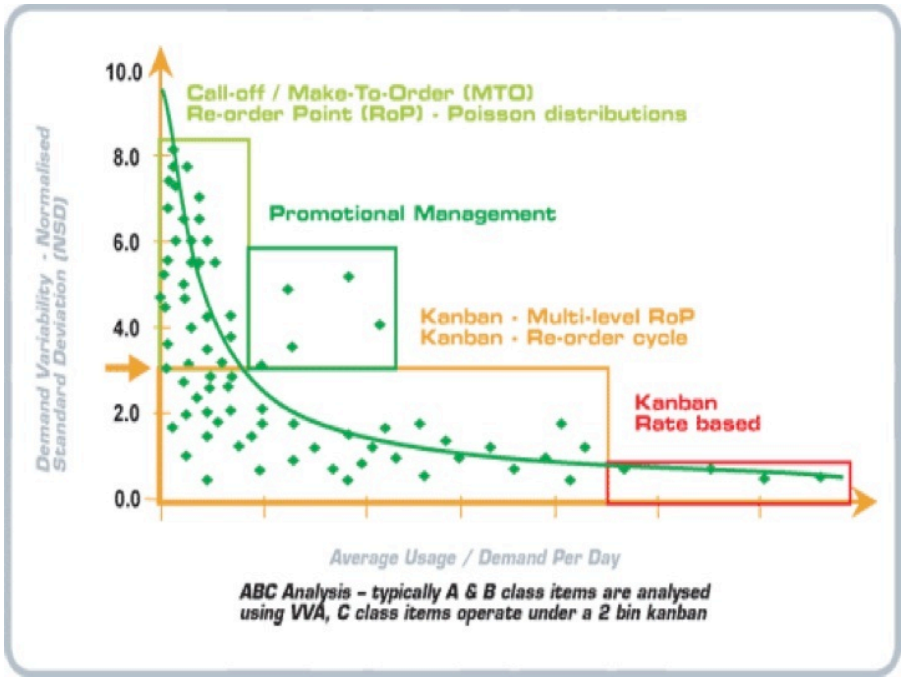
Multiple deliberately planned, but independent, inventory positions – these recognise that all value add process lead-times inevitably suffer natural variation as well as responding to load, especially when capacity utilisation is high. The inventories both absorb and prevent the variation being propagated / amplified up and down the supply chain through MRP's 'dependent demand'

Replenished to a calculated stock target in line with real demand – each inventory position is sized according to average demand over the local replenishment lead-time, plus something for local variability, with appropriate adjustments for trend, seasonality and events. Inventory at every echelon is replaced as it is consumed by down-stream demand and the supply chain thereby autonomously responds to real demand, and its relatively low level of variation, without propagating / amplifying forecast error induced variability and creating the cost generating buffers of capacity, time & inventory.

Efficient and stable sequence – replenishment at every echelon has its own optimal sequence / cycle which is always followed, respecting MOQs (which means certain items are sometimes skipped) and never interrupted or changed so Operations can be level loaded to extremely high levels of capacity utilisation

without 'stress'.

The appropriate replenishment techniques and when they should be used are as illustrated below:



1. High Volume / Low Variability - 'level schedule' or 'rate based' supported by a planned level of variability buffer inventory

2. Low Volume / Low to High Variability – depending upon the circumstances the appropriate technique might be ATO, MTO, 2-bin or poisson based.

3. Medium Volume / Medium Variability – replenish against consumption, up to a managed stock target in a stable and optimal sequence.

4. High Volume / High Variability – use of 1 or 3 but with either ATO response to spikes or their anticipation, and advance stock build using a forecast, for Events. But real Events, that need planning for, or reacting to, are very much less common than might be expected in, say, a highly promotions intensive market place, because the autonomous demand driven response to stock targets is surprisingly resilient.

These item level techniques can be different at different levels within the supply chain (including within the factory), depending upon the local demand volume / variability. And they can just as easily apply across the extended collaborative supply chain as within a single company's (3). For instance, a supplier might respond to a customer via ATO or, assuming it has visibility of downstream stock / demand, replenish against consumption, while using level schedule for upstream material supply.

That Demand Driven is transformational is demonstrated by its typical benefits when implemented (4):

1. Achievement of consistently high planned service levels, with

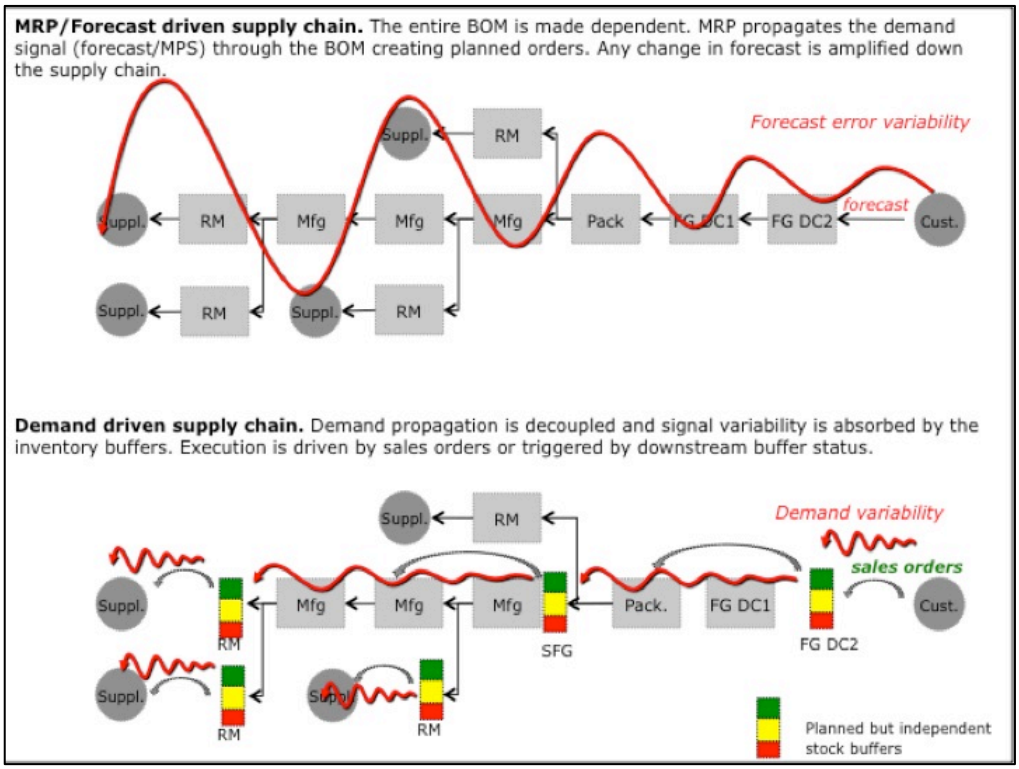
2. Reductions in average inventory of between 30% to 50%, and

3. Reduction in unplanned over-time, or increase in capacity utilization, enabling cost reductions of c20%, with
4. Lead-time reductions of up to 85%

These can be understood in the context of what supply chains really are – flows of materials through value add processes that are prone to turn into queues whenever there is variability due to lack of flexibility, particularly in the presence of high capacity utilisation. This lack of flexibility can either be buffered with time (make the customer wait), capacity (chop and change the schedule with unplanned change-overs) or high levels of inventory (5).

If the supply chain isn't flexible enough to respond perfectly to demand then these buffers are inevitable. MRP's erroneous use of fixed lead-times and dependent demand are a serious inhibitor of flexibility and, ironically, the frequently seen response of MRP system lead-time inflation to compensate only makes the situation worse – not least by causing more work to be released to the factory floor thereby further increasing demand for capacity.

In reality, supply chains will exhibit all three buffers and in 'forecast push' supply chains the aggregate buffer is always far more than that necessary because of the variability injected by the forecast error and its amplification by fixed lead-times and dependent demand. Demand Driven supply chains suffer significantly less variability, hence their improved performance, due to the elimination of forecast error induced variability and minimisation of the residual through use of the multiple de-coupling points as demonstrated below:



The Myths

Demand Driven is just MTO – the belief that Demand Driven is just 'make to order' is generally held by those who still erroneously think that 'pull', in a Lean context, is about responding to customer orders. In fact MTO is a form of

Demand Driven but is clearly not appropriate where customer's demand response times that are less than that of the supply lead-time, as is the case with fast moving products. As has been described, Demand Driven applies to such ex-stock supply chains where the forecast is used to size the buffers but replenishment is driven by demand.

Demand Driven is only for material replenishment – this is one of those myths, sometimes heard from analysts, that contains its own fatal illogicality. Demand Driven is certainly very suitable for managing the replenishment of materials that are stocked upstream to support an MTO or MTS final assembly. In effect, such stocks are an inventory buffer that allows, say, a faster MTO response. Seen in this way it is clear that such an approach is equally valid for driving final assembly itself which is exactly what Demand Driven 'ex-stock' manufacturers are doing.

Demand Driven isn't suitable for driving production – allied to the above, this suggestion seems to be based on the idea that somehow production activities are so complex that equally complex algorithms are necessary to 'optimize' performance. In fact, most of the often experienced immense complexity involved with managing multi-echelon / shared work centre / capacity constrained manufacturing environments is generated by the use of inaccurate forecasts to drive production and all the difficulty caused by the resulting variability, expediting and fire-fighting. No matter how complicated the production process, material flow always follows the queuing theory principles, described earlier, that justify the use of Demand Driven. In fact, the greater the complexity and volatility of the demand and supply environment the stronger is the case for using Demand Driven to eliminate 'forecast error induced' variability and avoid amplification of any that is residual.

Demand Driven is about Demand Sensing / Shaping and Real Time Response – this is the key message from technology providers, and their large consultancy partners, that have a vested interest in selling overly complex (and expensive) software and who seek to improve the performance of the supply chain model that they have been selling for c40 years.

By way of example, here are a couple of examples from current web-sites:

> Terra Technology (apparently a "cool vendor" according to Gartner) – "Confidently navigate volatile markets with accurate forecasts that reflect current market realities. Demand Sensing monitors daily demand signals from across the value chain and decreases forecast error up to 40%. This complements existing demand planning systems to create an agile demand-driven supply chain." (6)
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> SAP – "Organizations with disparate demand management approaches struggle with demand signal visibility and poor forecast performance. However, they can overcome these challenges with a comprehensive, holistic demand sensing and shaping approach that enables them to sense

demand patterns and respond to them more quickly and accurately.

Demand sensing and shaping includes the ability to capture and harmonize demand into a single demand picture to understand changing patterns quickly. These demand signals are integrated into core demand management response processes, such as short-term planning to drive fulfillment and manufacturing execution, and demand planning to adjust forecasts and new product launches. Promotional plans also benefit from more- accurate adjustments that increase their effectiveness and feed better inventory and supply planning decisions.
Effective demand sensing and shaping processes are driven across the organization, providing insight from all departments within the company. Items like sales forecasts and new product plans are incorporated into the demand management process with full understanding of the context." (7)

There is no doubt that these technologies can marginally improve the performance of what are still essentially 'forecast push' supply chains but the increment comes at an enormous cost and is significantly less than that offered by the real Demand Driven approach that allows the supply chain to autonomously Flow. In fact, Michael Lipton, SAP's Senior Director of SCM Solutions admitted as much in a 2013 Industry Week article in which he wrote:

"Lastly we are seeing some companies adopt the ***ultimate*** (my italics) demand-driven supply initiative—consumption-based pull planning. In this scenario, inventory buffers are placed at critical points in the supply chain to decouple processes and minimize lead times, and supply actions (deployment, production and procurement) are triggered by consumption-based replenishment. This affords protection against demand uncertainty by only building to a replenishment signal, not to a forecast" (8)

Demand Driven is MEIO – Multiple Echelon Inventory Optimisation is a methodology first developed by SmartOps and who have now been bought by SAP. The idea and maths behind MEIO is that in a multi-echelon supply chain, less aggregate safety stock can be held by relocating it from the customer facing echelon and positioning it upstream. While this might appear to be similar to Demand Driven it isn't because the echelons are still using 100% dependent demand and the logic of the forecast push MRP process is still to avoid use of the buffer. Whereas the static aggregate safety stock calculations may be correct, the dynamic reality continues to be high levels of supply chain variability and unplanned buffer due to the forecast error and its propagation up the supply chain. Supply Chains are dynamic 'complex adaptive systems' that, as such, cannot be optimised in a static sense – only continuously improved upon. (9)

Demand Driven Value Networks – is the terminology used by Gartner to describe their vision of how supply chains should be managed. In detail it involves (10):

1. End-to-end alignment and synchronization of demand, supply and product cycles across multiple enterprises
2. Ability to better manage demand through sensing and shaping processes
3. Ability to translate demand to deliver a profitable and sustainable supply response
4. S&OP that links execution with strategy to facilitate conscious trade-offs across demand, supply and product networks
5. Metrics driving joint value for customers, suppliers and shareholders

6. Technology architecture enabling collaborative relationships, end-to-end visibility, responsiveness, and fact-based decision making to maximize value and mitigate risk
7. Culture that develops and/or acquires talent to enable transformation and that encourages new learning, while also gaining scale by sharing standardized and proven practices

Most of this is very sensible but note the early reference to the need for demand sensing and shaping and the complete lack of any reference to the key element of what defines a real Demand Driven supply chain: its use of multiple planned but independent inventory buffers that are replenished in line with demand, not the forecast. Maybe Gartner feel constrained and unable to be fully independent, for some reason, in their definition of a real DDVN?

Academia

In the academic supply chain world Martin Christopher, Dennis Towill and Jan Godsell have co-authored a number of excellent papers on the strategic approach to demand driven supply chain management, supply chain segmentation and the appropriate use of different replenishment techniques: Leagility. Little, however, has been written specifically about "pull" replenishment except in the context of Lean. As a technique for managing 'end to end' supply chains with 'pull' there appears to be only one paper (11) and one study investigating the effectiveness of Demand Driven (12) though much has been written about the causes of 'bullwhip' and the negative impact of variability (13). According to Professor Jan Godsell, of Warwick University, this is because academics are perhaps unaware of the gap between what they take for granted (ie. the superiority of replenishment techniques using an 'order up to target' logic such as that used in Demand Driven) and what is actually used in industry (ie. forecast push MRP) – though she has herself experienced the extreme difficulty involved in trying to re-configure SAP APO to support Demand Driven ways of working!

Next Steps

If you are interested in the Demand Driven approach to SCM, the Demand Driven Institute run a 2 day education and certification course (CDDP / M – Certified Demand Driven Planner / Manager) through endorsed instructors (such as the author) and certify software packages that meet the real Demand Driven criteria. Information on these as well as some excellent white-papers and case studies can be found at www.demanddriveninstitute.com

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10. See Definition: Demand-Driven Value Networks, Burkett, M. 13 July 2012
11. Jan Holhager, Supply chain management: a just-in-time perspective, *Production Planning & Control*, 2002, Vol. 13, No. 8, 681–687
12. Lee & Yang, A system dynamics model to evaluate the performances of MRP and demand driven MRP, *Journal of the Korean Society of Supply Chain Management* October 2004, Vol. 14, No. 2, pp.125~136.
    Lee and Yang found that:
    i) Under conditions of perfect supply chain stability with no variance in demand, lead time and receipt qty the MRP model is more effective than DDMRP in terms of total management cost.
    ii) b) The greater the increase in these variances, DDMRP is more robust than MRP in terms of total management cost.
    iii) Generally, the MRP model is often deemed more appropriate for make-to-order environments and DDMRP is for make-to-stock. If we classify MTS and MTO by the size of their variances, the variance of MTO is greater than MTS but the simulation results are a little counter-intuitive: the more variance in demand, lead time and receipt qty, the more robust is DDMRP versus MRP which means that DDMRP is also more robust than MRP in make-to-order environments.
13. See for example Forrester, Industrial Dynamics 1961; Hopp & Spearman, Factory Physics, 1995