Building a Demand Driven Supply Chain

Moving industry from the world of Push and Promote to the world of POSITION AND PULL
What is the Problem we are Solving?

Today’s formal planning systems are fundamentally broken!
Old Rules, Old Tools, New Pressures

• Forecast error is on the rise
• Supply Chain Complexity and Volatility is increasing
• Legacy planning tactics and tools are breaking down
  ► Inside most modern ERP systems is MRP
  ► 79% of ERP Buyers implement MRP
  ► Conceived in the 1950’s
  ► Codified in the 1960’s
  ► Commercialized in the 1970’s and…
  ► …it hasn’t changed
The “New Normal”

- Global sourcing and demand
- Shorter product life cycles
- Shorter customer tolerance times
- More product complexity and/or customization
- Pressure for leaner inventories
- Inaccurate forecasts
- More product variety
- Long lead time parts/components

Worldwide there are more complex planning and supply scenarios than ever – the past is NOT an predictor for the future
<table>
<thead>
<tr>
<th>Circumstance</th>
<th>1965</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Chain Complexity</td>
<td>Low. Supply chains looked like chains – they were more linear. Vertically integrated and domestic supply chains dominated the landscape.</td>
<td>High. Supply chains look more like “supply webs” and are fragmented and extended across the globe.</td>
</tr>
<tr>
<td>Product Life Cycles</td>
<td>Long. Often measured in years and or decades (e.g. rotary phones)</td>
<td>Short. Often measured in months (particularly in technology)</td>
</tr>
<tr>
<td>Customer Tolerance Times</td>
<td>Long. Often measured in weeks and months</td>
<td>Short. Often measured in days with many situations dictating less than 24 hour turns.</td>
</tr>
<tr>
<td>Product Complexity</td>
<td>Low.</td>
<td>High. Most products now have relatively complex mechanical and electrical systems and micro-systems. Can you even work on a modern car anymore?</td>
</tr>
<tr>
<td>Product Customization</td>
<td>Low. Few options or custom feature available.</td>
<td>High. Lots of configuration and customization to a particular customer or customer type.</td>
</tr>
<tr>
<td>Product Variety</td>
<td>Low. Example – toothpaste. In 1965 Colgate and Crest each made one type of toothpaste.</td>
<td>High – in 2012 Colgate made 17 types of toothpaste and Crest made 42!</td>
</tr>
<tr>
<td>Long Lead Time Parts</td>
<td>Few. Here the word “long” is in relation to the time the market is willing to wait. By default if customer tolerance times were longer it stands to reason that there were less long lead time parts. More so, however, is that fact that supply chains looked different. Most parts were domestically sourced and thus often much “closer” in time.</td>
<td>Many. Today’s extended and fragmented supply chains have resulted in not only more purchased items but more purchased items coming from more remote locations.</td>
</tr>
<tr>
<td>Forecast Accuracy</td>
<td>High. With less variety, longer life cycles and high customer tolerance times forecast accuracy was almost a non-issue. “If you build it, they will buy it.”</td>
<td>Low. The combined complexity of the above items is making the idea of improving forecast accuracy a losing battle.</td>
</tr>
<tr>
<td>Pressure for Leaner Inventories</td>
<td>Low. With less variety and longer cycles the penalties of building inventory positions was minimized.</td>
<td>High. At the same time operations is asked to support a much more complex demand and supply scenario (as defined above) they are required to do so with less working capital!</td>
</tr>
<tr>
<td>Transactional Friction</td>
<td>High. Finding suppliers and customers took exhaustive and expensive efforts. Choices were limited. People’s first experience with a manufacturer was often through a sales person sitting in front of them.</td>
<td>Low. Information is readily available at the click of the mouse. Choices are almost overwhelming. People’s first experience with a manufacturer is often through a screen sitting in front of them.</td>
</tr>
</tbody>
</table>

From Demand Driven Performance – Using Smart Metrics (Debra Smith and Chad Smith, McGraw-Hill, 2013)
Modern Planning Systems Broken?!
Poll Question #1

What would happen to your planning and scheduling capability if you lost your Microsoft Office License?
US firms’ ROA fell to a quarter of its 1965 levels in 2012. To increase, or even maintain, asset profitability, firms must find new ways to create value from their assets.
Where to Start?
The First Law of Supply Chain

All benefits will be directly related to the speed of **FLOW** of materials and information.

Corollary:
Materials and Information must be RELEVANT!!!
"All Benefits" Encompass:

- **Service** is consistent and reliable when a system flows well.
- **Revenue** is maximized and protected.
- **Inventories** are minimized.
- **Expenses** ancillary and/or unnecessary are minimized.
- **Cash flow** follows the rate of product flow to market demand.

**Protect and Promote Flow = ROI Maximization**
Flow is the enabler for the primary objectives of most functions in the company.
Flow is the intersection of prevailing improvement methods

**Lean**
- Primary Objective: Reduce Waste

**Six-Sigma**
- Primary Objective: Reduce Variability

**Theory of Constraints**
- Primary Objective: Improve Throughput
Two Universal Point of Inventory

Too Little

Warning

Optimal Range

Warning

Too Much

Note: “Optimal” is from an on-hand perspective
The MRP “Bi-Modal” Distribution
Virtually All Supply Chains Suffer from the “Bi-Modal” Inventory Distribution

Three Simultaneous Effects:
1. Persistently High Inventories
2. Chronic and Frequent Shortages
3. High Expedite and Waste Related Expenses

“How can we have so much inventory and not be able to ship orders?!”
“We paid for fast freight now we don’t need it?!”
Poll Question #2

Do you have the bi-modal distribution in your business?
Nervousness: “The characteristic in an MRP system when minor changes in higher level (e.g. level 0 or 1) records or the master production schedule cause significant timing or quantity changes in lower level (e.g. 5 or 6) schedules or orders.” (APICS Dictionary 12th Edition, Blackstone, 86)
See How Nervousness Happens in MRP

FREE VIDEO

The Conventional Planning Puzzle
– Just How Crazy Does MRP Make Your Life?

Carol Ptak from the Demand Driven Institute demonstrates through a simple and realistic exercise just how complicated even the simplest environment can get through conventional MRP rules.
Bullwhip Example
What is Demand Driven MRP?

A multi-echelon materials and inventory planning and execution solution.

Demand Driven MRP (DDMRP)

Material Requirements Planning (MRP)  Distribution Requirements Planning (DRP)  Lean  Theory of Constraints  Six Sigma  Innovation
The Five Components of DDMRP

<table>
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<td>Strategic Inventory Positioning</td>
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1. Modeling/Re-modeling the Environment
2. Plan
3. Execute

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Component 1: Positioning

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Where?  
(Position)

BEFORE

How Much?  
(Quantity)

When?  
(Timing)
Component 1: Positioning

Demand Driven Material Requirements Planning

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Strategically places decoupling points within the product structure and supply chain to absorb variability and compress lead times

Dampened Variability

Compressed Lead Times
## Component 1: Positioning

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## 6 Factors

1. Customer Tolerance Time
2. Market Potential Lead Time
3. Supply and Demand Variability
4. Inventory Flexibility and Matrix BOM
5. Supply and Distribution Net Structure
6. Critical Resource Considerations
Failure to properly position inventory is a huge source of waste for most manufacturing and supply chain companies.

Position and Pull
Component 2: Buffer Profiles and Levels

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Group Trait Inputs + Individual Part/SKU Inputs

- Lead Time Category
- Make, Buy or Distributed
- Variability Category
- Significant Order Multiples

- Average Daily Usage
- Appropriate Discrete Lead Time
- Ordering Policy (min, max, multiple)
- Location (distributed parts)

Alerts:
- Stock Out
- ALERT!
- Rebuild
- OK
- Too Much
Component 2: Buffer Profiles and Levels

Buffer zones & sizes are a function of group profile (lead time and variability)

Individual part attributes (MOQ or OC)

The green zone is the heart of the coverage and shock absorption: 100% of average daily usage over the full lead time.

The yellow zone is the heart of the supply order generation process. It determines average order frequency and typical order size: MOQ or an order cycle in days.

The red zone is the risk mitigation embedded in the buffer and has two calculations. First is a % of the yellow zone and establishes the base. Second is safety based on the variability.
# Buffer Zone Sizing Calculation Examples

## Lead Time Categories for Parts

<table>
<thead>
<tr>
<th>LT Profile</th>
<th>Category</th>
<th>Lead Time Range</th>
<th>Red Base %</th>
<th>Safety Protection %</th>
<th>Yellow Base %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>From</td>
<td>To</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>1</td>
<td>Cat 1</td>
<td>1</td>
<td>5</td>
<td>90</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Cat 4</td>
<td>6</td>
<td>16</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>8</td>
<td>Cat 8</td>
<td>17</td>
<td>36</td>
<td>35</td>
<td>25</td>
</tr>
</tbody>
</table>

## Part Attributes

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Buffer LT Profile</th>
<th>LT Days</th>
<th>ADU</th>
<th>Variability</th>
<th>MOQ</th>
<th>Order Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>r457</td>
<td>1</td>
<td>2</td>
<td>18</td>
<td>Low</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>r672</td>
<td>4</td>
<td>14</td>
<td>120</td>
<td>Med</td>
<td>3</td>
<td>3 days</td>
</tr>
<tr>
<td>r654</td>
<td>8</td>
<td>31</td>
<td>3</td>
<td>High</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

## Minimum Order Quantity

Minimum Order Quantity or (Average Daily Usage x order cycle days)

Average Daily Usage x Lead time (usage over full lead time)

Safety % x Red Base

Average Daily Usage x Lead time x base red %

### Part r457

- **30 (MOQ)**
- **18(ADU) X 2 days**
- **25% X 41 = 10**

### Part r672

- **120 ADU X DAYS 360**
- **50% x 1008 = 504**

### Part r654

- **10 (MOQ)**
- **3 ADU X 31 days**
- **90% x 33 = 30**
Component 3: Dynamic Adjustments

Recalculated Adjustments

Buffer levels flex as Average Daily Usage is updated.

Planned Adjustments

Buffers are intentionally flexed up in anticipation of planned uplifts or seasons and then flexed down.
Component 4: Demand Driven Planning

Demand Driven Material Requirements Planning

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Shifts to a Sales Order driven planning method

- Planned orders create supply orders in anticipation of need
- Forecast error associated with Planned orders results in inventory misalignments and expedite expenses

From:
- Forecast
- Plant
- Planning
- Logistics
- Suppliers

To:
- Sales Order
- Plant
- Planning
- Logistics
- Suppliers

- Only qualified sales orders within a short range horizon qualify as demand allocations
- Sales orders give a near perfect demand signal in terms of what will be sold and when it will be sold.
Poll Question #3

How many of you directly tie the forecast to the creation of planned orders?
Component 4: Demand Driven Planning

DDMRP creates resupply orders based on the “available stock” status of each buffer. This gives prioritized sequence based on actual need.

- “Available Stock” is unique to DDMRP – used to create supply order recommendations
- On-hand + On-order – **Qualified** Sales Order Demands
Qualifying Demand
Past Due, Due Today + Qualified Spikes

Order Spike Horizon = Length of time in the future in which spikes are considered

Order Spike Threshold = Quantity in daily buckets which would qualify for available stock equation inclusion
Generating Supply Order Recommendations

Supply generation is based on what zone the available stock equation places the part.

Available stock = on-hand + on-order – QUALIFIED sales order demand (past due, due today and qualified spikes)

<table>
<thead>
<tr>
<th>Part</th>
<th>Open Supply</th>
<th>On-hand</th>
<th>Demand</th>
<th>Available Stock</th>
<th>Recommended Supply Qty</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>r457</td>
<td>5453</td>
<td>4012</td>
<td>1200</td>
<td>8245</td>
<td>0</td>
<td>No Action</td>
</tr>
<tr>
<td>f576</td>
<td>3358</td>
<td>4054</td>
<td>540</td>
<td>6872</td>
<td>3128</td>
<td>Place New Order</td>
</tr>
<tr>
<td>h654</td>
<td>530</td>
<td>3721</td>
<td>213</td>
<td>4038</td>
<td>2162</td>
<td>Place New Order</td>
</tr>
<tr>
<td>r672</td>
<td>2743</td>
<td>1732</td>
<td>623</td>
<td>3852</td>
<td>0</td>
<td>Expedite Open Supply (Execution)</td>
</tr>
</tbody>
</table>
Component 5: DDMRP Execution

Open Supply Priority Management

<table>
<thead>
<tr>
<th>Order #</th>
<th>On-Hand Status</th>
<th>Order Type</th>
<th>Due Date</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO 819-87</td>
<td>Critical 23%</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>WO 83241</td>
<td>Critical 37%</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>WO 211-72</td>
<td>Alert 54%</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
</tbody>
</table>

Order # | Order Type | Due Date  | Customer |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MO 12367</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12379</td>
<td>MTO</td>
<td>5/12/2011</td>
<td>Super Tech</td>
</tr>
<tr>
<td>MO 12465</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12401</td>
<td>Stock</td>
<td>5/14/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12411</td>
<td>Stock</td>
<td>5/16/2011</td>
<td>Internal</td>
</tr>
</tbody>
</table>

Priority by Buffer Status instead of Priority By Due Date!
On-Hand versus Available Stock

Average On-hand Position = Red Zone + One-half of Green Zone

Average On-hand Range = Top of Red Zone to Top of Red Zone + Green Zone
The Power of DDMRP

Too Little | Red | Yellow | Green | Too Much

# of parts or SKU

0
Analytics and Metrics

Starting Demand Driven

Initial Results

Mature Implementation
The DDMRP Pyramid

Better Alignment of resources to actual demand retains flexibility, promotes velocity with fewer course corrections.

New emphasis on relevant operational components for FLOW.

Fundamental planning equation based on sales order demand against dynamically managed decoupling points.

Fundamental Principal
Certified Demand Driven Planner Program

Upcoming sessions in Europe, Australia, Africa, Asia and North America

CDDP Information and Registration: [http://demanddriveninstitute.com/cddp_program.html](http://demanddriveninstitute.com/cddp_program.html)
LeTourneau Case Study
Synchronization and Flow Challenge

Distortions & amplification in demand requirements reverberate backward

Supply Variability

C = Customer

= Remote Location

Steel Products

Component Supply (H/L)

Forestry Products

Mining Products

Drilling Systems

Offshore Products

End Item Assembly inherits the amplifying upstream variability.

Lead Time before DDMRP

Demand / Information Variability

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DDMRP Design

= Strategic Replenishment Buffers
= Time Buffer

C = Customer
= Remote Location
DDMRP (Longview) vs. MRP (Houston)

Low Inventories
High Service
Fewer Expedites

High Inventories
Shortages
Massive Expedites

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About Chad Smith

Chad Smith is the co-author of the third edition of *Orlicky’s Material Requirements Planning 3/E* (Ptak and Smith, McGraw-Hill, 2011) and the co-author of *Demand Driven Performance – Using Smart Metrics* (Smith and Smith, McGraw-Hill, 2013). He is a co-founder and Partner at the Demand Driven Institute, an organization dedicated to proliferating demand driven methods globally.

Chad serves as the Program Director of the International Supply Chain Education Alliance’s Certified Demand Driven Planner (CDDP) Program. Clients, past and present, include Unilever, LeTourneau Technologies, Boeing, Intel, Erickson Air-Crane, Siemens, IBM, The Charles Machine Works (Ditch Witch) and Oregon Freeze Dry. Chad is also a certified expert in all disciplines of the Theory of Constraints studying directly under the tutelage of the late Dr. Eli Goldratt.

Contact Chad at: csmith@demanddriveninstitute.com