Inventory Planning & Optimization: Extending The Enterprise through the Supply Chain
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Executive Summary

A good way to introduce Inventory Planning and Optimization (Inventory Management) is to say that competitive advantages arise from an organization’s ability to deliver the right product to the right place at the right time, at the right price.

The implication is that companies with superior planning and execution systems to support the movement of merchandise will control the market. As Forrester Research notes, “As the flow of goods more closely matches demand conditions, companies are able to trim inventories, improve customer satisfaction, and avoid nasty surprises” (Source: C. Mines, Six New Technologies to Boost Business Results, Forrester Research, May 2002)

In addition current trends around inventory management are:

- **Manual inventory reduction policies** – These crude policies have come at a cost to customer service levels.

- **Mass customization** - The range and variety of products available to customers is unprecedented.

- **Shorter product life cycles** – When demand does not meet forecasts, inventory write-offs are the result.

- **Market leaders invest heavily in technology and advanced planning systems** - Leading companies like Wal-Mart and Dell, who make use of advanced SCM solutions have higher inventory turns than their industry competition.

<table>
<thead>
<tr>
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<th>Leader - Inventory Turns</th>
<th>Laggard– Inventory Turns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPG Suppliers</strong></td>
<td>Procter &amp; Gamble - 6.43</td>
<td>Johnson &amp; Johnson - 3.07</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Dell - 64.34</td>
<td>Compaq/HP - 14.84</td>
</tr>
<tr>
<td><strong>Contract Manufacturers</strong></td>
<td>Flextronics - 8.86</td>
<td>Solectron - 4.92</td>
</tr>
<tr>
<td><strong>Retailer</strong></td>
<td>Wal-Mart - 7.29</td>
<td>K-Mart - 4.39</td>
</tr>
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Sources: Zacks investment Services and Forrester Research Figure 1 – Inventory Turns widely Differ in Industries
In the last decade, Retailers, Distributors and Manufacturers having been introducing supply chain management (SCM) software, specifically designed to enable firms to better manage the planning (SCP software) and execution (SCE software) of supply chain functions. Figure 2 shows the various functional options available in the SCM market. The black eclipse shows the area of Inventory Planning and Optimization. A few companies have achieved success through custom development utilizing a mix of decision support tools and simple algorithmic solutions.

**ERP Systems Today**

ERP systems were developed in the 1970’s to allow large companies to automate the processing of transactions related to business functions like finance, order processing, human resources and material requirements planning. Companies like **SAP**, **Baan** and **JD Edwards** were among the first to explore these opportunities. ERP systems were designed to allow a single software package to replace disparate and obsolete software within the corporation.
The late 1990’s saw a huge growth in the adoption and implementation of supply chain planning systems. ERP vendors have added new SCM modules onto their core product suites and are aggressively marketing this new functionality.

Some of the reasons outline ERP vendors have added SCM functionality to their product include:

- **Transaction focus (ERP) vs. Decision Support focus (SCM)**
  ERP systems were developed for transaction processing, data collection and data reporting. Users who accessed the ERP database looking to make critical supply chain decisions were overwhelmed by the sheer volume of content.

- **Rigidity vs. Alternative Analysis**
  Assumptions regarding operating constraints such as lead times and safety stock are often hard-coded in ERP systems. Inflexible plans created under these conditions are not favorable to optimizing results for a Customer’s particularly unique complexities.

- **One-Dimensional Planning vs. Multi-Factor Analysis**
  ERP systems normally employ some flavor of MRP (Material Requirements Planning) or MRP-II (Manufacturing Resources Planning) for internal supply chain planning. Unfortunately these methodologies are sequential in nature, which makes them unsuitable for considering multiple dynamically changing constraints such as varying lead times and incorporating real demand into their equations.

Plans created by sequential techniques are rarely optimal on the first attempt. Because organizational requirements change consistently, sequential planning can never produce a truly optimal plan for any useful period of time.

**Inventory Planning & Optimization Solutions**

Inventory optimization software is the most recent addition to the suite of Supply Chain Management (SCM) solutions. These solutions establish the optimal mix between inventory investment and service levels for each inventory item at each location within an organization.

Inventory Planning and Optimization solutions do not process transactions. Rather, they use the data from the existing ERP or Transaction systems such as POS to allow managers to make better operational decisions and then execute against them.
These solutions are strategic and tactical planning and initial execution process tools that analyze all necessary information, past, present and future to build the ideal working inventory model. Users are then also given the ability through the solution to operate against the model, making dynamic adjustments along the way, to recover profit from inventory.

Advanced functionality typically includes:

- Merchandise and Material Acquisition Analysis & Planning
- Demand Planning & Forecasting
- Inventory Modeling
- Automated Replenishment
- Distribution and Re-Distribution
- Collaborative Planning
- Analysis Tools

Inventory Optimization software finds the optimal level of inventory investment, for a given customer service level for each item of inventory at each location within an organization. Optimization balances supply to meet demand at the lowest possible cost (investment in inventory), using the least company resources, for a given service level, for each item at each site within the entire supply chain.

Organizations today realize that although strategies focusing on outsourcing transportation, e-business and new distribution models are important, these are all secondary in relation to what lies at the heart of any supply chain: INVENTORY. Although firms have invested significantly in ERP and MRP systems in the last decade, overall inventory levels within the extended supply chain remain relatively unchanged.

Inventory management solutions free up company resources to focus on managing the business more efficiently and addressing other business challenges.

Inventories typically comprise 40-50% of a manufacturing or distribution organization’s capital investment. “Right-sizing” this investment, without compromising service levels, provides management with a beneficial way of increasing return and freeing needed capital for expansion and other strategic investments. Again this goes against conventional wisdom, which states that
inventory reductions will not provide the same profitability increase as that of increasing sales. However, with gross margins under extreme pressure, the reduction of investment in “dead” stock is significant. It reduces the Cost-of-Goods by not purchasing merchandise that will not be sold.

“While sales are obviously important, ongoing inventory optimization practices actually afford the single largest opportunity to have a direct impact on profitability. Optimization of inventory can result in an inventory reduction of 30%, while also reducing out-of-stock situations and ensuring that the correct stock is available to satisfy demand. These are benefits that can’t be realized by increasing sales.” (Source: J.Healy, Profit from the inside out, isourceonline.com, 2002)

Traditionally, inventory management was measured by way of the number of times stock was turned. However, by focusing exclusively on this measure, organizations failed to take advantage of things like volume discounts and customer service levels.

To avoid simply getting more efficient at moving the wrong stock around, the trend is for Retailers, Distributors and Manufacturers to leverage their ERP investment by implementing relatively inexpensive and rapidly deployed Inventory Planning and Optimization solutions.

Inventory Optimization involves consideration of multiple factors in determining the desired stocking levels and purchase quantities for all products in the organizations “catalogue”.

**Characteristics of Inventory Optimization systems include**

- **Lead time forecasting** – forecasts the most appropriate supplier lead time for any item or supplier and quantifies the variability of this lead time into a measurable variance.

- **Service level analysis** – information monitored includes demand history, demand variation, profit margins and lost sales.

- **Demand forecasting** – includes seasonality and life cycles, promotional filters, demand spikes, trend analysis, item profit margins and other deterministic factors.

- **Order frequency** – correct order frequency analysis can reduce inventory by 10 – 15%. The trade-off between economic break points and minimizing on-hand quantities results in a dynamic review period for re-ordering.
• **Replenishment** – takes into account timing of the order, order point, potential overstock/under stock situations, promotional information, and production changes. Purchasing and inventory management established as a profit center.

• **Network aware** – inventory planning is done taking into account the requirements of the entire supply chain network including suppliers and customers. This global view replaces the traditional sub-optimization by product and/or location.

• **Collaboration** - new browser-based technology allows for planning through the participation of the entire supply chain community. This was previously not possible in the past, where systems were not open to integration. CPFR (Collaborative Planning for Replenishment) and VMI (Vendor-managed Inventory) are now becoming commonplace.

**Forecasting and Algorithms are an Important Element as part of a Complete Solution**

Forecasting is not to be confused as being used only in calculating demand. In fact, any good software will use forecasting for lead-time analysis as well, as this presents a key factor in replenishment decisions and hence proper inventory modeling. Forecasting should be used on a group level as well as individual SKU levels and exploded and collapsible respectively. Some innovative solutions use best fit forecasting by allowing different forecasts to compete with each other with the winning forecast being applied. Forecasts must be able to handle promotions and events, various causal attributes from internal and external sources, and lost sales in order to be effective.

Another important area where forecasting and other algorithms are used is in safety stock calculations. One cannot stress enough the importance of safety stock calculations. Some vendors will do simple averaging, others some forecasting. Certainly a more innovative approach has been the adoption of neural network-based algorithms that factor in a whole set of variables into the final calculation.

**How is the Return on Inventory Optimization measured?**

Inventory optimization systems add value by recovering profit from inventory in the following areas:

• Increased profitability by avoiding markdowns and obsolescent write offs.
• Lowered working capital cost of holding excess stock through redistributing excess

• Better purchase order management.

• Better cost management associated with space utilization, both at warehouses and stores.

• Lower transportation costs through network planning

• Reducing excess stock by accurate forecasting of demand.

• Increased customer service levels.

• Increased Customer spending based on increased availability.

• Improved product mix.

• Safety stock cannot be reduced through better predictive techniques that decrease variability and uncertainty and therefore control holding costs.

• Lost sales reduced through improved in-stock position.

• Slow moving items treated with rules that account for periodic review rather than constant monitoring.

• Exception management and event management allow buyers and product managers to focus their efforts instead of having to manage each and every order.

• Better understanding of lead time, with business managed better accordingly.

Other savings that organizations make, which are more complex to measure, but never-the-less can make a significant contribution include but are nor limited to automated functions that some software solutions will execute and leave managers to manage through exception, efficiencies within the organization, better planning and related shorter planning cycles, and the freeing up of cash flow.

**The Case for an Inventory Optimization Solution**

Inventory Optimization solutions allow an organization to achieve a balance between the most efficient investment in inventory and highest customer service levels.
"One such misconception is that existing enterprise resource planning (ERP) systems can handle inventory management adequately. For small distributors not working in complex environments, this may be true. Most ERP systems do count and track inventory very well, and possibly even provide a basis for replenishment. However, such systems can lack the sophistication required to take inventory management to the next level, as well as the responsiveness necessary to handle rapidly changing market conditions. Nor do they have the depth or strength to evaluate and forecast inventory down to individual products and locations, which is essential if you're going to squeeze out additional costs and increase profits." (Source: S. Kilgore, Balancing Supply and Demand, Forrester Research, March 2002)

ERP vendors themselves have recognized this fact, and have recently started adding advanced planning functionality as separate extensible modules to their core product offerings. Inventory Optimization software recognizes that different industries have different inventory profiles and requirements. That fast moving retail items have different characteristics to slow moving items in automotive spare parts. Inventory Optimization software have this functionality.

<table>
<thead>
<tr>
<th>Type &gt;</th>
<th>Slow Moving</th>
<th>Recurring</th>
<th>Multi-tier</th>
</tr>
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<tbody>
<tr>
<td><strong>Example</strong></td>
<td>Automobile Gearboxes</td>
<td>Household Detergents</td>
<td>Packaging</td>
</tr>
<tr>
<td><strong>Inventory Characteristics</strong></td>
<td>High Service Criticality, Sporadic Demand, Lead time exceeds service levels</td>
<td>Continuous demand, reliable lead times and high volumes</td>
<td>Seasonal demand, variable lead times, and moderate volumes</td>
</tr>
<tr>
<td><strong>Inventory Model Based upon</strong></td>
<td>Causals and service levels</td>
<td>Historical demand</td>
<td>Historical and causal demand</td>
</tr>
<tr>
<td><strong>Application Requirements</strong></td>
<td>Item criticality and product substitution</td>
<td>Model must be linked to demand forecasts</td>
<td>Optimization across multiple tiers</td>
</tr>
<tr>
<td><strong>Example of Applications</strong></td>
<td>JustEnough, i2, Servigistics</td>
<td>Manugistics, Non-Stop, JustEnough, i2, SAP APO, JD Edwards /E3</td>
<td>i2, JustEnough, Optiant, SAP APO, Manugistics</td>
</tr>
</tbody>
</table>

Figure 5 shows how different inventory profiles have different requirements.
The Bottom Line

Considerations for any organization looking at implementing Inventory Optimization software also include the following:

- **How long will it take to implement the new modules?** This will be a function of the modularity of the enterprise’s ERP and SCM software and how well they integrate. Additionally, the time period will be dependent on the experience and capabilities of the implementation team. An experienced business analysis team can significantly reduce the time cycle by identifying the most important components, prioritizing the implementation, refining the existing business processes and organizational structure to take advantage of these capabilities.

- **How costly will the new software be?** The cost components will include, in addition to any license fees, the labor to integrate the new modules, the hardware and network upgrades to support the integration and the training and documentation necessary to insure the effective use of these tools.

- **Vendor Lifecycle** will the software vendors and integrators be around to support their efforts now and in the future. In today’s market, the life expectancy of most technology companies is severely limited. It is important to stress the need for extensive knowledge transfer to reduce the dependency of these organizations.