

Managing demand uncertainty

People, processes and leadership revolutionize HP media's supply chain

BY ROB WILKINS, BUBLU THAKUR-WEIGOLD AND STEPHAN M. WAGNER



WHILE FICKLE CONSUMERS, EVOLVING technology and unpredictable markets create challenges for any operations team, they also present opportunity. Innovative teams can turn such operational lemons into lemonade, making supply chain innovations as much a competitive advantage as the features of its products. The Hewlett-Packard media division is relatively young, having been established in 2001 just as digital photography was becoming the standard for image capture commercially and at home.

HP already had capitalized on consumer demand for cameras and photo printers with ink, paper, photo-related and other media products. The business grew quickly, but as consumer technology exploded, HP's media business realized that it needed a more efficient supply chain to ensure continued product availability for customers and financial viability for shareholders.

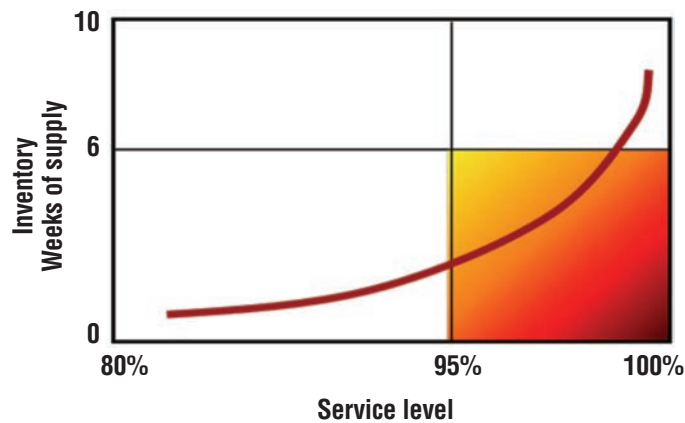
The quarterly scramble

HP media's operations team works under continuous cyclical time pressure. Because a publicly traded corporation like HP must provide regular financial reports, HP managers pay significant attention to their quarterly business metrics, which impact stock price and other crucial measurements. Inside the organization, this leads to activity in four three-month cycles: As sales teams work to hit revenue targets each quarter, in the background, supply chain teams continuously monitor and adjust operational metrics to hit their own performance goals.

HP media operations teams meet weekly to review actual shipment updates and performance indicators like forecast accuracy, manufacturing capacity, inventory and product availability. In a quarter's second month, time becomes tighter and the team begins to "run out of runway" when final corrections kick in too late to enter the current quarter's reports.

THE EFFICIENT FRONTIER

Figure 1. HP media operations must make sure enough, but not too much, inventory is available to maintain a high service level.



Measuring and managing performance

Time pressures complicate the task, as operations teams must balance the needs of customers, shareholders and internal stakeholders (like marketing) against timing challenges.

HP media manages its business by measuring availability (or service levels), revenue, gross margin and inventory (a proxy for cost). Within operations, supply chain managers face the ongoing challenge of reaching the sweet spot between the highest possible service level (or availability) and the lowest possible cost (or inventory weeks of supply), as shown in Figure 1.

On-shelf availability is critical in the supplies business. If customers want to buy HP media but the product is out of stock at the retailer, they buy a competitor's goods. Low availability means lost customers.

This concept differentiates HP's supplies business from its hardware business. If a personal computer model is out of stock, customers likely will buy another model, not necessarily a different brand. Therein lays the dilemma.

Naturally, marketing and sales teams want 100 percent availability to fill every

incoming order. Statistical analysis, however, shows that an infinite amount of inventory – and with it, unconstrained cost – would be required to sustain that service level. On the other hand, operations and financial analysts strive to minimize inventory, which could reduce ability to fulfill orders and generate revenue. Sales performance drops exponentially with every percentage point of inventory savings.

HP veterans Eric Johnson and Tom Davis showed in their 1998 article "Improving Supply Chain Performance by Using Order Fulfillment Metrics" that, "for a given set of policies, and for the prevailing operating environment," there is a "physics" to every supply chain system. The asymptotic trade-off is a function of the uncertainty that the supply chain must digest. "It indicates what is achievable, given current operating conditions – things like manufacturing cycle time, supplier performance and forecasts of varying customer order patterns."

To manage these trade-offs, HP media monitors days of inventory (or DOI), effectively the ratio of total days in a financial year to inventory turns. The following equations calculate this, where

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COGS equals cost of goods sold:

$$\text{Inventory turns} = \frac{\text{COGS}}{\text{Average inventory}}$$

$$\text{DOI} = \frac{\text{COGS}}{\text{Inventory} * 365}$$

Generally, the lower the DOI the better, though the value varies by industry. Because the report of turns is based on past average inventory levels, the measure looks backward. DOI essentially computes the average days the company needs to sell off its inventory and represents the cash conversion cycle to analysts and investors.

HP media uses software that computes the efficient frontier to set optimal inventory levels to achieve 95 percent service levels in each region. That is, with 95 percent availability, the business tolerates up to 5 percent of products in a short-term backlog at the end of the quarter. It's accepted that this proportion of orders may be difficult to deliver because factors like supplier response, manufacturing capacity and transport times vary unpredictably. And in the end, HP can't always know what customers may buy.

Supply chain challenges

HP media has a global supply chain with manufacturing nodes primarily in Europe, though a significant portion of its customer base is in North America. The production process often custom designs items with specialized coating chemistry. Supplier lead-times are typically four to six weeks, plus another four weeks for ocean transit to North America.

The configuration detailed in Figure 2 results in a complex system. Operations must enable revenue in a retail business driven by deals and promotions without exceeding strict quarterly inventory limits. Simultaneously, they must deliver on plans to increase revenue significantly over the next two years. The sales teams

work to get the orders in, and the inventory must be there. And all the while, regular scrutiny by shareholders and management keeps up the pressure to respond precisely and quickly to market changes.

For HP media teams, managing uncertainty requires best available information quality and flow. The company culture values scientific, data-driven methods, but in this case they implemented more than just technical solutions. Behavioral changes in stakeholders played a key role. HP media managers began looking at products, partners and processes in a new way. Each of the following steps improved the system's response to uncertainty, capturing revenue at every opportunity.

Demand-pull

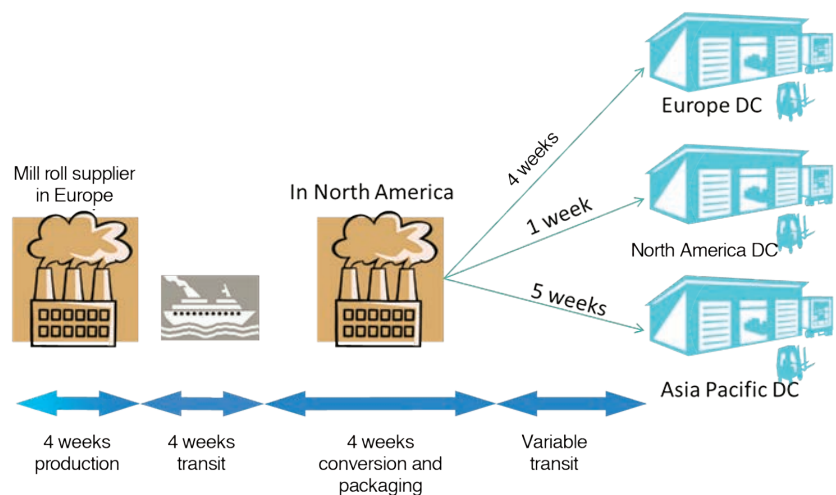
Working with a key supplier in Europe, HP media implemented the demand-pull program, which aims to convert supply chain planning from forecasts to actual consumption, effectively switching replenishment strategy from push to pull. Originally, the media team passed predictions upstream to suppliers, who delivered the requested quantity and

waited for the next order. By contrast, the new system sent actual consumption data to be used as replenishment quantities. Demand-pull essentially uses reorder point logic in its planning processes to trigger purchase orders when a minimum tolerable quantity of inventory on hand is reached.

Interesting in HP's implementation of reorder point logic is the frequency with which information is refreshed and passed upstream to suppliers. The review at which the reorder point quantity is adjusted is made daily, based on the uncertainty of customer demand measured as the coefficient of variation. At a variability of more than 10 percent, the reorder point is adjusted to keep the process from becoming too "nervous," preventing overcorrection. In case of promotions or events (like a trade show), an additional quantity is factored into the replenishment order. The adjustments are made manually on an SKU-by-SKU basis by the planning manager. Previously, weeks-of-supply targets were set once or twice a year. By increasing the refresh frequency, the supply chain operation improved both its responsiveness and flexibility.

GLOBAL DISTRIBUTION

Figure 2. HP media's photo paper supply chain spans continents.



THE DEMANDING PHONE SUPPLY



If you can't supply it, they can't buy it.

Nowhere is that more evident than in the consumer electronics trade, where rapid innovation can make today's whiz-bang product outdated in weeks or months. This is why business analysts considered it a major win for Samsung when its Galaxy S III smartphone beat Apple's iPhone 5 to the market. Samsung hopes to sell 200 million smartphones by the end of 2012.

But a supply chain glitch, acknowledged by Samsung mobile communications President Shin Jong-kyun to *The Washington Post*, could curtail those hopes. By June, AT&T, Verizon, T-Mobile and other U.S. carriers had delayed shipping dates for the Galaxy S III, according to the *International Business Times*.

Although the planned delays were minor, Douglas A. McIntyre of 247wallst.com wrote that "logistics, and a shortage of just one critical part, can cause 'next week' to stretch out into the week after and the week after that." Further delays could allow Apple to release its iPhone 5 in time to flank its primary rival, McIntyre wrote.

The demand-pull program in HP's media business was tested first in pilots that focused on products with nonfluctuating demand patterns. Initial results showed that a new product with less than six months' order history, or one with infrequent consumption, was not suitable for replenishment by demand-pull. Its reorder point logic actually would increase the inventory of a product with small demand.

The teams rolling out demand-pull were pleased by the enthusiastic response of suppliers. Demand-pull's more accurate information flow allowed them to plan their own production and procurement activities better, reducing their costs and stabilizing revenue streams. Not surprisingly, what started with a handful of stock keeping units administered through demand-pull has now grown to more than 80. With approximately 12 percent of its product portfolio on demand-pull, including the highest-volume products with key manufacturing partners, the media group manages the largest implementation of demand-pull at HP today.

Risk and portfolio management

Supply chain managers are not marketing

specialists, but they know all products are not created equal and don't sell equally well. This is where segmentation of the product range comes in. As the end of the quarter approaches, HP's media business wants to reduce factory output without endangering revenue. To achieve this, they categorize products by revenue and gross margin. Key products are protected by supplementing the forecast quantity with some upside potential. For all other products, this flexibility is reduced to a minimum. Close collaboration between marketing and supply chain teams has been a key to improving business results.

Betting on potential winners

The media team makes informed judgments on major product categories based on actual shipment performance compared to original forecast quantities. If some categories are selling more strongly than forecast, the operations team protects it by adding a discretionary level of buffer. Those categories that are selling below expectations are assigned no upside buffer.

The introduction of new products presents planners with the greatest levels of uncertainty and risk. With no performance

history as precedent, forecasts tend to face high probabilities of error. When the media division introduced the Faux Canvas series for retailers (which prints digital photos onto faux canvas with a cardboard frame), HP managers drew on existing information to mitigate risk. Knowing a similar product had been so successful that it sold out of a major retailer in Europe, they anticipated increased sales in North America.

To prepare for this upside, the media operations team planned the products in an alternate, offline system. In contrast to the conventional planning tools, this offline system ensured that operations could simulate demand scenarios and trigger production with key manufacturing partners within the holiday window. Correlating from unlikely sources and executing manually proved to be more effective than the traditional process.

Reducing production at quarter's end

Factory build quantities for media are based on consumption in the channel, starting and stopping manufacturing at various, predetermined stages if customer demand diverges from expectations. This form of

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real-time decision making ensures that HP media does not overproduce. The upstream collaboration process has helped maximize revenue, reducing inventory by nearly 50 percent without affecting availability, which has led to closer collaboration with suppliers to enable upside flexibility, reduce lead-times and hold inventory at various stages in production for HP.

Hunting profit in the supply chain

Fueled by increased sales resources and the targeting of key customers, the media business anticipated significant revenue growth in one of its categories. The operations team collaborated with marketing, sales and regional staff to review their growth potential. It became clear that not all products were created equal. The marketing team used a segmentation process to identify the set of SKUs that most likely would drive revenue growth. The cross-functional teams conferred on how to improve supply chain responsiveness to capitalize on unforecasted growth.

Those actions triggered several other actions. For one, service level targets were increased aggressively as a result of software modeling. The team knew that this buffer would help, but since the software modeling is based on historical forecasts, it would not be a sufficient hedge against unforecasted growth. They continued to look for optimizing levers.

The media team evaluated shorter logistics routes. Since many of the manufacturing partners are located in Europe, the ocean transit time to North America can be as long as 21 days. Rather than leave transportation optimization to the outsourced third-party logistics (3PL) partner, the operations team personally investigated alternate ocean routes. They found an established Europe-to-U.S. ocean lane that was one week shorter than the ocean lane currently in use. The intervention saved one week of transit time and

improved customer response time.

Since the sales teams were pursuing new accounts aggressively, operations teams did not want supplier capacity to be a constraint on order fulfillment. Since factory capacity cannot be expanded on short notice, the upstream readiness would have to be prepared in advance. The media team collaborated with key suppliers to add 26 percent manufacturing capacity per year.

But supply chain responsiveness could not improve without lead-time reduction. The team found a key supplier who would build to forecast rather than to purchase orders. This process change significantly compressed what was then a normal six weeks' supplier lead-time. Through this kind of collaboration with key suppliers – not just sharing information – HP's media supply chain was becoming a network of learning organizations.

Inefficiency can develop insidiously, over time, when teams rely on legacy structures and outdated logic while their supply chains continue to evolve. By themselves, none of the actions described here would have been enough to produce significant business results. It was the synergy of multiple actions that enabled revenue growth in the media system.

Minimal investment, maximum improvements

In the past four years, HP's media business has reduced DOI by 48 percent and reduced inventory cost by 55 percent. In addition, aggressive portfolio management has resulted in a 20 percent reduction in the number of products offered, while simultaneously growing revenue. Operationally, the business is much more efficient.

It is noteworthy that not a single innovation in the HP media division involved technology or an off-the-shelf software solution. The success of the division's business results was enabled by people, process and leadership. ❖

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