

HP

STRATEGIC PLANNING AND MODELING GROUP

THE HIDDEN COSTS OF INVENTORY

**XAVIER DE MONTGROS
LINDA WRIGHT**

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ABOUT THE AUTHORS

In 2002, Xavier de Montgros served as Supply Chain Manager for Hewlett-Packard's entire product line of laptops and desktop PCs, where he works with 6 divisions and 4 regions to improve supply chain performance. He has been with HP since 1984, when he began as a procurement engineer, later becoming the European manager for HP's components qualifications centers. Since then, he has been Engineering Manager, Marketing Manager, and then Manufacturing Manager within HP's PC organization. He has been working with HP's worldwide PC organization since 1998. Mr. de Montgros has a degree in mechanical engineering from ECAM in Lyon, France, and an MBA from IAE in Paris, France.

Telephone: +33 47614 5667 or +33 67299 1384
Email: xavier_de-montgros@hp.com

Linda Wright is a Finance Manager in HP's Personal Systems Group (PSG), where she works with HP's regional and finance teams to perform activities such as setting supply chain metric goals, benchmarking competition, and identifying projects that will improve PSG's financial bottom line. Linda has been with HP for over 10 years, gaining extensive experience in supply chain analysis. As a key member of the HP-Compaq integration team, she analyzed key factory strategies, helped identify the supply chain restructuring budget, and successfully established a common tool used by the post-merger HP to track supply chain metrics. Prior to working in PSG, she was a finance and supply chain expert in HP's Notebook Division, where she helped transform years of steady losses into profits through the implementation of the "International Direct Ship" supply chain platform, and through aggressive negotiations with HP's OEM partners. Linda was also a future-products marketing manager, where she introduced and managed HP's award-winning Omnibook product. Linda has a B.S. in Finance and an MBA, both from the University of Utah.

Telephone: (408) 873-6571
Email: linda_wright@hp.com

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XAVIER DE MONTGROS
LINDA WRIGHT

ABSTRACT: In the past few years, Hewlett-Packard has pioneered many innovations in the electronics manufacturing industry, but none are more important than the adoption of inventory-driven cost (IDC) as a metric for measuring supply chain performance. Up until now, IDC has been a well-kept secret that has helped HP to reduce inventory costs in its PC product lines by over 3.5 times in the past 2 years, and cut inventory unit counts in half. For HP, the primary contributors to inventory-driven cost were rapid devaluation, short product life cycles, and price protection. HP implemented scores of programs to address these issues through proven supply chain management techniques: supplier-managed inventory, designing products for postponement, moving to a build-on-demand manufacturing model, and “pull”-based replenishment. IDC was a key metric used to drive improvements in these areas. By adopting IDC as a uniform standard, HP was able to pinpoint trouble spots and make improvements that led to millions of dollars in savings. Most importantly, IDC allowed them to tie the same metric to both operational performance and to the ultimate financial bottom line: profitability.

In 1997, Hewlett-Packard faced a dilemma: enjoying a hefty and growing market share in the PC business, while at the same time one of its top-selling product lines had been posting steady losses since 1993. It seemed that remaining competitive in the open market was somehow not enough to boost the bottom line – but why not?

The answer turned out to lie in the nature of the PC industry itself. PCs epitomized the hazards of staying afloat in the technology industry. Constant technology advances meant new products were obsolete in as little as 6 months. An unpredictable customer base flocked to whichever brand offered the best combination of price and availability at that moment. It wasn't enough to rely on brand loyalty any more; if the right model wasn't in the right place at the right time, the sale was lost. But manufacturers couldn't just stock the sales channels with inventory, either – steep price devaluation for both components and finished goods meant that any excess at the end of a product's short life had to be written off. Finally, stiff price competition meant cutting street prices to the bone, again and again.

“A common rule of thumb is that the value of a fully assembled PC devaluates at the rate of 1% a week.”

– Xavier de Montgros

Since its inception in 1939 as a manufacturer of high-end scientific measurement devices and medical equipment, HP had based its success on good old-fashioned business values: high-quality, high-performance products that were built to last. Initially, this strategy worked for PCs as well. During the 1980s and early 90s, HP created a niche for itself in high-end PCs, and enjoyed the same name-brand recognition that had served it so well over the years.

Meanwhile, the PC industry had undergone a radical transformation. PCs were shifting from a high-end device to a commodity, and price considerations were increasingly dominant in purchasing decisions. Although the big-name companies with solid reputations, good customer support, and good out-of-the-box customer experiences managed to stay on top of the PC market, even the big players were seriously challenged by price erosion and the need to minimize their per-unit costs in order to remain profitable.

Even beyond this, the PC market was literally exploding. Demands for PCs had grown fivefold through the

1990s, and prices were constantly falling. HP responded initially by slashing prices on all its PCs: 10% in 1991, followed by 26% in 1992, and another 22% in 1993. At the same time, HP radically improved the efficiency of its manufacturing supply chain to ensure product availability in order to capture every possible sale. These strategies paid off – by the late 1990s, HP had risen from Number 13 in market share to Number 5, and by the fourth quarter of 1999 it had displaced IBM as the third largest manufacturer of PCs in the world.

THE HIDDEN COST: INVENTORY

And yet, internally, the numbers told a different story. What good were billions of dollars in sales and a dominant market share if successful products were still losing money? It wasn't sales that were the problem: the problem was that it was costing HP more to make and distribute the units than it could sell them for.

Year after year, the notebook division tried different measures to improve profits. Nothing worked – until the notebook division began to focus on the costs of holding inventory. The idea was, the longer HP held onto inventory – no matter where in the supply chain it was being held – the less profit it would make on the final sale.

The notion that it could cost big money just to own inventory for an extra few weeks was radically new at the time. In the old days, when the same model of product could be sold for several years, there was plenty of time to sell excess units off if demand dropped for a few months. For “normal” products that didn't devalue every month, inventory itself didn't incur costs other than warehousing. Now, however, even a difference of a few weeks could make or break a product's profitability.

The inventory problem was exacerbated by the complexity of the manufacturing supply chain. HP-owned inventory was spread out over a sprawling supply chain: HP-owned components at suppliers, WIP at HP-owned factories and distribution centers, and inventory at resellers.

Supply chain improvement programs were put in place, but it was often difficult to measure how successful these programs were. To reduce inventory, HP needed to track it – and also to clearly tie the inventory numbers to bottom-line profitability. What HP needed was a universally agreed-upon, proven metric that had immediate operational value that in turn translated into longer-term financial gain.

In 1998, HP's notebook division reconfigured its supply chain to reduce the number of facilities and shorten manufacturing times. Called “International Direct Ship”, the new plan cut out all the regional distri-

bution centers and pushed inventory ownership onto HP's suppliers and manufacturing partners. By 1999, HP-owned inventory had been reduced by 55 days in the U.S. with a concurrent 7% reduction in the cost of sales.

After shifting focus to inventory-driven costs, the notebook group saw an almost immediate improvement. Inventory-driven costs dropped from 18.7% of total revenue in 1997 to 12.2% in 1998. 1999 saw an even more dramatic improvement with IDC dropping to 3.8% of revenue. These reductions translated directly into savings for the notebook division's bottom line.

1998 was the turning point, where the notebook division finally broke even. By the end of 1999, the group was both stable and turning a profit; these improvements were all due to improved supply chain management and reductions in inventory.

Focusing on inventory led to the following improvements:

- Direct shipping from manufacturer to reseller, implemented early 1999. This cut out a lot of middle steps and hence the need to maintain separate caches of inventory at each location.
- Shifting ownership of parts to suppliers and manufacturing partners, and only purchasing parts when needed. This removed the cost of inventory from HP's books, and provided some protection from component price drops.
- Moving from a build-to-stock to a build-to-order business model and negotiating flexible manufacturing terms with manufacturing partners.

Although it was the changes to the supply chain that allowed the notebook division to turn itself around, it was IDC that gave HP the ability to clearly identify exactly where changes were needed, and to cost-justify changes that, according to more traditional thinking, wouldn't have made sense. For example, IDC enabled changes to the channel replenishment process and moving to supplier-managed inventory – both of which have been major contributors to inventory cost savings.

IDC FACTORS

HP's PC organization consisted of several divisions, including commercial desktops, notebooks, consumer PCs, and NT servers. Various product groups within this organization began to reassess the efficiency of their internal operations, using inventory-driven costs, or IDC, as a standard to measure how well they were doing, and specifically enacting measures to reduce the number of weeks of supply for both components and finished units. Sure enough, it was at this point that the notebook

division turned around, and went from double-digit losses in 1997 to showing a profit by the end of 1998. Other HP product divisions showed improvement as well.

HP had identified four major line items that contributed to inventory-driven costs: component devaluation, excess/obsolescence costs, price protection, and cash-to-cash financing.

Of these, component devaluation was the biggest hitter and the primary reason HP began tracking IDC. Key components such as microprocessor chips and memory typically have steep devaluation curves. For example, a CPU price might drop as much as 40% during a 9-month life cycle.

Two factors contributed to devaluation costs:

- How much inventory HP owned
- The magnitude and frequency of the price drops

Thus, the penalties of holding excess parts inventory could be enormous. HP had no control over the price drops, but it could control how much inventory it was holding at the time that the part dropped in price. Historically, HP had maintained inventory in many places: HP-owned factories and distribution centers, merge centers, in-transit inventories. Every time the prices dropped, HP was hit with another devaluation cost.

To avoid this cost, HP had to own as few parts as possible, which it accomplished through the following strategies:

- Reducing the number of nodes in the supply chain.
- Consolidating manufacturing facilities.
- Taking possession of components on an as-needed or "just-in-time" basis, paying the going price at that time, and working with suppliers so as to minimize inventory when a price drop was anticipated.

This required cooperation from suppliers, who were responsible for managing the parts inventory themselves to ensure the high levels of availability required by HP.

The second IDC factor was price protection. If HP dropped the price of a product after units had already been shipped to a sales channel, HP had to reimburse its channel partners for the difference for units that had been shipped but not yet sold, so that the channel partner didn't have to sell at a loss. To reduce this cost, HP had to ensure that channel inventory never exceeded a minimum number of days of supply. To maintain product availability, HP thus had to keep its own manufacturing turnaround times short and replenishment cycles frequent, so that channels didn't stock out. HP also

offered incentives to the channels to manage lower levels of inventory. IDC analysis showed that the cost of these incentives was lower than holding the current levels of channel inventory.

A third IDC factor was excess/obsolescence costs. End-of-life write-offs was initially the most obvious portion of this cost. With product life cycles so short, even a small miscalculation in anticipated demand could result in stacks of worthless goods that had to be written off or sold at a steep discount. To avoid this cost, HP had to be very efficient in managing product rollovers, so that new models were introduced just as the last remaining units of the old models sold out.

Finally, there was cash-to-cash financing. This captured the opportunity cost of capital associated with HP's investments in inventory, including management of cash flow between payments received for goods sold, and payments to suppliers for parts received. To reduce this cost, HP collected payments from customers faster, negotiated more competitive payment terms with vendors, and moving to a build-on-demand model where payments for goods were received in advance of even ordering the parts to manufacture those units.

MAKING IT CONSISTENT

With HP's PC organization, several divisions had begun to use IDC on their own. Prior to 2000, HP's commercial desktop division and the notebook division had each been tracking IDC separately. Both divisions had been extremely successful in reducing costs and improving profitability. With a confidence inspired by its earlier successes in the commercial PC and notebook divisions, HP started to manage the supply chain efficiency at group level.

Linda Wright, a finance analyst with the notebook division, had watched the notebook group turn itself around using the IDC metric. She knew it was imperative for the rest of the PC divisions to follow suit. When she saw a job posting for a finance manager position in HP's WorldWide PC Organization, she submitted her name and got the job in January of 2000.

One of the first things she did was to improve IDC tracking across all divisions. She worked closely with the region and division finance teams to develop a standard template for supply chain metrics. She knew that such a tool had been successful when employed in the notebook division, and she wanted to leverage that success across all the other divisions, as well as giving those divisions the visibility they needed to make improvements to their bottom line.

Linda also worked closely with operations managers and finance managers to determine what information they needed to make decisions and how they wanted to view the data. For example, how could they tell if it was cost-effective to switch to a more expensive but much faster shipping method in order to reduce inventory for Product A? How about Product B? These decisions had to be made product by product.

Next, Linda went back to the finance community to make sure that the data could be collected in the requested format for each line item in a timely manner. In some cases, the data had to be manually assembled; in others, it was possible to automate the data gathering. The team also set goals by IDC line item for each region and product line, based on future known projects and market conditions.

The presentation of the data was almost as important as the data itself. Everyone used the same input worksheet as a common template. Thus, the same line items were used, each with the same definition, same source of information, and same method of calculation. As a result, all users could look at the same line item and know exactly where the data came from, and what it really meant.

Each year, Linda's team reviews the layout of the IDC template, interviews the key users, and makes any needed adjustments based on this input. The ongoing review process takes about a month.

A TEAM EFFORT

When management decided to focus effort on IDC, Linda lead the reporting process with a lot of help from regions and divisions. Strong team support also worked as HP implemented monthly management reviews of the regional and division-level results. A team lead by Xavier de Montgros, a manager within HP's worldwide PC division, drove these reviews and planning cycles.

HP began to systematically use the IDC metric as one of the important characteristics of any new supply chain investigated. As the successes mounted, the use of IDC in a consistent, proven, and agreed-upon way was disseminated to other product groups, such as the server and printer divisions.

BENEFITS

What were the benefits of all this organizational consolidation? Was it worth it to spend months agreeing on a metric, and even more time to figure out how to gather the data?

The biggest advantages of the IDC template were:

- Gave HP's vice president of operations and finance visibility into inventory-driven costs, by line item, region, and division. Actually, all the

operations and finance managers had the same visibility, and could clearly see whether each program was on track and meeting goals.

- Inventory-driven cost was a good benchmark to compare different products, for example desktop PCs versus notebooks. Questions like “why are freight expenses higher for Product X than Product Y?” could be answered in a way that took into account each product’s different characteristics and market requirements. Thus, each product group was free to choose the strategy that best suited their needs.
- The IDC metric provided a tangible basis for action. If it was high, the entire team knew what needed to be done and where they needed to focus. In addition, it allowed high-level operational planners to optimize across product divisions and leverage manufacturing opportunities more easily. For example, the “International Direct Ship” supply chain platform is cost-effective for certain types of products, but not others.
- The PC organization could track progress over time.

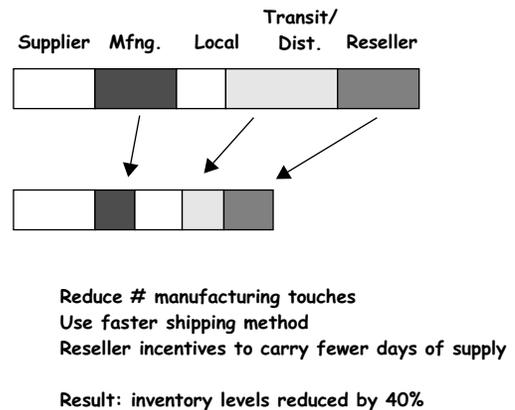
“It is easier to focus on IDC than to reinvent your network of factories and hubs.”

– Xavier de Montgros

The IDC metric was extensively used in scenario modeling exercises when designing supply chain configurations for new products. When setting appropriate goals for different products, it was possible to compare each new product to similar products in the past.

In fact, IDC allowed planners to pinpoint where in a supply chain to reduce inventory holding times, and by how much (Figure 1). What counted was the total time that HP owned a piece of inventory, not where it was. It could cost HP more to ship an item by boat than by air freight if the 4 weeks the product spent on the boat was costly enough in terms of inventory cost.

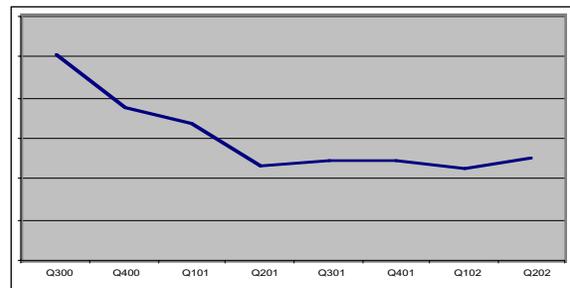
Figure 1: Where in supply chain?



THE IDC METRIC - RESULTS

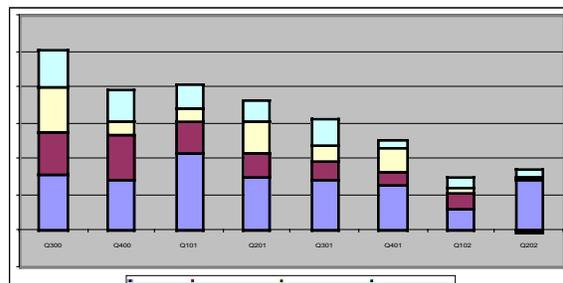
Using IDC as a metric allowed HP to clearly pinpoint supply chain improvements over time. During the past 2 years, HP’s worldwide inventory has declined 50% and is holding steady, as shown in Figure 2.

Figure 2: Worldwide inventory in dollars



In addition, HP’s worldwide IDC and cash-to-cash dropped more than 70%, as shown in Figure 3.

Figure 3: Worldwide IDC and cash-to-cash



Inventory Driven Costs
Inventory, days of Supply

EPILOGUE

Since Hewlett-Packard's merger with Compaq in May of 2002, the push to adopt IDC company-wide has moved forward. Currently, all of HP has either adopted, or is in the process of adopting, a standard set of inventory cost and supply chain metrics.

As a cross-functional metric, IDC is used across all groups from marketing and finance to engineering and operations. Formerly, each group monitored its own piece of the picture: marketing looked at price protection, material divisions looked at excess material, and engineering monitored obsolescence. Now, each of these groups understands how their actions affect groups outside their own department.

For example, if a product designer specifies a proprietary hard drive that takes 3 months to obtain, then during those 3 months, HP becomes liable for excess, devaluation, and write-offs. IDC allowed the designers to see what this design decision might cost down the road.

When IDC was first adopted, it was critical to improve the bottom line, especially for divisions that were losing money. Currently, IDC has transitioned from being a metric for improvement to being a metric used for monitoring. As an integrated part of the company culture, IDC serves a key purpose but is far from the end-all of HP's long-term strategic planning.

KEY LEARNINGS

1. Identify what is important to the business, and focus on things you can improve. The IDC metric enabled HP to discover the points in their supply chain that were most in need of improvement – as well as to highlight areas where they were doing well.
2. Standardization across organizations is key to gaining across the board cooperation and a common understanding. By adopting standard templates as part of their core implementation of IDC, HP ensured that all the planners were looking at the same thing, and they all had the same understanding of what they were looking at.
3. The only way to accomplish structured changes is to monitor actuals against your metric regularly and consistently over time, and to be patient. The IDC proof-of-concept pilot in the notebook division took two years to complete, and it took another two years for the changes to be propagated worldwide.
4. Be able to clearly articulate what you are doing, both with partners and procurement. The use of IDC showed clear results that could be shared both within and outside of the HP organization.