When you consider a holistic, i.e., end-to-end, approach to supply chain management, you find different solutions to your problems.

Xavier de Montgros, Supply Chain Development Director at Hewlett-Packard (HP), was referring to HP’s Inventory-Driven Cost (IDC) metric, introduced in the late 1990s in an attempt to restore the company’s profitability in the highly competitive personal computer (PC) industry. The new performance measure was intended to focus the organization’s attention on creating value in the supply chain through efficient matching of demand and supply.

HP Company Background

HP, a leading provider of IT infrastructure, personal computing and access devices, global services, and imaging and printing equipment to business and home consumers, had traditionally based its success on high-quality, high-performance products and earned a dominant market position in high-end computing systems. In 2001, HP had sales revenues of $45.2 billion and net earnings from operations of $624 million, garnering the company rankings of 28th and 70th, respectively, in terms of revenues on the Fortune 500 and Global 500 listings.

With HP’s increased reliance in the 1990s on the PC and peripherals market came a change in industry and competitive dynamics. Gone were the days of relatively low competition, loyal customers and reasonably predictable sales cycles. Instead, as PCs were shifting from high-end devices to commodities, HP was facing the challenge of customers who based purchasing decisions on price and availability rather than technological features. Competition rose sharply as other providers, such as Dell, Toshiba, IBM and Lexmark, were able to offer the same products using the same basic technologies and often with identical components from the same suppliers. Market demand for PCs grew fivefold through the 1990s, but average selling prices fell roughly 15% per year. As a result, cost factors that had formerly been insignificant, such as material devaluation, scrap, write-offs, price protection and discounts, now became critical to profitability. Although the big players in the PC industry managed to stay on top of the market, they were seriously challenged by the sharp price erosion and the need to constantly reduce their per-unit costs to remain profitable.

A New Performance Measure: Inventory-Driven Cost

As the PC industry evolved into a large-volume, low-margin business with short product life cycles and intense competition, HP’s profits dwindled. For example, the notebook division posted double-digit losses from 1994 until 1997 even though HP had achieved significant sales and market share growth in the segment. Improving the efficiency and effectiveness of supply chain operations was recognized as an important source of competitive advantage that could help HP restore its financial performance.

Although supply chain matters were traditionally considered purely “execution” issues related to the logistics of bringing a product to the customer at minimum cost, HP management increasingly became aware of the supply chain’s potential to create value by matching demand and supply. The problem, however, was that the financial consequences of any demand-supply mismatches were traditionally not reported by
Hewlett-Packard: Performance Measurement in the Supply Chain

the firm’s accounting information systems. At HP, such mismatches turned out to be extremely expensive and damaging to the company’s competitive position. In particular, it became clear that the longer HP held on to inventory — no matter where in the supply chain it was being held — the less profit the company would make on the final sale.

Given the lack of any representative performance measures that would enable individual players in the supply chain to see the impact of their decisions on company-wide performance, HP management decided to introduce a new metric, called Inventory-Driven Cost (IDC). The purpose of IDC was to focus people’s attention on managing inventory throughout the supply chain and to track progress on improving the company's bottom line. HP management wanted a universally agreed-upon metric that both had immediate operational value and translated into longer-term financial gain. IDC stimulated operational improvement programs in several of HP’s business units, particularly in the highly dynamic PC business. The critical impact of IDC was illustrated by the fact that from 1997 to 1999, the notebook division went from double-digit losses to turning a profit as the IDC dropped from 18.7% to 3.8% of revenues.

Components of IDC

HP had been a leader in supply chain innovations since the early 1990s. An internal consulting team, the Strategic Planning and Modeling Group (SPaM), had been assigned the task of introducing quantitative methods into HP’s decision-making processes. The SPaM group consulted with various product divisions to help improve supply chain designs and processes through better material flows and product design. In addition to the traditional inventory-related costs (such as inventory financing, warehouse storage, tax, insurance, rework, breakage and spoilage), SPaM identified three major line items that contributed to IDC: material devaluation, price protection, and excess/obsolescence costs (see Exhibit 1).

Material devaluation referred to an internal price adjustment caused by price changes in the raw material supply and parts inventory. The company’s high dependence on outsourced parts was one of the primary reasons HP began tracking IDC; for example, in the PC business material costs typically made up 70% of the total product cost. The price erosion in the market meant that it was beneficial to buy materials at a later stage when they cost less, instead of purchasing them 67


Exhibit 1 - IDC example

Let us assume we are assembling a new line of desktop PCs for a special order we received from one of our resellers. The machine will sell on the market for $1,000. The total material cost for the machine is $700. The components are bought at the beginning of week 1.

During assembly, market dynamics generate $50 in raw material devaluation and a reset in the pricing of the product, which has to be competitively priced at $900. The machines are shipped to the reseller at the beginning of week 2 for $900. Storage costs, including taxes and insurance, are about $5 per unit, while the computed financing costs are $7 per unit.

Fifty percent of the products are sold in week 3 and 30% are sold in week 4. At the end of week 4, the company decides to price the whole desktop segment more aggressively to gain market share, and it reduces the price by another $100. Price protection for the remaining 20% of the volume has to be recognized to the reseller partner.

At the end of the product life cycle, in week 10, 10% of the units are still unsold and a fire sale is arranged, offering an additional rebate of $200.

Finally, in week 13, 2% of the units is returned back to the OEM with a return cost of $10 per unit. The returned units are scrapped at their residual value.

<table>
<thead>
<tr>
<th>Revenue</th>
<th>$900.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Material</td>
<td>($700.00)</td>
</tr>
<tr>
<td>Gross Margin</td>
<td>$200.00</td>
</tr>
<tr>
<td>Financing Charges</td>
<td>($7.00)</td>
</tr>
<tr>
<td>Warehousing</td>
<td>($5.00)</td>
</tr>
<tr>
<td>Material Devaluation</td>
<td>($50.00)</td>
</tr>
<tr>
<td>Price Protection</td>
<td>($20.00)</td>
</tr>
<tr>
<td>Fire sale on end-of-life inventory</td>
<td>($16.00)</td>
</tr>
<tr>
<td>Return cost</td>
<td>($0.20)</td>
</tr>
<tr>
<td>Write off obsolete inventory</td>
<td>($16.00)</td>
</tr>
<tr>
<td>Actual Gross Profit</td>
<td>$85.80</td>
</tr>
<tr>
<td>IDC$</td>
<td>($114.20)</td>
</tr>
<tr>
<td>IDC as % revenue</td>
<td>12.7%</td>
</tr>
<tr>
<td>IDC as % inventory value</td>
<td>50.8%</td>
</tr>
</tbody>
</table>

annualized IDC rate
early on and holding them in inventory for extended periods. Although HP had no control over the price drops, it could control how much inventory it was holding at the time the part dropped in price. Material devaluation involved the materials and finished goods on HP’s books as well as those of the channel — if suppliers and/or channel partners were carrying lots of inventory, HP would also feel the consequences (albeit indirectly).

Price protection was the result of competitive price pressures affecting the value of the inventory held by HP’s channel partners. If HP dropped the price of a product after units had already been shipped to the channel, it had to reimburse its channel partners for the price difference for units that had been shipped but not yet sold. A common rule of thumb was that the value of a fully assembled PC decreased at the rate of 1% a week. This notion of perishability was radically new in the electronics industry at the time. In the old days, when the same model of product could be sold for several years, holding buffer inventory was considered the right thing to do, and the company did not incur any inventory-related costs other than warehousing. In the new environment, however, even a difference of a few weeks could make or break a product’s profitability.

Beyond these IDC components, HP included two additional elements in its profit and loss statements: product returns and cash-to-cash financing. Returns represented a loss in revenues and additional processing costs for HP. The majority of returns were from the resellers due to overstocks; their magnitude depended on the terms and conditions negotiated with the channel partners. Finally, cash-to-cash financing captured the opportunity cost of capital associated with HP’s investments in working capital necessary to bridge the cash flow gap between payments received for goods sold and payments to suppliers for parts received.

**IDC-Driven Supply Chain Improvement Projects**

The operations team at HP’s European PC business line implemented several projects that helped improve IDC performance, such as Build-to-Order, Channel Replenishment and Supplier-Managed Inventory. The move from Build-to-Stock (BTS), in which factories supplied regional centers with finished PCs that were held in inventory, to Build-to-Order (BTO), initiated in 1994, clearly benefited IDC performance by enabling HP to acknowledge orders on the basis of inventory of low-level parts, subassemblies and components from suppliers rather than of finished goods inventory. HP also needed to make its evaluation of “net requirements” more reactive and, therefore, started doing it weekly rather than monthly. HP’s switch to a BTO production method increased its flexibility to meet market demand and resulted in reduced levels of both channel and finished goods inventories, mitigating the risk of price protection and obsolescence.

In 1998, HP implemented Channel Replenishment (CR) — also known as Vendor-Managed Inventory (VMI) — with all first-tier resellers and some second-tier resellers. Managing inventory at the resellers’ locations helped HP reduce channel inventory, which in turn helped lower price protection. HP reviewed its relationship with its channel partners and established IT links with them that relayed the level of inventory, consumption of products and demand forecast on a daily basis. When a PC was sold at a reseller’s location, the sale was registered on HP’s system. Based on stock levels at the reseller, the production plan, sales orders and backlogs, HP would determine the replenishment lot to be shipped to the reseller. The impact of CR was a 50% drop in channel inventory. The channel valued CR since it shared in the resulting lower costs without making large investments. HP initiated ten CR pilot projects before rolling out the concept to its entire reseller base.

Supplier-Managed Inventory (SMI) was also introduced in 1998 to reduce the impact of component devaluation and the write-downs of inventory caused by the short product life cycle of PCs, which ranged anywhere from six weeks to 12 months. SMI consisted of two actions. First, HP asked its suppliers to hold the inventory in hubs close to HP factories so that HP could institute just-in-time call methods, which allowed the company to reduce inventory levels. The second action was to use standard parts in product design, encouraging suppliers to hold them in inventory to gain economies of scale with other customers, which resulted in reduced warehousing costs for HP. As a result of SMI, HP was able to reduce its obsolete inventory because the parts were generic and thus easily consumed. The result of implementing SMI was a savings of 1% to 2% of total costs per PC.

Finally, IDC also led to the implementation of International Direct Ship (IDS). Under the IDS program, HP’s Mobile Computing Division decided to cut out all of its regional manufacturing and distribution centers and move the ownership of inventory to its suppliers and manufacturing partners. The heavy cost structure and the complexity of the supply chain were major disadvantages in the highly competitive notebook market. The solution was to centralize manufacturing in a single location worldwide and to ship the finished product directly to customers, without degrading customer service. The IDC methodology was highly instrumental in justifying such a radical change; the analysis showed that the savings from IDC reduction more than offset the additional logistics and order-processing costs associated with the new program. By

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1. The accounting definition of the cash-to-cash cycle is inventory + accounts receivable – accounts payable.
2. For a more detailed discussion of Channel Replenishment, see INSEAD Case Study 03/2002-4947, Supply Chain Evolution at HP (A).
1999, HP-owned inventory for PCs had been reduced by 55 days with a concurrent 7% reduction in the cost of sales.

Deploying IDC Throughout the HP Organization

Since the creation of the Mobile Computing Division (MCD) in the 1980s, notebook computers had sold well. The problem, however, was that those sales did not translate into profits. HP had tried everything to improve the situation, from increasing sales through new designs to cutting operating costs, but to no avail. It was not until HP implemented IDC that the notebook division was able to turn things around. At the end of 1998, only one year after implementing IDC, MCD broke even; by the end of 1999, MCD turned a profit. Inspired by this success, HP started to use IDC for managing supply chain efficiency at the PC group level. In 1998, the PC organization started rolling out IDC globally. As the successes mounted, the use of IDC was disseminated to other product groups, such as the server and printer divisions.

IDC was introduced by top management at the group level and then cascaded down to the line management. Because all line managers at HP were evaluated based on profit performance, the income statement was changed to include IDC as a separate line item. This reporting ensured that IDC was visible to all managers and that everyone from sales, marketing, manufacturing and other areas shared a common understanding of the metric. After several years, IDC had become ingrained in every HP manager’s mind; as de Montgros explained, “IDC was part of the culture of the company.”

The implementation of the IDC metric throughout HP was a joint effort between the finance and operations departments. Every business group had a member of the finance team integrated into it to ensure that the finance department was in close contact with operations. Finance was responsible for establishing the IDC metric and putting the monthly reporting structure in place, while operations was in charge of driving concrete actions for improvement. The success of the IDC metric was due, in large part, to the teamwork between those two departments, which had to persuade the rest of the organization of IDC’s merits.

The finance team set targets by IDC line item for each region and product line, based on future planned projects and market conditions and after management negotiation. Quarterly targets were supposed to be challenging yet achievable, because it was critical for HP to make fast progress on improving its bottom line. A team consisting of executive staff from the different business units, the group controller, and the group supply chain manager drove the monthly management reviews and planning cycles of the regional and division-level results. Whereas management at the group level looked at the total, aggregate IDC, the regional level went through a much more detailed IDC analysis. In particular, the regional heads scrutinized projects line item by line item to identify their impact on the various elements of IDC.

Benefits Derived from IDC

IDC was a cross-functional metric, aimed at helping everyone in the organization think about the “big picture” and stimulating collaboration among different parts of the supply chain. Before IDC, marketing was monitoring price protection, while excess material was the material division’s responsibility and obsolescence was being measured by the engineering department. IDC ensured that the decisions being made involved the best course of action for the entire organization and did not just optimize a single division’s local objectives.

IDC created greater transparency in the supply chain by highlighting costs that were not easily observable but had a significant impact on the bottom line, particularly in the PC business, where gross margins were only 4% to 5%. It was by making these hidden costs visible to the supply chain people that IDC was beneficial in helping drive down costs and improving profitability.

In addition, IDC also led to structural changes in the supply chain. Case in point: Where should HP build its new factories? Previously, when HP analyzed potential locations, it looked at traditional manufacturing costs, freight and duty, etc. Since the adoption of IDC, it undertook a more comprehensive analysis. As de Montgros explained:

“The cheapest place to manufacture is Asia. When you service Europe and North America, the cheapest method of shipping is to use ocean freight. However, if you consider material devaluation, write-offs, and price protection, you see that you are losing lots of money as the inventory sits on the boat. IDC helps managers make the right trade-offs.”

Thus, IDC drew attention to less obvious costs that could quickly deplete the bottom line and helped people set the right priorities.

IDC was also pivotal in the rollover to new products. Although channel inventory no longer figured on HP’s books, end-of-life channel stocks could come back to haunt HP in the form of obsolescence. Previously, in decisions on how quickly to ramp up a new product or retire an existing one, the total cost of the rollover was often underestimated because only the total direct cost of the finished goods was taken into account. By including rebates, returns, and fire-sale discounts, IDC helped determine the real cost of obsolescence, allowing product teams to evaluate alternative rollover strategies and select the most appropriate one.

The results obtained from using IDC were impressive. In its 2001 annual report, HP announced that “inventory management ... exceeded expectations; thanks to effective management, HP experienced a $495 million reduction in HP-owned inventory for the year and achieved a slightly improved inventory-to-sales ratio over last year.” During the period 2000–2002, HP’s worldwide PC inventory declined by 50% and was holding steady, and IDC had dropped by approximately 70%.
Beyond IDC

In May 2002, HP merged with Compaq Computer Corporation. The “new” HP had combined revenue of approximately $56.6 billion in fiscal 2002, with operations in more than 160 countries. After the merger, there was a push to adopt IDC company-wide, and HP used IDC to bring Compaq’s inventory-driven costs down. As of May 2003, all of HP had either adopted, or was in the process of adopting, a standard set of supply chain effectiveness metrics.

When IDC was first introduced, it was a critical instrument for improving the company’s flagging bottom-line performance, especially for divisions that were losing money. After a few years of successful application, however, use of the metric changed. According to de Montgros:

“IDC is not something that you can stop looking at. At the same time, however, we have put in place supply chain processes that make us feel more assured that things are under control. Therefore, we are no longer as concerned with it as when we first implemented it. It’s no longer a metric for improvement, but one for keeping the business on track.”

For that reason HP changed its monitoring frequency of the IDC from monthly to quarterly. As the big gains in terms of IDC had been made, HP started to focus its attention on other aspects of the business, such as freight costs, manufacturing costs, and cash-to-cash financing.

Despite IDC’s strengths as a supply chain-wide performance metric, management also recognized that there were some caveats. For example, some of the costs included in IDC were event driven; consequently, reported IDC performance in a given period could be significantly distorted due to one major event, such as a product rollover. For this reason, HP management felt that it was important not to lose sight of the long-term trends in IDC.

Furthermore, because IDC was a composite metric made up of several different factors, a large shift in one factor could have a major impact on the overall metric and draw attention away from other IDC costs. For example, in the second quarter of 2002, HP was forced to make a large write-down on memory, which hid the obsolescence costs of other components. In addition, there was the controllability issue. For example, the erosion of material value as a result of market conditions made IDC performance look very poor at a given point in time, although the supply chain team had done a good job managing the channel inventory — excess and obsolescence were almost zero for that quarter.

Finally, IDC did not include the opportunity cost of lost sales. In fact, after the merger with Compaq, the new HP was quite conservative on the supply side. When demand for PCs subsequently turned out to be much higher than expected, the company was unable to supply on time and lost sales. However, the common belief at HP was that in a low-margin market such as the PC industry, the company was better off losing some sales than carrying too much inventory.

HP felt that it had evolved to the best possible level of total supply chain costs between suppliers and customers. The next challenge would be to work on the complete cycle — after-sales, remarketing, refurbishing, etc. — and extend the supply chain beyond the first delivery. To dispel the thought of HP becoming complacent, de Montgros cautioned: “You are never world-class forever. You have to keep an eye on things so that you keep progressing.”

COMMENTS ON THE CASE STUDY

Nicholas Seiersen
Principal, BearingPoint

The company recognizes that a major expense and risk in their industry is E & O inventory (excess & obsolete). There are many ways to manage the issue, and putting the right metrics in place is certainly one of the more effective ways to make sure managers make the right trade-offs. “What you measure is what you get” still holds true in most North American Corporations. The results highlighted are the first proof of this.

Effective metrics and incentives are not a panacea, however.

The organization must also be focussed on effective execution of the business, and the Q2, 2002 memory glitch suggests that the organization may have room for progress. This example illustrates what we all know about Supply Chains - the more you fix, the more you discover that can be improved, in this case the upstream aspects of the supply chain.

HP seems to have abdicated the opportunity to improve forecasting, and is leaving the opportunity cost of sales on the table, not seeking to optimize this with the cost of after sales fixes that are being measured.

The company is not pursuing opportunities to improve the downstream supply chain, such as postponement strategies, development of supply chain capacity flex, more responsive replenishment models, or drop ship strategies.

These opportunities that are not being addressed are symptomatic of the issues of span of control in large organizations - “if I do not control it through my hierarchy, I
cannot impact it.” This is probably one of the most vexing challenges to the supply chain professional, and no organization has found an adequate response. The matrixes organization is plagued by unclear accountabilities and responsibilities, and the traditional hierarchical organization is plagued by turf wars and squabbles over who owns the results. When the Supply Chain sits at the “C” level in the organization, the issue still exists further down the chain of command, which is still frequently stovepiped by function of by business unit. The supply chain remains too complex for this broad responsibility to be pushed far enough down the organization where the complex trade-offs can be made by front line employees.

This conundrum is still looking for resolution. The pages of this journal are open to any innovative experiences in this space!

John PAUL
Director of iCognitive
Associate professor,
Bordeaux Business School

Companies are rethinking their performance measurement to maximize the profit and reduce risk of obsolescence: HP case.

If we refer to the current market clock speed, the critical challenge for companies in some specific industries segment such as electronics, telecommunication, mobile phones or apparel is the:

• Volatility of the demand and the supply
• The technology and material obsolescence
• The price and margin erosion

To improve supply chain efficiency and effectiveness, to restore or to maintain company’s competitiveness, traditional business operational model and performance measurement metrics are no longer enough.

In such circumstances companies are looking and are formulating new solutions through innovation and research.

HP business case is a perfect illustration of what is happening in the market place today.

In short what does happen to HP?

“In the 1990s, Hewlett-Packard’s PC business was struggling to turn a dollar in profit, despite the company’s success in winning market share.

By 1997, margins on its PCs were as thin as a silicon wafer, and some product lines had not turned a profit since 1993.

The problem had everything to do with the PC industry’s notoriously short product cycles and brutal product component price deflation. A common rule of thumb was that “the value of a fully assembled PC decreased 1% a week”.

The Return on sales (ROS) was one the key metrics or performance measurement in used during that period by HP.

ROS is a widely used ratio, found in many reports and studies targeting all kind of industries, from

• Pharmaceuticals,
• Automotives,
• F&B
• Tobacco,
• Oil& gas
• Chemicals etc.

What are the parameters of the Return on Sales (ROS) calculation?

Return on Sales = Net income (before interest and tax) / Sales

The major characteristic of the ROS is to indicate the level of profit from each dollar of sales generate by the company.

It is also known as operating profit margin and is part of Northern route in DUPONT model.

It’s not a concept but a financial ratio used internally by the management, as well as externally by investors and financial institutions. This metrics is included in iCognitive public Benchmark study for South East Asia and china.

Objective:

This ratio can be used as a predictor of the company’s ability to withstand changes in prices or market conditions

If your company is experiencing a cash flow crunch, it could be because its mark-up is not enough to cover expenses. Return on sales can help point this out, and allow you to adjust prices for an adequate profit. Also, be sure to
look for trends in this figure. If it appears to be dropping over time, it could be a signal that you will soon be experiencing financial problems.

The ROS of a company determines its ability to withstand competition and adverse conditions like rising costs, falling prices or declining sales in the future. The ratio measures the percentage of profits earned per dollar of sales and thus is a measure of efficiency of the company.

**What the ROS is unable to explain:**

The limitation of the Return on Sales metrics comes essentially from the fact that it doesn’t help to bring a broader visibility of the company’s potential source of losses. HP became aware of that and took a step forward by deciding to look into the financial consequences of any demand-supply mismatches.

The emergence of Inventory Driven cost (IDC) in HP

After a series of iteration and intensive research on supply chain management, HP finally find an innovative and advanced performance measurement that could focus all HP employees attention on better balancing supply and demand through the entire supply chain and prioritize supply chain improvement as well.

“In the past few years, HP has pioneered the supply chain innovations in the electronics manufacturing industry, but none is more important than the adoption of the inventory driven cost (IDC) as a metric for measuring the bottom-line impact of demand/supply mismatches.

HP discovered after a thorough review of the problem that:
- The standard “holding cost of inventory”
- The capital and physical costs of inventory (warehouse space, storage taxes, insurance, rework, breakage, spoilage)

Accounted for only about 10% of HP’s inventory costs.

The greater risks that turned out, resided in the following four essentially hidden costs which all stemmed from mismatches between demand and supply leading to excess inventory:
- Component devaluation costs for components still held in production
- Price protection costs incurred when product prices drop on goods distributors still have on their shelves;
- Product return costs that have to be absorbed when distributors return and receive refunds on overstock items;
- Obsolescence costs for products still unsold when new models are introduced.

The power of the Inventory Driven Costs metrics is not only to bring an end to end visibility of the costs through the entire supply chain but also to make the operational and finance department to work together for achieving the corrective actions.

Up until now, IDC has been a well-kept secret that has helped HP to reduce inventory driven costs in its PC product lines by 70% in the past 2 years, and cut inventory unit counts in half.

For HP, the primary contributors to inventory driven costs were rapid material 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,
- “Pull”-based replenishment.

IDC was a key metric used to drive improvements in these areas. By adopting IDC as a uniform standard across the organization, HP was able to identify opportunities for value creation in the supply chain and make significant operational improvements that led to millions of dollars in savings.

Most importantly, IDC allowed HP to tie the same metric to both operational performance and ultimate financial bottom line.”

By developing metrics to track these costs in a consistent way throughout the PC division, HP has found it can manage its supply chains with much more sophistication.

Gone are the days of across-the-board measures such as, “Everyone must cut inventories by 20% by the end of the year,” which usually resulted in an inflation of cookie-cutter lean production and just-in-time initiatives.

Now, each product group is free to choose the supply chain configuration that best suits its needs.

Any company facing low margins, short life cycles, highly perishable or seasonal products, and unpredictable demand can follow HP’s example.”

We can easily summarized by saying that “Research and innovation” are really critical success factors for outstanding business performers. Commitment and consistency are the second enabling discipline that companies need to put in place.