

# strategy+business

## When Offshoring Isn't a Sure Thing

For further information:

[editors@strategy-business.com](mailto:editors@strategy-business.com)

Booz & Company

from **strategy+business** issue 36, Autumn 2004

reprint number 04303

# When Offshoring Isn't a Sure Thing

Gung ho for going global? Make sure to look beyond labor costs.

by Tim Laseter

**O**ut sourcing as a response to cross-border competition is hardly new. The shifting of jobs among companies, industries, or countries (what today is called *offshoring*) dates back to the advent of trading (and warring) among the ancient Greeks, Persians, Egyptians, and Phoenicians.

But the current political debate over outsourcing and its international counterpart, offshoring, represents only one dimension of global competition's complex risks and rewards. Creating the optimal operational "footprint" is far more complicated than chasing low wage rates. If it were that simple, how would we explain the decades-long stream of direct foreign investment in U.S.-based production facilities by Japanese automakers? And why did the Haier Group Company, the budding Chinese multinational appliance manufacturer, decide recently to build a refrigerator plant in South Carolina?

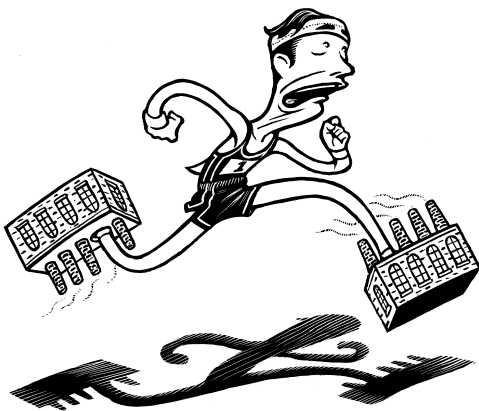
At a minimum, global companies must explore the interplay among three factors when contemplating offshoring parts of their

operations to other countries: transportation costs, labor intensity versus capital intensity, and market responsiveness.

To appreciate how these factors influence global operational strategy, consider three separate announcements from the global chip manufacturer Intel in April 2004: a \$2 billion upgrade of an established chip facility in Chandler, Ariz.; a plan to add 1,000 new employees to its existing roster of 1,500 at its development center in Bangalore, India; and a \$375 million investment to build a chip plant in Chengdu, China.

The reinvestment in Intel's Arizona-based "Fab 12" factory (which was originally built in 1996 at a cost of \$1.2 billion) aims to convert the semiconductor fabrication facility's production from 200-millimeter wafer technology to state-of-the-art 300-millimeter wafers. The change was inspired almost entirely by the expertise of the plant's work force, which has doubled in size to 4,000 employees since it opened eight years ago.

"This conversion will not only enable us to improve our capital efficiency by giving us more than



**Tim Laseter**

(laseter@t@arden.virginia.edu) is the author of *Balanced Sourcing: Cooperation and Competition in Supplier Relationships* (Jossey-Bass, 1998) and serves on the operations faculty at the Darden Graduate School of Business Administration at the University of Virginia. Formerly a vice president with Booz Allen Hamilton, he has 20 years of experience in supply chain management and operations strategy.

Deb Chatterjee and David Eakes, students at the Darden Graduate School of Business Administration at the University of Virginia, provided research assistance for this article.

twice the capacity at significantly lower costs, but it will enable us to utilize our experienced and talented work force in Arizona,” Intel said in a statement. In this decision, as in others, high U.S. labor rates were less of a concern to management than the capital costs of wafer fabrication. Indeed, Intel’s other 300-millimeter wafer “fabs” are similarly located in areas not known for low wages: Hillsboro, Ore.; Rio Rancho, N.M.; and Leixlip, Ireland.

Intel’s Bangalore expansion, by contrast, was most certainly motivated mainly by attractive wage rates and the limited capital investment required. Since digital software products can be quickly and cheaply transported by telephone lines, Intel was able to tap into highly educated but lower-paid Indian software engineers, thereby lowering its software development costs, enhancing its global competitiveness, and strengthening its local presence in India’s fast-growing market.

Even though there are significant wage advantages to employing Chinese labor, the Chengdu investment was largely an effort to expand Intel’s market presence in China. The sealing and testing activities of the Chengdu plant, which will employ about 675 people, place it near the customer end of Intel’s supply chain. That will allow the company to respond efficiently to the increasing market demand in China and the rest of Asia.

As Intel’s announcements in April underscore, a multinational company’s reach and range of business activities require it to address diverse strategic choices. And each investment made by a globally savvy firm requires a different response to the trade-offs among transportation, capital, labor, and market respon-

siveness (the lead time necessary to meet customer demands).

A look at how different companies in the consumer electronics value chain make offshoring decisions will help illuminate these trade-offs.

**Transportation Cost**

Think about the balance between transportation costs and low wage rates. Companies that naively source in less developed countries just to take advantage of lower wage rates routinely fail to account for transportation costs. To their chagrin, they discover that the price of road, rail, sea, and air transportation frequently offsets the savings from producing in developing countries.

Product characteristics, such as weight and mode of transport, determine transportation costs. Most goods move around the world in 40-foot-long shipping containers that hold a maximum of 40,000 pounds. The containers can be transferred seamlessly between ships, trains, and trucks. Shipping a container across the Pacific Ocean costs about \$4,000, depending on the ports used. Transportation by truck from the West Coast to the Midwest could add another \$2,000. (Air freight is far more costly than other transport methods and is rarely used except for high-value products, such as small electronics components.)

How does a company factor transportation costs into its global footprint decision? Companies can’t afford to ship products long distances when transportation costs significantly increase the product’s total cost. Although item size is important, a key consideration is the cost of transport relative to the value of the product: It’s clearly

much easier to justify shipping costs for an \$80,000 Mercedes-Benz than it is for a \$20,000 Chrysler. Shipping a \$100 microwave oven is an entirely different decision.

One way to calculate the relative significance of transportation costs in an offshoring decision is to use a metric we call *revenue per product pound* (RPP). Now, RPP might seem like an overly simplistic measure. How can one compare a computer wafer with, say, a hunk of steel? But these are *exactly* the kinds of measures that should be consid-

ered by operations strategists to assess the impact of logistics on global sourcing decisions.

### Capital Intensity

Even when transportation costs are not a major factor, offshoring may still be inappropriate because of the relative costs of capital and labor, a measure known as capital intensity. As we have already noted, the savings from low-wage laborers can be

largely irrelevant for highly capital-intensive businesses.

Whereas the speed and power of computer chips is continually increasing, changes in steel manufacturing occur far more slowly. But because the cumulative capital investment in the mature steel industry rivals that of semiconductor manufacturing, Ispat also generates less than \$2 of sales annually for each \$1 of net fixed assets on its books.

Like other computer original equipment manufacturers, Apple Computer Inc., a buyer of both chips and steel, limits its manufacturing expenditures by outsourcing some production to contract electronics manufacturers such as Soletron and Sanmina-SCI. By avoiding vertical integration and limiting manufacturing investments to less capital-intensive assembly and testing, Apple generates more than \$9 in sales for each \$1 in net fixed assets.

Moving closer to the end-user in the consumer electronics value chain, one can see that a retailer is far less capital intensive than a manufacturer. For example, every \$1 of net fixed assets of U.S.-based retailer Best Buy, consisting of stores, fixtures, and distribution centers, produces some \$11 in sales. Although both Apple and Best Buy have low capital intensity, their respective RPPs are quite different: \$70 for Apple versus a mere \$8 for Best Buy.

## Companies that chase lower wages can find that transportation costs offset the savings.

When transportation costs and capital intensity are analyzed together, it is easier to understand why some companies operate close to the customer and others do not. For example, in the high-transportation-cost, capital-intensive steel industry, Ispat Inland's U.S. plants allow it to remain competitive with steelmakers in lower-wage regions. Less capital-intensive computer manufacturers, such as Apple, have the luxury of choosing to ship high-

ered by operations strategists to assess the impact of logistics on global sourcing decisions.

Consider Intel's range of products. Its Pentium chip sells for several hundred dollars, but weighs only a few ounces; Intel's motherboard assemblies weigh far more than a chip but cost less per unit. Based on the data available, we estimate that Intel garners around \$1,000 in revenue per product pound of goods produced across its range of products. With such a high RPP, transportation costs are less critical in Intel's global footprint decisions.

largely irrelevant for highly capital-intensive businesses.

A simple way to understand capital intensity is to look at the ratio of sales to assets (one form of this, DuPont Analysis, was used by Alfred P. Sloan in the 1920s to run the General Motors Corporation). Our version of the ratio compares sales to net fixed assets, or the amount invested in property, plant, and equipment to generate those sales. The ratio can be deduced from a publicly reported company's income statement and balance sheet.

A look at the consumer electronics industry's value chain helps clarify the role capital intensity plays in determining global location decisions. Intel generates less than \$2 of sales per year for every \$1 of net fixed assets on its books, due to the size of the capital investment required to stay competitive in semiconductor manufacturing. Ispat, by contrast, has less need to invest in rapidly improving process technolo-

RPP products from low-wage-rate countries. In fact, Apple faces pressure to do so because labor costs are important to its overall costs.

**Lead Time**

Apple’s evolving corporate strategy shows how the third factor — market responsiveness — enters into the footprint decision. As Apple emphasizes integrated consumer entertainment solutions, it is expanding its retail channels, including the online iTunes Music Store and more than 75 physical retail stores in such upscale locales as New York City’s Soho district and San Francisco. Moving closer to the consumer forces a company to improve its ability to get goods and services to its customers fast. Even if a company that ships product from across the globe can keep its transport costs in check, the incremental

lead time necessary to ship that far can create a supply chain too unresponsive to customer needs.

To quantify the challenge of managing lead time, we employed Little’s Law, an operational construct that measures the length of a company’s “supply pipeline.” Little’s Law, named for Professor John D.C. Little of the MIT Sloan School of Management, states that the length of the pipeline (the “throughput time”) can be calculated by dividing inventory by the rate of sales measured in inventory dollars. The resulting measure provides a perspective on the lead time, measured in days, to convert inventory into revenue. A highly responsive operation has a rapid throughput time, which means it holds little inventory and quickly converts its inputs into customer outputs.

By focusing on assembly and

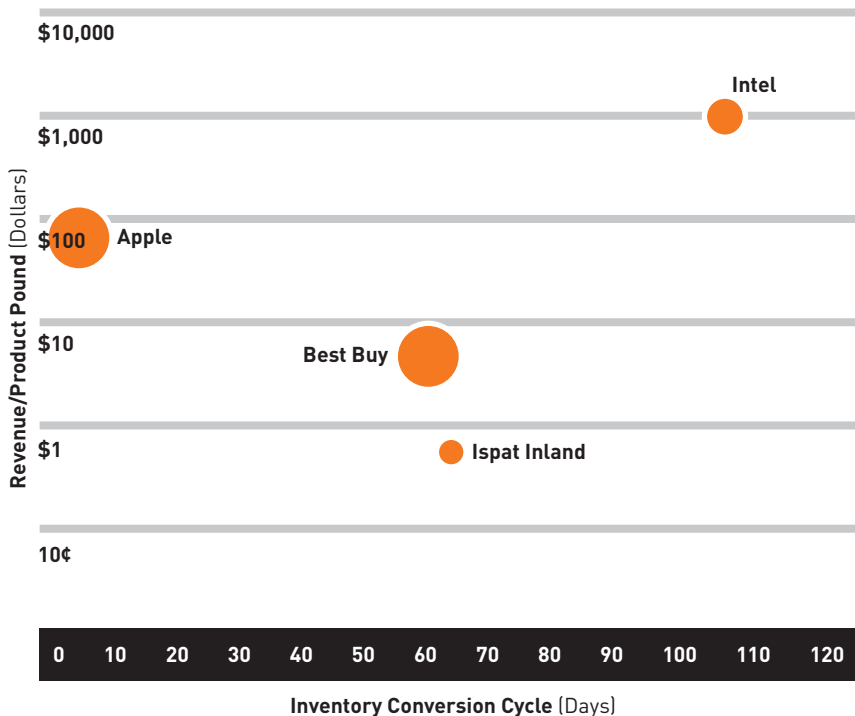
quickly shipping finished product to its customers, Apple maintains a short pipeline with an inventory conversion cycle of only five days. Intel, by contrast, averaged 111 days of throughput time for its pipeline in 2003. A chip produced in one of Intel’s U.S. wafer fabrication facilities may go to Malaysia for packaging, assembly, and testing before shipment to an OEM customer elsewhere in the world. Because Ispat Inland needs to run its production in large batches and maintain a high utilization rate of its capital-intensive manufacturing assets, its throughput time averaged 64 days in 2003. This is similar to Best Buy’s supply pipeline of 61 days.

To fully assess the significance of the three major variables in global operational footprint decisions, it is important to view them relative to each of the other variables, as well as independently. Looking at each of the three variables simultaneously helps explain the global operating footprint for our sample of companies and highlights potential strategic vulnerabilities.

Exhibit 1 plots the three key metrics for each company. The horizontal axis shows the throughput time as measured by Little’s Law. The vertical axis shows revenue per product pound on a logarithmic scale so that the high values for Intel and Apple can be displayed with the lower values for Ispat Inland and Best Buy. (Increments on a logarithmic scale designate order-of-magnitude increases rather than linear increases.) The size of the circle indicates the sales-to-net-fixed-asset ratios of each company.

Intel’s small bubble size and upper-right-corner location highlight the strengths and weaknesses of its competitive position. The

**Exhibit 1: Global Operations Footprint Metrics**



**Note:** Circle size proportional to the ratio of sales to net fixed assets  
**Source:** Analysis of company financials from Hoover’s and other public data

need to continually invest billions in new production technologies produces a low sales-to-asset ratio. Asset intensity — fueled by annual capital investment averaging \$5.5 billion over the last three years — makes Intel less sensitive to competition from less developed, low-wage countries, and its high RPP allows it to serve a global customer base from anywhere without undue concern over transportation costs. The soft underbelly of Intel's strategy could be its long throughput time, which, as measured by Little's Law, has grown by nearly 50 percent in the last five years. Intel may need to locate closer to its major customers, which increasingly are in Asia. Alternatively, an Asian competitor could possibly displace Intel, not by leveraging lower wage rates but by being closer to the factories assembling electronic gear using microprocessors.

The small bubble size for Ispat Inland reflects changes in the steel industry over the past two decades. Steel production in the United States, measured in tonnage, grew by 36 percent between 1982 and 2002, even as industry employment dropped by nearly 75 percent over the same period, from 289,000 steelworkers to 74,000. Many steel companies went bankrupt because of the high cost of pensions and health care for the displaced or retired steelworkers. New owners acquired the steel-producing assets after gaining concessions from unionized steelworkers to reduce unfunded pension liabilities. Despite the labor cost challenges, the low RPP has kept some domestic production in the U.S. alive.

The low RPP of Best Buy supports the argument that retailing is an inherently local business. But

that does not mean that Best Buy or other bricks-and-mortar retailers are safe. Amazon operates on a global basis and has an inventory conversion cycle of about 27 days, less than half that of Best Buy. Amazon holds inventory centrally and ships directly to consumers, thereby shortening the throughput time and simultaneously avoiding investment in retail storefronts. Amazon generates more than \$24 in sales for each \$1 of net fixed assets, compared with Best Buy's 11-to-1 sales-to-asset ratio.

Apple's global footprint reflects its priority to serve customers across the globe with rapid delivery. The company manufactures in Sacramento, Calif.; Cork, Ireland; and Singapore to achieve its five-day throughput. Despite relatively low capital intensity and highly shippable products, Apple chooses to prioritize market responsiveness over low-wage-rate country production.

### Offshoring Reconsidered

Returning to our original query, it is now easier to understand why foreign manufacturers build plants in the United States. Japanese automakers, and even the Chinese appliance manufacturer Haier, can justify investment in the high-wage United States because of the relatively high cost of transporting autos and refrigerators to the U.S. market from Asia. They also want a shorter pipeline so they can be more responsive to market needs. Of course, both tend to apply more capital-intensive production technologies in developed countries than they would in a lower-wage country. Many industries and companies will also find that the optimal trade-off of transportation, capital intensity, and market responsiveness will lead them to continue investing

in developed markets like the United States to optimally serve those markets.

But the news isn't all good for those fighting the growth in offshoring. Application of the operations footprint metrics to back-office "knowledge" work explains the heavy push by many companies to outsource call centers, accounting, and software development to India. Telecommunication costs, which continue to fall, are the services equivalent of transportation costs for a manufactured product. And such work is largely labor intensive rather than capital intensive, so developing regions offer a significant cost advantage.

Even manufacturers that can gain an advantage in time and transportation costs from local production must still strive for productivity improvements in order to remain competitive.

The history of steel production in the United States over the last 20 years is a sobering harbinger for other domestic industries struggling to stay globally competitive: Investing in new process and product technologies and continuously improving productivity remain entry stakes into the game. No industry or company can sit on its laurels, or be too narrow in its decision making, if it is to succeed in today's global economy. +

Reprint No. 04303

*strategy+business* magazine  
is published by Booz & Company Inc.  
To subscribe, visit [www.strategy-business.com](http://www.strategy-business.com)  
or call 1-877-829-9108.

For more information about Booz & Company,  
visit [www.booz.com](http://www.booz.com)

Originally published as “When Offshoring Isn’t a  
Sure Thing” by Tim Laseter.

**booz&co.**

© 2004 Booz & Company Inc.