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The China Rip Tide: Threat or Opportunity?

Profiting from the Growing Supply-Chain Bottleneck

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The China Rip Tide: An Introduction

Surface freight from Asia to the west coast of North America and to Europe is growing at a rapid—by historical standards, an explosive—rate, while port and surface-transport capacities are not. North American ports and rail systems are beginning to choke, and delays and uncertainties are increasing. Freight demand on the North American west coast has been growing at a rate equivalent to one Port of Vancouver per year, and a rapid expansion of port and rail capacity will be difficult given political pressures and formidable environmental resistance. A similar situation exists in Europe. Although the problem is not as acute there, plans are ostensibly in place to add significant port capacity over the next six to eight years. Nevertheless, the conditions we describe in this report are going to get far worse before they start getting better.

The ports and rail systems of the North American west coast are implementing changes, but these are not likely to meet the growing demand, for many reasons. The most significant is that each of the North American participants in the China-anchored supply chains has a narrow view of its role and a limited notion of the end-to-end potential for improvement. The changes being made or contemplated reflect this narrow focus. They are incremental, and their effects will be swept aside by the bigger forces of the China rip tide.

In Western Europe, capacity utilization in the major ports is running between 90 and 95 percent, which allows little margin to absorb the variability inherent in overseas shipping. During the summer of 2004, a spike in demand caught operators off-guard and resulted in long delays for unloading container ships. Some ships were even turned away from ports such as Antwerp. Operators dealt with the problem by adding equipment, hiring dockworkers, and improving scheduling, but such measures only buy time in the near term. The situation did not get any better in 2005 and is not expected to improve this coming summer. Although the planned capacity additions are significant, it would take only one or two expansions to come on late or not at all for European ports to be unable to support the surge from Asia. A study by Drewry Shipping Consultants shows that actual capacity added is usually about a third of what is proposed, and it typically becomes available at least four years later than originally planned.

In North America, the supply chain bottleneck is beginning to affect the performance of manufacturing and retailing companies that rely on surface logistics to get their goods from Asia to the heartland. But few executives at retail or durable-goods companies understand the magnitude of the challenge being forced on them. Even fewer are investing against the phenomenon to reduce costs, improve profitability, and create competitive advantage. One exception is Nike. The *Financial Times* recently reported that the company had joined other big importers in the Waterfront Coalition, an organization set up to lobby for more funding and political support for infrastructure improvements.

We believe strongly that a firm focus on reducing time and variability in the China-anchored supply chains serving North America and Europe can help companies dramatically reduce their costs, improve their margins, and build competitive advantage. We believe that such performance improvements will dwarf the more conventional profit-improvement efforts now under way at most of the companies we are familiar with. We also believe that North American

and European companies should be looking closer to home (to Mexico, Central America, and South America for U.S. companies and to Central and Eastern Europe for Western European companies), where the cost-of-labor penalty (relative to labor rates in China) is more than compensated for by superior supply-chain performance that is significantly less variable and virtually unaffected by port and surface-capacity constraints.

Retailers live or die by a very simple creed: stock products that sell; don't stock products that don't. As North American and European companies source more of their goods from China, the risk of getting this wrong increases dramatically. The effects show more in the economic profits than in the accounting profits. Accounting profits capture Generally Accepted Accounting Principle (GAAP) costs, revenues, and losses. Economic profits capture the hidden costs of lengthening supply chains: increased inventories, overproduction and underproduction, write-downs of excess inventories, and, most important, lost margins from stockouts. In reality, accounting profits may be positive while economic profits are not. Economic profits can be the source of insight for creating competitive advantage.

Some executives may be tempted to stop reading here and pass this paper on to their logistics people. That would be a huge mistake. The actions required to turn the threat of the China rip tide into an opportunity are cross-functional, come together at the very top of the company, and require strategic choices, investments, and initiatives.

So what can companies do, aside from nothing? They can retreat by bringing manufacturing home. They can adapt by building landside capability in ports not yet congested in order to sidestep the problem. Or they can be still more creative and competitive by doing one of the following:

- They can aggressively manage their China-based supply chain, looking for ways to squeeze time from it that competitors haven't identified or exploited.

- They can explore alternatives that will minimize adverse supply-chain effects, including options—such as increased use of air freight—that may appear costly but may actually lower overall expenditures by reducing hidden costs.

- They can invest in premiums and capabilities. Premiums are the extra payments required to get substantially enhanced performance by means of preferred treatment from ground, sea, and air shippers, port services, and other suppliers. Investments in capabilities enable companies to be better than competitors at managing their business in spite of the problems on the North American west coast. These initiatives can include cross-docking, facilitated portside handling, and "track and trace" capabilities to keep boxes moving.

- They can diversify supply with multiple suppliers and supply points or produce domestically for critical components and products, accepting higher production costs as a tradeoff for lower stockouts and supply-chain costs.

Companies that make creative investments like these will benefit enormously, change the dynamics of their industry, and open a competitive gap that will complement and enhance

advantages founded on merchandising and store management. The China rip tide presents a major strategic challenge that many companies are not dealing with explicitly because they underestimate the importance of fast, effective supply chains. Most know that supply chain management is important, but they underestimate the magnitude—and the impact on profitability—of the hidden costs of longer supply chains, reduced flexibility, and lost gross margin from missed sales and write-downs. And rarely do executives think of supply chain investments as an outright source of competitive advantage.

In their rush to source from China, many companies are blindly walking into a strategic trap. The trap is thinking that sourcing from China will result in lower product costs, when in reality the supply chain dynamics will, in many cases, drive up overall costs and reduce profitability, thereby creating an opening for a competitor. Their only salvation will be if all their competitors make the same mistake. But competitors that do not source from China—or that do focus on supply chain speed—will be competing with a different set of economics. The first company to see and correct the strategic error of sourcing from China without an appropriate investment in supply chain dynamics to minimize costs will seal the fate of its competitors.

The Lure of China

China's emergence as one of the world's leading export nations is driven by a huge disparity in costs, caused primarily by hourly wages that are a small fraction of those in North America and Western Europe. This cost disparity is likely to expand rather than shrink, in part because the hourly wage gap will not close nearly as rapidly as many believe, and in part because other cost factors weigh in China's favor to a degree that most U.S. policymakers and Western executives haven't yet begun to comprehend or appreciate.

Typically, a U.S. or Western European factory worker costs an employer $15 to $30 per hour. A Chinese factory worker earns less than $1 per hour—a $14 to $29 gap. If, over the next five years, wages in China increase at a rate of 15 percent annually while those in the United States increase at 3 to 4 percent annually (a very healthy growth rate), average hourly wages in 2009 will be $2 in China and $18 to $36 in the United States. So despite the disparity in growth rates, the gap will have widened to $16 to $34. Government-mandated labor costs such as workers' compensation will further widen this gap.

Of course, there is the exchange-rate question. Our prediction that the gap will widen assumes that there will be no change in relative currency values. Predicting exchange rates, especially over the long term, is hazardous. But the experience of Japan may help set expectations. Largely as a result of Japan's success with industrial exports, the yen-dollar exchange rate went from a low of 360 in the early 1970s to about 100 today—an almost fourfold increase in the value of the yen relative to the dollar over about 30 years. If the yuan were to strengthen against the dollar at a similar rate over the next five years, the wage gap would narrow significantly. But wage rates in China would still be less than half those in the United States.

Wage rates are driven, first and foremost, by supply and demand. As China's industrial sector and middle class grow, wages and other labor costs will increase. But they will not increase

enough to close the gap with the United States, France, Germany, or Japan and improve the competitive positions of the labor forces in those countries. The gap is too wide—and the Chinese labor pool too deep—for that to happen.

China still has 800 million people living in the countryside—–nearly three times the entire U.S. population. Again, a comparison with Japan's experience can be illuminating. Even during the early stages of Japan's emergence as a global exporting power, the rural population supplying labor to Japan's industrial engine was less than half the size of North America's total population. Yet Japan's successful stint as a low-cost manufacturing site, based on low wages relative to those in the West, ran for almost 30 years.

We envision a similarly solid run for China. The migration of China's rural labor force to manufacturing jobs will mitigate any steep rise in wages for low-skilled workers in this decade. And although better-skilled workers will demand higher wages, the supply of candidates for skilled positions is also great and increasing, with almost half a million engineers graduating from Chinese universities every year, compared with 150,000 in the United States and 60,000 in Germany.

Wage rates are just one factor driving costs. The productivity of the labor force is another. Productivity is gauged in many ways, including quality, output per unit of labor cost, and output per unit of capital-and-support costs, as well as annual improvements in all these measures.[1]

In short, corporate and political leaders should not bank on China's cost advantage going away—or even shrinking—anytime soon. In fact, our experience suggests that the gap will increase before it decreases. So sitting this one out won't work. The advantage is here to stay, and the disruption will be significant. We're convinced that as many as 15 to 20 percent of industrial products in the United States and Europe—together with their associated jobs—will migrate almost entirely to China and other rapidly developing economies in the foreseeable future. Another 20 to 30 percent of jobs are up for grabs, depending on the strategies of their producers. The longer Western management teams wait to sort out their China strategies, the greater the risks their companies face.

Will Container Port Congestion Reduce and Even Reverse the China Cost Advantage?

The growing imbalance in supply and demand in Pacific container shipping can be captured in one statistic: over the next several years, close to 100 new container-loading berths will be built in China, each with a lift capacity of about half a million TEU per year. (TEU stands for twenty-foot equivalent units. Most of the containers used in North America and Europe are around 40 feet long, making them equal to two TEU.) Over the next several years, no more than five new berths are planned for the west coast of North America.

1. In quality, too, the Chinese are excelling. Once a Chinese plant's initial process problems are worked out and it has moved along its learning curve, it can often achieve quality equal to that of many leading plants in the West. For example, the Honda automotive plant in China has emerged as the quality leader among all of Honda's plants outside Japan, even surpassing the company's impressive North American operations.

Imports from China to North America are growing at 18 percent per year in value and at 12 percent per year in number of containers. It is hard to imagine anything short of a global catastrophe altering this trend. In the run-up to Christmas of 2004, gridlock hit the Los Angeles-Long Beach ports, the entry point for almost half the goods coming into the United States. Nearly 100 cargo ships floated at anchor waiting to be unloaded—a process that took up to twice as long as normal.

The results of the 2004 dock jam were serious and far-reaching. The Sharper Image blamed at least part of its 2004 third-quarter loss on reduced inventory from port congestion. Final results are not yet in for the end of 2005, but retailers, wholesalers, shipping companies, and ports did make adjustments in early 2005. The shipping companies "rebalanced" their networks, moving containers to other ports on the west and east coasts. Retailers and manufacturers began ordering sooner, carrying more inventories, extending their planning horizons, and resorting to air freight for critical products and components. To avoid bottlenecks in the future, Hudson Bay Corporation—the major Canadian department-store retailer—is opting to ship through the Panama Canal to the Port of Halifax, at a cost of about 37 days, just to be sure its goods are in Canada for the selling season. But most of these adjustments are limited and merely postpone the inevitable. Shipping times will increase. Business performance will suffer.

It's much the same story in Europe. Most of the largest ports are increasingly plagued by congestion, labor shortages, and strained networks as utilization has consistently averaged around 90 to 95 percent over the past four to five years. Although Far Eastern ports in Asia have been able to expand quickly enough to handle more shipments, such European destination ports as Southampton and Felixstowe in the United Kingdom and Rotterdam and Antwerp in the Low Countries are constrained by stringent environmental and planning rules, which allow for only modest expansion at best.

Many of these European ports plan significant capacity additions over the next five years, from almost 32 million TEU in 2004 to approximately 50 million TEU in 2010, a capacity increase of approximately 8 percent annually. (See Exhibit 1.) Demand, however, is expected to grow almost 10 percent per year and, given past experience, could exceed even this robust projection. Assuming *all* the planned capacity additions come online as expected, European port utilization will still be at almost 90 percent by 2010. And this estimate does not take into account the practical implications of the planning process (such as delays and reductions in capacity), which to date has added more than four years to the time it takes to bring new port capacity online.

EXHIBIT 1
CURRENT AND POTENTIAL CAPACITY OF EUROPEAN PORTS

Port	Current area (hectares)	Development area planned (hectares)	2004 throughput (million TEU)	Planned 2010 throughput (million TEU)	Total throughput increase	Main investments/comments
Hamburg	6,480	2,590	7.3	11.3	55%	Improved layout of existing surface areas and use of modern handling technology are expected to raise handling capacities to 11.3 million TEU by 2010
Rotterdam	10,500	2,000	7.2	10.9	51%	New Maasvlakte 2 terminal, due in 2012-2014, should allow for tripling of current capacity
Antwerp	11,599	1,440	6.1	11.7	92%	Construction on the left bank of the harbor is already under development (about 250 hectares)
Bremerhaven	4,783	-	3.5	6.2	77%	New terminal to become operational in 2010; construction will not expand port area
Felixstowe	284	na	3.5	3.7	6%	Proposed expansion would increase the quay length available for container handling by close to 1,000 meters, giving a total quay length of 1,350 meters accompanied by expansion of the port's Trinity Terminal
Le Havre	5,000	-	2.4	4.5	88%	Six new berths are planned by 2008; six additional berths will be built later on, according to traffic requirements
Southampton	283	-	1.5	2.0	33%	Existing plans to develop Dibden Bay are widely questioned for environmental and economic reasons (additional 162 hectares of area worth £600 million would be available in about 2014)
Total	38,929	6,030	31.5	50.3	60%	

SOURCES: Port authorities; European Sea Ports Organisation; BCG analysis.
NOTE: 1 hectare = 2.471 acres; TEU = twenty-foot equivalent units (containers).

At some point this year or next, the ports on the west coast of North America are expected to reach their combined container-unloading capacity. Many have plans for expansion to levels approaching those of Asian ports. (See Exhibit 2.) The expansion would come either from an increase in dockside footprint at current levels of container lift capacity, as indicated in the ports' master plans, or from significantly improved lift productivities. The footprint expansion is doubtful. Local communities consider container ports to be polluters, noisy contributors to road and rail congestion, and just plain ugly. Less threatening business expansions have been stymied by complaints like these. Productivity improvements would require a breakthrough in labor-management relations—unlikely in an environment defined by a long history of discord.

EXHIBIT 2
CURRENT AND POTENTIAL CAPACITY OF WEST COAST PORTS

Port	Current area (1,000 acres)	Master plan area (1,000 acres)	2004 throughput (TEU)	2004 productivity (TEU/acre)	Capacity at 2004 productivity (TEU/year)			BCG's assessment of political and environmental barriers
					Current land	Master plan land	Difference	
Los Angeles	1,477	1,941	7,321,440	4,957	7,321,440	9,621,473	2,300,033	Very high
Long Beach	1,262	1,885	5,779,852	4,580	5,779,852	8,633,139	2,853,287	Very high
Oakland	674	764	2,043,122	3,031	2,043,122	2,315,942	272,820	Very high
Seattle	464	464	1,775,858	3,827	1,775,858	1,775,858	0	Medium
Vancouver	325	710	1,539,058	4,736	1,539,058	3,362,250	1,823,192	Very high
Tacoma	456	828	1,127,261	2,472	1,127,261	2,046,869	919,608	Medium
Portland	200	200	274,609	1,373	274,609	274,609	0	Medium
Total	4,858	6,792	19,861,200	4,088[1]	19,861,200	28,030,140	8,168,940	

SOURCES: Moffatt & Nichol; BCG analysis.
NOTE: TEU = twenty-foot equivalent units (containers).
[1] Weighted average based on number of acres.

Either a footprint expansion or a dramatic increase in productivity would push off the day of reckoning for three to five years. If some miraculous combination of modern management techniques, good labor relations, and political astuteness were to achieve both the footprint expansion and the productivity improvements, the day of reckoning would be postponed for eight to nine years at current container-import growth rates and volumes—a miracle that is very unlikely to occur.

But the problem is bigger than the ports. Existing rail infrastructure to disperse the flood of goods from China throughout the United States is also being strained, with freight out of Los Angeles and Long Beach already very near capacity, and freight out of Oakland, Seattle, and Tacoma expected to reach capacity in 2007 or 2008. No major rail-infrastructure projects are being discussed to alleviate this looming capacity problem.

Two potential solutions exist for North America—one for the medium term and one for the longer term. The medium-term answer is the development of a port in British Columbia. This alternative requires a smaller capital investment than the longer-term solution and could happen more quickly. The Port of Prince Rupert (PPR) is just south of the Alaska-Canada border. It is the northernmost deep-water port in North America that does not freeze, and it is 1,000 miles closer to Shanghai than Los Angeles-Long Beach. At present a bulk port, PPR is underutilized, and so is the rail line serving it. Moreover, the rail line runs eastward, away from all the west coast congestion, and eventually reaches into the U.S. Midwest. Under the right circumstances, PPR could become a major container facility, handling roughly 5 million TEU per year before the rail line reaches capacity.

Unfortunately, PPR will take a long time to develop. The portside facilities do not exist and need to be built. Government approval at all levels will be slow to materialize because of the claims of native peoples, an absence of priority in the permitting process, and a lack of vision. Even if these hurdles can be overcome, PPR has several additional drawbacks that make it unlikely to succeed as a popular alternative to existing ports. For one thing, customers with cargoes for U.S. destinations will be reluctant to endure the double customs delays from importing first into Canada and then into the United States. For another, PPR will never be a major market in its own right, so every container arriving there will have to be shipped onward. Finally, shippers will always want to offload prioritized cargo at Los Angeles-Long Beach, Oakland, or Seattle—or all three—before taking the time to visit a port where extensive transshipment will produce considerable delays even in the best of cases. This drawback will effectively eliminate PPR's 1,000-mile geographic advantage.

If developed, PPR is likely to remain a backup port for Vancouver for the foreseeable future. The situation will probably not improve until the double customs handling is reduced to a single handling and until customers interested in faster movement of containers demand that the shipping companies build a preferred spot for PPR into their schedules.

The longer-term solution is in Mexico. A number of sites exist that could be developed into a large-scale deep-water port. Roads and rail lines into Arizona or Texas would need to be built, and the entire project, optimistically, would take about ten years and $10 billion. Although more expensive to develop than PPR, a new Mexican port is a very realistic possibility, if only because something must be done, because Canada is unlikely to get organized to pick up its PPR option, and because the Chinese are growing impatient.

In fact, neither port nor rail expansion is likely to happen soon. Companies are going to have to fend for themselves.

The Direct, Indirect, and Hidden Supply-Chain Costs of China Sourcing

Companies that source manufactured goods in China do so because of the attractive production costs. But unit product cost (UPC) is only one part of a very complex picture to consider in outsourcing. As supply chains lengthen, they incur direct, indirect, and hidden costs. Direct and indirect costs include shipping, nesting and de-nesting of containers at both ends of the ocean pipeline, inventory storage, handling, procurement, insurance, and overall financing.

Hidden costs are more difficult to identify and quantify. These are the costs that arise from the dynamics of the supply chain. As supply chains lengthen, they also add time. The longer it takes to move a product from point A to point B, the more difficult it is to manage the chain without fluctuations, which create cost. Fluctuations arise as a change in demand at point B ripples back through the chain. Moreover, the flow of information about demand is delayed as it moves back through the chain and, as a result, distortions arise and build. Typically, a very small but unanticipated change in demand at point B can produce a change in demand at point A that is three to five times greater. This phenomenon is explained by system dynamics.

At most companies, management thinks of these system-dynamics effects as forecasting errors, and the greater the forecasting error, the further into the future managers seek to predict demand. But because forecasting errors increase with the magnitude of the delay, these efforts merely aggravate the system effects still further. Forecasting errors create and drive all types of hidden costs.

For one thing, variations in production loads from widely fluctuating demand cause factories to be overloaded and underloaded, resulting in inflated variable costs from overtime premiums and expedited material handling, as well as in fixed costs that are not absorbed. For another, additional inventory must be carried through the supply chain to facilitate fulfillment and cope with slack demand. What's more, that additional inventory must sometimes be discounted, with a resulting loss of margin. Then there is the lost gross margin from inventory that could have been sold had it been available when customers wanted it. Finally, we have observed that even if you are *not* overstocked in categories with lengthened supply chains, chances are someone else will be—so category-wide pricing pressure eats into everyone's margins.

Another hidden cost is the expense of flushing defective inventory from the supply chain. Time is lost identifying the cause of a quality problem, correcting it, and resetting production. Moreover, defective goods are still being fed into the chain during this period. Costs must be incurred not only to remove the defective inventory but also to produce additional goods to meet back orders and current demand—further straining factories—and to physically replace the marred goods with new product throughout the chain.

As it takes longer for containers to move through ports, further hidden costs are created, including the overtime costs that frequently arise from idled ships, unreliable portside loading and unloading, and overburdened rail-transport services. There are also the costs of rerouting shipments to other ports—in the case of the North American west coast, to the east coast and the Gulf of Mexico.

How significant can these costs be? One way to get a handle on them is to compare the economics of a typical domestic supply chain with those of one based in China. Such a comparison or simulation can become very complex very quickly. To simplify it, we have assumed

- a domestic unit price of $10
- a domestic UPC of $4, for a gross margin of $6
- a Chinese UPC of $3, for a gross margin of $7
- an operating margin of $4 for the domestic producer and $5 for the outsourcer to China, after a steady-state supply-chain cost of $2 per unit for both the domestic and China-based chains (a conservative estimate for the China-based chain, since its shipping-related costs will be higher than those of the domestic chain)
- a steady-state demand of 1,000 units per week on average

- a variable and fixed cost per unit at steady-state demand

We start with a set of assumptions about manufacturing and logistics costs. (See Exhibit 3.) These costs are composed of those that are fixed at a steady volume of 1,000 units per week and those that are purely variable by unit.

EXHIBIT 3
BASE MANUFACTURING AND LOGISTICS COST STRUCTURE FOR A DOMESTIC PRODUCER

	$/unit
Selling price	10.00
Manufacturing costs	4.00
Logistics costs	2.00
Accounting operating margin	4.00

	Fixed cost/unit ($)	Variable cost/unit ($)	Total cost/unit ($)
Manufacturing costs	2.40	1.60	4.00
Logistics costs	1.32	0.68	2.00
• Plant	0.48	0.12	
• Transit	0.04	0.36	
• Distribution center	0.64	0.16	
• Retail	0.16	0.04	

SOURCE: BCG analysis.

For the supply chains themselves, we assume some basic, fairly average operating parameters. (See Exhibit 4.) For example, the domestic and nonintegrated supply chain has

- manufacturing and sales in the United States
- an end-to-end cycle time of six weeks
- manufacturing time of three weeks
- plant inventory targets of two weeks
- transit time from factory to distribution center of two weeks
- a distribution-center inventory target of two weeks

- transit time from distribution center to retail outlets of one week
- retail inventory targets of half a week

EXHIBIT 4
SUPPLY CHAIN ASSUMPTIONS

		Nonintegrated			Semi-integrated					Integrated		
Sourcing site		United States		China	United States		China			United States		China
Cycle times (weeks)		3	6	11	3	6	11	18	18+/−6 normally distributed	3	6	11
Product Flow												
Manufacturing	Lead time	1 week	3 weeks	6 weeks	1 week	3 weeks	6 weeks	6 weeks	6 weeks	1 week	3 weeks	6 weeks
Plant inventory	Target based on	2 weeks of average distribution-center orders[1]			2 weeks of average distribution-center orders[1]					2 weeks of average outside sales[1]		
Transit from plant inventory to distribution center		1 week	2 weeks	4 weeks	1 week	2 weeks	4 weeks	11 weeks	6–17 weeks	1 week	2 weeks	4 weeks
Distribution center inventory	Target based on	2 weeks of average retail orders[1]			2 weeks of average outside sales[1]					2 weeks of average outside sales[1]		
Transit from distribution center to retail		1 week	1 week	1 week	1 week	1 week	1 week	1 week	1 week	1 week	1 week	1 week
Retail inventory	Target based on	0.5 week of average outside sales[1]										
Outside sales												

SOURCE: BCG analysis.
NOTE: Other product-flow assumptions: weekly ordering cycle and information delay of one week.
[1] Four-week rolling average.

The transit times may seem long at first glance, but we are trying to capture typical order-to-delivery times for these segments of the supply chain, which are always longer than shipping times themselves.

Inventory targets are set in supply chains to trigger orders and the markdowns needed to relieve excess inventories when they occur. In this simulation, when inventories exceed targets, the price of the excess inventory is slashed 20 percent and sales are assumed to be immediate. There are key omissions in this simulation that seriously affect the economics (in the negative!). These omissions are all real-world phenomena and include

- a network of manufacturing plants for subassemblies and the transit times between them (for instance, manufacturing partly in Puerto Rico for tax reasons or sourcing a key electronic part from the United States for assembly in Malaysia)
- cross-shipping between distribution centers and retailers
- possible variations in transit times

- the use of Mexico, or of Central and Eastern Europe, as a supply base, which, compared with China, is cost disadvantaged but time advantaged

Demand is never a steady state—it always varies—but for the purposes of the simulation, we assume an average demand of 1,000 units per week with a variation about the mean of 300 units. We assume no growth or decline over time. Here again, we have left out some key factors that could have a seriously negative impact on the economics of this simulation:

- The ramping up of new products and the ramping down of old ones
- Seasonal and promotional sales variations
- Growth or decline in demand
- A shift in mix, since we assume a single stock-keeping unit

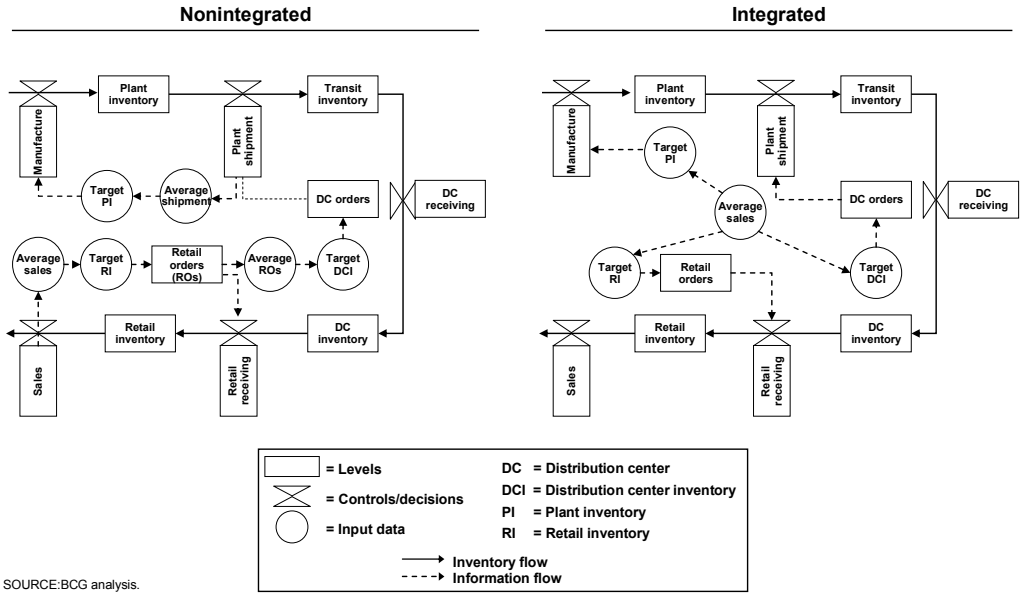
We would need to construct a very much more complicated simulation to capture the effects of these omissions. Experience tells us that including these omissions aggravates the negatives you are about to see.

Our simulation also assumes three states of supply chain sophistication. (See Exhibits 5 and 6.) These states depend on how information on customer demand flows:

- In a *nonintegrated* supply chain, each upstream step gets its information on demand from its customer on the next step down the chain
- In a *semi-integrated* supply chain, each step gets its information on customer demand from its customer two steps down
- In an *integrated* supply chain, each step has a full view of final customer demand

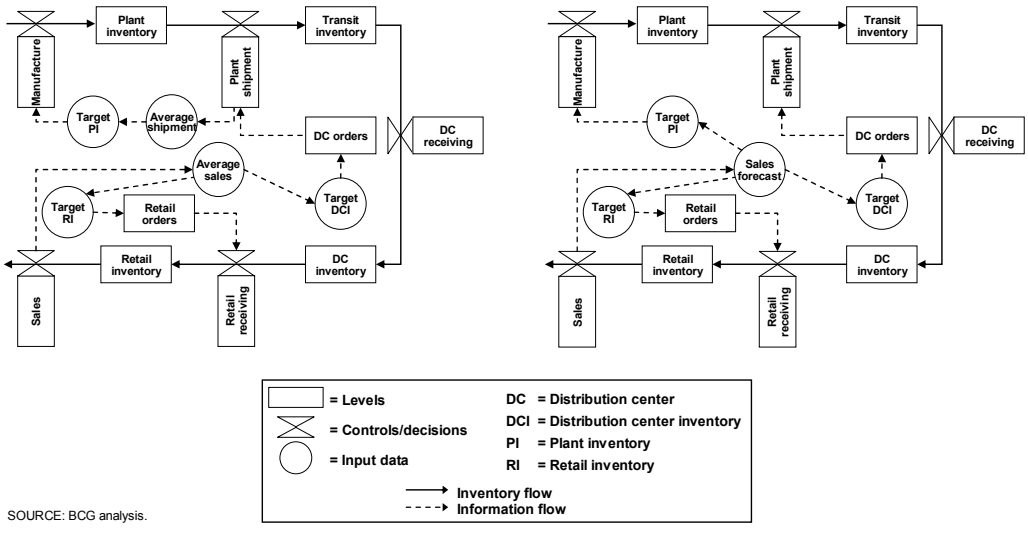
For analytical purposes, we also consider the results of having a perfect forecast, as explained below.

EXHIBIT 5
SUPPLY CHAIN MODELS



SOURCE:BCG analysis.

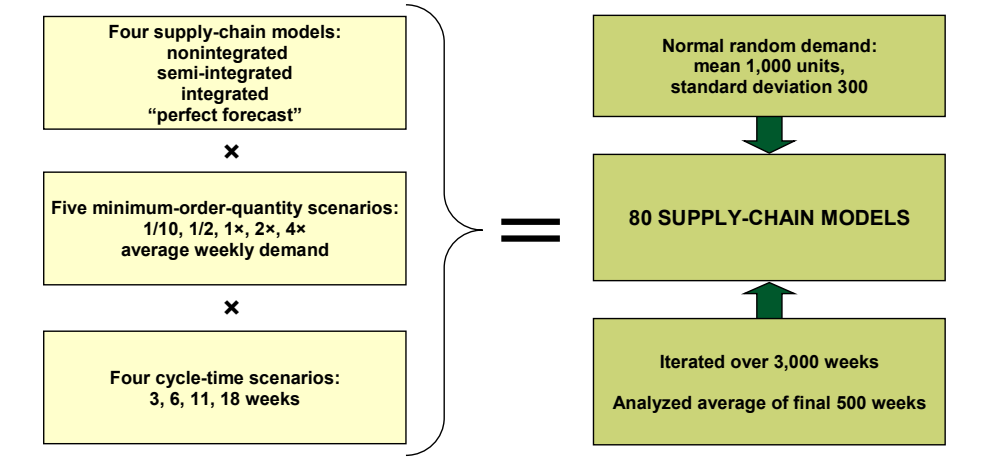
EXHIBIT 6
SUPPLY CHAIN MODELS



SOURCE: BCG analysis.

The simulation is demanding. (See Exhibit 7.) There are four supply-chain models, five minimum-order-quantity scenarios, and four cycle-time scenarios, resulting in 80 supply-chain simulations. These models are subjected to normal random demand and are run over 3,000 weeks to escape the effects of initial conditions in which everything—inventories, production loads, sales, and stock balances—is by necessity in a steady state.

EXHIBIT 7
SCOPE OF THE ANALYSIS PRODUCED 80 MODELS



Key measures	
"Theoretical" operating margin ($/unit)	= Revenue minus manufacturing and logistics costs
Operating margin ($/unit)	= Theoretical margin less added costs due to product flow inefficiencies
Realized margin ($/unit)	= Operating margin less costs of discounts and stockouts

SOURCE: BCG analysis.

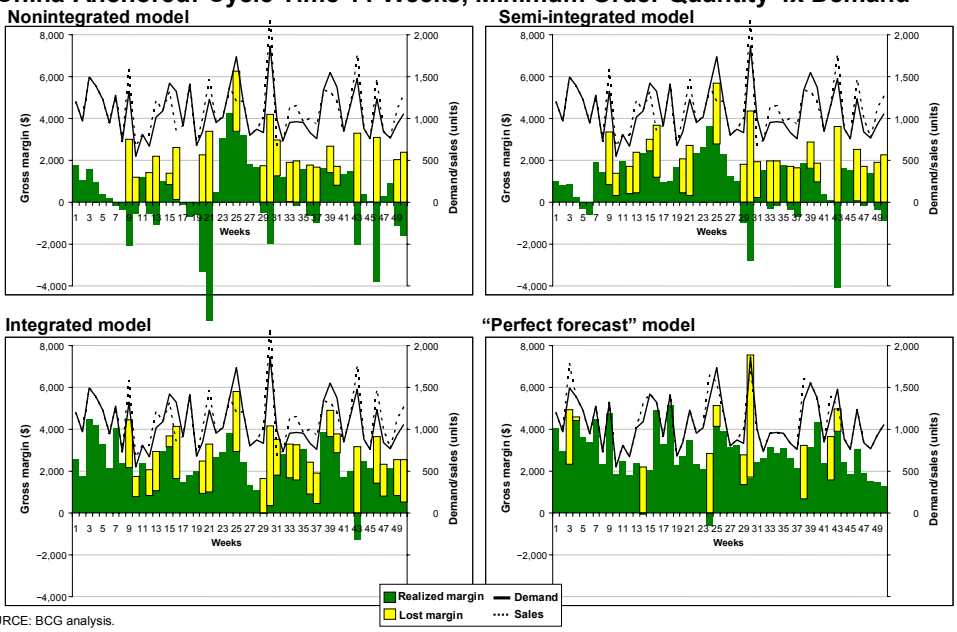
In the first set of simulations, these levels of information management sophistication are applied to a wholly domestic supply chain and to a chain with China at one end and, say, Chicago at the other. In our first comparison, the domestic chain has an overall cycle time of six weeks and sets its production run at one month of average demand. The China-based chain has an overall cycle time of 11 weeks and also sets its production run at one month of average demand. Information flows for both chains are nonintegrated, and weekly demand is allowed to fluctuate randomly about average weekly demand.

When the two supply chains are subjected to this demand profile, retail inventory fluctuates between being overstocked and out of stock. An example of the system response to these demands is shown for illustrative purposes in Exhibit 8. The exhibit depicts how the four China-anchored supply-chain models, from the *nonintegrated* to the *perfect forecast* model,[2] respond to

2. In the perfect forecast, sales forecasts are perfectly forecasted, *forward*-looking four-week averages and are available to all participants in the supply chain. In contrast, sales forecasts for the nonintegrated, semi-integrated, and integrated supply chains are based on historical averages of sales and product demand at various steps in the supply chain, depending on the degree of integration. The perfect forecast provides a benchmark measure of profitability for the supply chains, if they could have access to perfect knowledge of future demand. The data generated by the perfect forecast are used for internal analyses only and are not material to this discussion.

random demand (the solid line) and to the resulting sales (demand less stockouts plus discounted sales—the dotted line). When overstocked, we discount the excess inventory in order to move it. When understocked, we count as a cost of doing business the lost opportunity of not obtaining the gross margin from the goods that weren't available. The margin realized from sales revenues less supply chain costs is shown in green. The margin lost owing to stockouts is in yellow.

EXHIBIT 8
ILLUSTRATIVE OPERATING MARGIN
China-Anchored: Cycle Time 11 Weeks, Minimum Order Quantity 4x Demand



SOURCE: BCG analysis.

The results: The domestic chain experiences volatility, which adds supply chain costs. The operating margin averages $0.77, as opposed to our assumed steady-state operating margin of $4. The China-based chain experiences even greater volatility because of its longer cycle times and nonintegrated information flows. It ends up with an operating margin of $1.02, as opposed to the assumed steady-state operating margin of $5. Because of its lower UPC, the China-based chain still has the advantage.

The Competitive Implications of Lengthening Supply Chains

Exhibit 9 shows a series of scenarios comparing a China-anchored supply chain with a wholly domestic chain. The China chain is likely to move quickly to a semi-integrated state of sophistication as the difficulties of managing the nonintegrated chain become apparent. In doing so, it improves its operating margin to $1.21 per unit. At that point, the management of the China-based chain is likely to cut price—by, say, a dollar per unit—to gain share from the domestic chain. It believes that the move will reduce its gross margin from $7 to $6 and its steady-state operating margin from $5 to $4.

EXHIBIT 9
SEQUENCE OF COMPETITIVE EVENTS

	Domestic manufacturing only		Entry of Chinese competitor		Chinese competitor integrates		Price reduction		North American manufacturing optimizes supply chain		Bottlenecks in Asian supply chain		Bottlenecks plus uncertain transit time	
Critical supply-chain factors	North America		North America	China	North America	China	North America	China	North America	China	North America	China	North America	China
Integration	Nonintegrated		Non-integrated	Non-integrated	Non-integrated	Semi-integrated	Non-integrated	Semi-integrated	Integrated	Semi-integrated	Integrated	Semi-integrated	Integrated	Semi-integrated
Cycle time (weeks)	6		6	11	6	11	6	11	3	11	3	18	3	18+/−6
Minimum order quantity	4×		4×	4×	4×	4×	4×	4×	1×	4×	1×	4×	1×	4×
Retail price ($/unit)	$10		$10	$10	$10	$10	$9	$9	$9	$9	$9	$9	$9	$9
Manufacturing cost ($/unit)	$4		$4	$3	$4	$3	$4	$3	$4	$3	$4	$3	$4	$3
Theoretical operating profit ($/unit)	$4		$4	$5	$4	$5	$3	$4	$3	$4	$3	$4	$3	$4
Actual operating profit ($/unit)	$0.77		$0.77	$1.02	$0.77	$1.21	($0.16)	$0.28	$2.19	$0.28	$2.19	($0.70)	$2.19	($1.43)
Advantage/ disadvantage				32%		57%		NA		−87%		−132%		−165%

SOURCE: BCG analysis.

If the domestic supply chain matches the price cut to hold share, it will see its operating margin turn into a loss of $0.16 per unit, while the China-based chain's margin will decline to $0.28 but still be profitable. The reality is likely to be somewhere in between, but the China-based chain will still have the advantage through a combination of low UPC and semi-integrated information flows.

But now our scenario takes an interesting turn. The domestic supply chain can neutralize the China-based supply chain's advantage if it *integrates* its information flows and cuts end-to-end cycle times by half (still a big *if* for many companies). With that enhanced responsiveness, the domestic chain will see its operating margin increase from a loss of $0.16 per unit to a profit of $2.19 per unit. Now *it* has the advantage. However, the competitive dynamic might continue, with the China-based chain becoming integrated and also cutting its cycle time in half. In that case, the advantage returns to the China-based chain because of its lower UPC.

The domestic supply chain should become time based with or without the threat of a China-anchored supply chain. The potential improvements to its competitiveness and profitability are too great for companies to ignore, although they still do.

For European competitors, the issues and implications of a China-anchored supply chain are very similar, since transit times from China to Europe are comparable to those from China to the United States, and Western Europe also faces similar issues with port capacity. However, from a Western European perspective, there is an important third option to consider: Central and Eastern

Europe (CEE). Sourcing from CEE allows companies to capture a significant portion of the savings available in China while paying only a fraction of the penalty in lengthening supply chains. Furthermore, as almost all the goods manufactured in CEE arrive in Western Europe by truck or train, the risk of port congestion is avoided as well. In rough figures, fully loaded labor costs are $25 to $30 per hour in Western Europe, $2 to $5 per hour in CEE, and about $1 per hour in China. Transit times from CEE to Western Europe are measured in days (four to five days from western Russia and two days from the Czech Republic, Hungary, Poland, Romania, and Slovakia). Simply put, sourcing from CEE provides 80 to 90 percent of the benefit of sourcing from China while incurring only 10 to 20 percent of the supply chain penalty (and, again, avoiding increasingly congested European ports).

To understand the implications of these differences, we simulated three different supply chains: domestic Western Europe, China anchored, and CEE anchored. The assumptions for Europe were the same as for the United States (as labor costs and domestic lead times are comparable). Since transit times from China to Europe are the same as from China to the United States, the assumptions for China also remained unchanged. For the CEE-anchored supply chain, we made the following conservative assumptions:

- Manufacturing costs of $3.20 per unit (versus $4 in Western Europe and $3 in China)
- An additional week of manufacturing lead time compared with the Western European chain
- An additional week for transit from plant inventory to distribution center compared with the Western European chain

The net effect is that the *simulated* CEE supply chain is two weeks longer than the domestic Western European supply chain. That's probably the case if sourcing is from central or eastern Russia but unlikely if sourcing is from countries in the region of the Czech Republic, Hungary, Poland, Romania, and Slovakia. Despite the conservatism built into the simulation, the CEE-anchored supply chain is systematically advantaged compared with the Europe- and China-anchored supply chains. Exhibit 10 shows a summary of the simulations.

EXHIBIT 10
SEQUENCE OF COMPETITIVE EVENTS
Serving Western Europe, Including CEE as Third Sourcing Option

	Integration	Cycle time (weeks)	Minimum order quantity	Retail price (USD)	Manufacturing costs (USD)	Theoretical operating profit (USD)	Actual operating profit (USD)	Advantage/ disadvantage
Domestic manufacturing only								
• Western Europe	None	6	4x	10	4.00	4.00	0.77	
Entry of foreign competitor								
• Western Europe	None	6	4x	10	4.00	4.00	0.77	
• Central/Eastern Europe	None	8	4x	10	3.20	4.80	1.51	96%
• China	None	11	4x	10	3.00	5.00	1.02	32%
Foreign competitor integrates								
• Western Europe	None	6	4x	10	4.00	4.00	0.77	
• Central/Eastern Europe	Semi	8	4x	10	3.20	4.80	1.68	118%
• China	Semi	11	4x	10	3.00	5.00	1.21	57%
Price reduction								
• Western Europe	None	6	4x	9	4.00	3.00	(0.16)	
• Central/Eastern Europe	Semi	8	4x	9	3.20	3.80	0.75	NA
• China	Semi	11	4x	9	3.00	4.00	0.28	NA
Domestic manufacturing optimizes								
• Western Europe	Full	3	1x	9	4.00	3.00	2.19	
• Central/Eastern Europe	Semi	8	4x	9	3.20	3.80	0.75	(66%)
• China	Semi	11	4x	9	3.00	4.00	0.28	(87%)
Foreign competitor optimizes supply chain								
• Western Europe	Full	3	1x	9	4.00	3.00	2.19	
• Central/Eastern Europe	Semi	8	2x	9	3.20	3.80	1.61	(26%)
• Central/Eastern Europe	Semi	5	2x	9	3.00	4.00	2.13	(3%)
• Central/Eastern Europe	Full	5	1x	9	3.00	4.00	2.84	30%

SOURCE: BCG analysis.

Only when the domestic competitor fully integrates its supply chain, reducing cycle times to three weeks and minimum order quantities to 1x, does it outperform the CEE-anchored supply chain. The CEE-anchored supply chain outperforms the China-anchored supply chain in all instances, as one would expect.

All of this assumes that the CEE-based competitor does not integrate. Given the proximity of CEE to Western Europe and the increasingly free movement of people, capital, and technology, there is little to prevent the CEE-anchored competitor from fully integrating, as the competitor anchored in Western Europe does in the last scenario in Exhibit 10. The exhibit also shows the results of varying levels of such integration. If the CEE competitor reduces minimum order quantity (MOQ) from 4x to 2x without shortening the supply chain, its disadvantage falls to 26 percent. If, simultaneously, the cycle time is reduced from eight to five weeks, the disadvantage falls to a negligible 3 percent. And if the MOQ is further reduced to 1x (the same as the Western European competitor), the CEE-anchored competitor again gains a significant advantage of 30 percent (while still incurring the conservative two-week cycle-time penalty).

Back to the Real World

Unfortunately, the world we live in isn't evolving in a way that would help the China-based chain—and it wouldn't be evolving that way even if the various adjustments presented in the exhibit were made. As noted, the surface-freight situation in North America and Europe is seriously challenged. Utilization at ports and on railroads is approaching all-time highs right now. With freight volumes increasing faster than the ports can handle them, the situation will only worsen. Options are limited. Some Asian ships are too big to go through the Panama Canal

to less busy ports on the Atlantic coast. Even some of those that can fit through the canal must offload and reload containers to meet the canal's pilot-visibility rules. The offloaded containers are sent by rail across the isthmus to be reloaded on the other side, adding even more transit time. And while shifting to east coast ports might improve the predictability of shipping times, it certainly won't shorten them.

Because of the problems on the North American west coast and in Europe, cycle times of the China-based supply chains are going up, not down. If they increased from 11 weeks to 18 weeks, as they are today for some retailers and manufacturers of durable goods, the China-based chains would suffer a decline in operating margin to a $0.70 *loss* per unit, while the enhanced domestic chains would still be realizing a profit of $2.19 per unit.

But that's not all. The cycle times of surface shipments (from China to Chicago, for example) are not only increasing—they are also becoming more variable. About 50 percent of the containers at one shipping company are offloaded within two weeks of their scheduled dates, and these are considered to be on time. The other 50 percent are even less predictable!

If the surface time of 18 weeks can randomly vary six weeks either way, the semi-integrated China chain will lose $1.43 of operating margin. So a domestic supply chain with integrated information flows and fast cycle times can outperform a China-based chain, despite China's low UPC.

Turning Threats into Opportunities: What Companies Should Be Doing

Everyone rushing to source from China can't be wrong. Exhibit 11 shows the top annual container importers to the United States—a list that includes many familiar names.

However, some of these companies—as well as others—are having second thoughts about their China-sourcing strategies and are either reworking their North American logistics networks or even retreating from China.

EXHIBIT 11
THE TOP CONTAINER IMPORTERS TO THE UNITED STATES, 2004

Importer	TEU/ year	Importer	TEU/ year
Wal-Mart	576,000	Payless ShoeSource	54,200
The Home Depot	301,200	Samsung	52,800
Target	202,700	Matsushita Electric Corporation of America	52,100
Sears/Kmart	186,000	Toyota Motor Sales, U.S.A.	52,000
Dole Food Company	164,100	General Electric Company	51,800
Chiquita Brands International	115,600	Williams-Sonoma	50,000
Ikea International	100,000	Mattel	49,300
Lowe's	100,000	Pier 1 Imports	48,100
Heineken USA	83,000	Sony Corporation of America	47,900
Ashley Furniture Industries	69,800	Nike	47,900
Costco Wholesale Corporation	66,400		

SOURCE: *Manufacturing & Technology News*, October 2005.
NOTE: This exhibit does not distinguish between importers to the east and west coasts of North America; TEU = twenty-foot equivalent units (containers).

- Wal-Mart has built a 1.3-million-square-foot warehouse near the Port of Savannah, Georgia, and will open an $80 million distribution center near Houston, diversifying from Pacific ports
- The Home Depot has built a 1.4-million-square-foot facility in Savannah
- Toyota and Nissan are considering a plan to move more imports through Mexican ports
- Red Bull has diverted all inbound shipments from southern to northern California ports and is redistributing products to local markets in southern California as needed
- Windbrella has eliminated its Florida warehouse and has enlisted UPS to ship umbrellas directly from its China production plant to U.S. retail outlets
- Red Wing Shoes is having its products consolidated by UPS in China prior to shipment
- Kodiak is bringing boot manufacturing back to North America

So what can companies do? They need to be very aggressive in managing their China-based supply chains, looking for ways to squeeze time from them that competitors haven't identified. And how can they do that? By assessing all their operations and processes anew and by adopting many of the recommendations we offer below for newcomers.

For companies that haven't yet sourced from China, we recommend the following steps:

- Reduce minimum-production-order quantities and reduce cycle times as quickly and as much as possible
- Refrain from sourcing or manufacturing in China until management fully understands the dynamics of the supply chains
- Create an integrated or a semi-integrated information flow within the company's existing supply chain
- Conduct in-depth examinations of buying practices and management of supplier relationships at all levels of the supply chain in order to identify areas where hidden costs could arise and to prevent their occurrence
- Segment the demand chain on the basis of order predictability and demand volatility so that components with the highest gross margins and the most volatile demand get the fastest handling
- For European companies, carefully evaluate the unique opportunity to source from Central and Eastern Europe, where labor savings are almost as significant as in China and the supply chain penalty is relatively small

If a company does decide to source from or manufacture in China, it should explore alternatives that will minimize adverse supply-chain effects, including options that might appear costly at first but may result in overall lower costs.

- Use air freight for products with the highest margins and volatility.
- Insist on point-to-point ocean shipping. To reduce costs, shipping companies build larger and larger container carriers, which must then be scheduled to call on multiple ports. Shipping products on a vessel that has your destination as its last port of call can add weeks—and great variability—to transit times.
- Develop better relationships with transportation providers. This could mean identifying and paying shippers for preferential treatment. In *hot hatching*, for example, you offer a premium to a shipper that will load your goods onto its vessel last and unload them first. Another option is to work with the few shipping companies able to offload containers directly onto rail cars that head east on an express basis—cutting days and sometimes weeks out of the supply chain.

All these initiatives require investment in one of two forms: in premiums or in capabilities. As noted above, premiums are the extra payments required to get substantially enhanced performance and preferred treatment from suppliers like ground, sea, and air shippers and port services. We have talked with many of these companies, and they do not know what to offer at

what price. Companies can get results by forcing suppliers to compete on service in return for premiums.

Investments in capabilities, which tend to be a good deal harder to discern and carry out, include

- accelerating the flow and interpretation of information
- developing designs that enable final assembly to take place close to the point of final demand, thereby minimizing the time and cost effects of long supply chains
- learning to source, manufacture, launch, and withdraw products more effectively
- exploiting new concepts for fast freight

Identifying these investment opportunities requires exhaustive investigation and analysis of costs, revenues, and lost margins in today's end-to-end supply chains. Companies need to ask What if? And they need to explore their answers thoroughly for each and every white space before deciding that no additional investment in premiums and capabilities is likely to produce further improvement. They need to be especially alert to the subtle but important system effects of investing at one part of the chain to affect performance at another.

Next Steps

Information is power, and companies need to invest in it. Here are six information-related steps that managers can take to improve a company's supply chain:

1. Estimate the size of the prize and make sure you seriously consider all viable options (including CEE for Western Europe). How will the ideas discussed here work in these different environments? What are their special situations: High volatility? Fast fashion cycles? Customization? Distributed manufacturing?

2. Walk the line. Figure out what is actually happening and why, step by step.

3. Focus on dramatically improving the responsiveness and reliability of key participants in the supply chain. Sometimes simple procedural changes can have huge implications.

4. Identify and vet the changes necessary within the organization and across the supply chain to realize opportunities. Companies are seldom organized to make the cross-functional changes required to materially impact the performance of a supply chain. One company's purchasing group sourced the parts for a particular design from suppliers in three different countries solely on the basis of UPC and without regard for the system impact of the decision. The result was frequent assembly shortages and emergency air-freight charges.

5. Get information to the top of the company. Push efforts onto the A list of priorities of the company's leadership—or else abandon the effort altogether. Dramatically improved supply-

chain performance can't happen without a mandate from leadership. Otherwise, the near-term and narrowly focused performance parameters of the organization will bring all sustained effort to a halt.

6. Build improvement efforts into operating plans and budgets throughout the company. Some organizations simply build in stretch-performance goals and let their business units rush to find solutions. This method is scary to watch, but it can be very effective.

In general—and of utmost importance—strategy must match supply chain. If a company decides not to source goods in China while its competitor does, the rival's direct cost advantage can sometimes be overridden by increasing its logistical disadvantage. For example, what if the company with the domestic supply chain is able to increase the degree of customization its customers want or to raise the fashion quotient—more variety or more frequent selling seasons—in some category of its business? In that case, the demand volatility for certain products will be increased and the China-anchored competitor, with its long lead times, could find its logistical problems aggravated.

Companies with time-advantaged supply chains might also consider consignment pricing, requiring their wholesale customers to pay only when they sell the company's products. To match this appealing offer to customers, competitors with a much longer supply chain will have to incur much higher costs for carrying greater inventory.

Some Closing Observations

The current problems of sourcing in China represent a giant nontariff trade barrier. In fact, the best strategy for U.S. protectionists may lie not in quotas or tariffs but in the active backing of environmentalists' efforts to hinder port expansion! And the situation is likely to get worse before it gets better. Politicians throughout the United States and Canada will dither and debate until the options for alleviating the port bottlenecks have vanished.

Companies will do what they can—we have suggested a number of competitive tactics—but a single corporation can do little to solve the broader problem. An increasingly frustrated China, which has the most to lose from this de facto trade barrier, may undertake a major initiative, such as developing a new port on the west coast of Mexico. Any such effort would take years to have an effect, but the possibility is real.

Whether your company is operating and selling from Europe or North America, it will not be easy to get your own situation right. Winning will require creativity and insight into customer behavior, as well as segmented options, detailed cost analysis, and the kind of management that will strike many executive teams as an out-of-body experience. Yet the problem is severe enough that *someone* out there is undoubtedly trying to do something about it. That someone had better be you.