

# The New Industrial Revolution: De-verticalization on a Global Scale

## *Critical Issues and Investment Implications*

- *Well-orchestrated **collaboration** is displacing command and control **integration***
- *Many industries are being transformed as*
  - *the competitive balance of power is reordered,*
  - *barriers to entry fall and*
  - *the pace of innovation accelerates*
- *The implications for global productivity growth are positive*
- *The investment implications are clear:*
  - *Understanding a company's position in its industry's transformation is vital and*
  - *Timing is critical*

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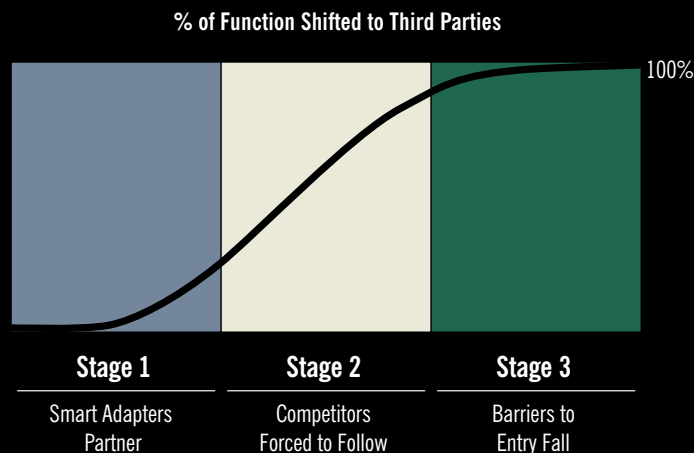
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## Executive Summary

- The global economy is in the midst of a major business-process revolution as significant as the one that occurred a century ago. As a result of a substantial decline in interaction costs, the new revolution is leading to the widespread de-verticalization of corporate business structures.
- De-verticalization is the process of separating functions and services from a vertically integrated business. Companies are undergoing this change because they can operate more efficiently and achieve better results by relying on partners to perform certain functions, rather than by maintaining control of these processes themselves.
- As de-verticalization unfolds in a given industry, supply-chain partners focused on particular aspects of the value chain emerge. Frequently, these partners develop greater economies of scale and superior skill than their in-house counterparts. The development of these partners reduces redundancy of operations in an industry and lowers the barriers to entry.
- De-verticalization is a profoundly destabilizing, continual process. The competitive edge gained by de-verticalizing is usually fleeting because established rivals copy effective strategies, and lower barriers to entry encourage new competitors to emerge. Thus, companies must continually find new functions to de-verticalize in order to maintain their edge, and any given industry may go through many rounds of de-verticalization.
- Investing profitably in industries that are de-verticalizing requires understanding where the industry is in the transition and companies' positions within it. Our "de-verticalization curve" conceptualizes this transition and its continually changing competitive dynamics. Timing is critical to investment success.

### How De-verticalization Unfolds



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# The New Industrial Revolution: De-verticalization on a Global Scale

By **Amy Raskin,** and **Nils Mellquist,**  
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## INTRODUCTION: A TALE OF TWO REVOLUTIONS

Early in 2005, a little-known, eight-year-old Chinese car company, Chery Automobile, made an audacious announcement. It plans to enter the North American market in 2007 with a line of six luxury vehicles priced at a substantial discount to comparable models. By 2010, it plans to offer 16 vehicle models and sell a million cars in the US and Canada.<sup>1</sup>

To achieve this feat of time to market and customer acceptance, Chery has formed a joint venture with US-based Visionary Vehicles, a sales and marketing firm. It has also commissioned Italy's Pininfarina (designer of Peugeot sports cars and Ferrari race cars) and Bertone (designer of the Lamborghini) to design the auto bodies.<sup>2</sup> Lotus Engineering of the UK, Mitsubishi Automotive Engineering of Japan and Austria's AVL are assisting with the engines and drivetrains.<sup>3</sup> A variety of less well-known, mostly Chinese manufacturers will make most of the other auto parts. Chery's main task will be assembling the vehicles.

Nothing could be more different from the operating model that has governed the auto industry for most of its history. In the 1920s, Ford Motor Company did everything from smelting its own steel and growing its own rubber to making its own auto parts and assembling them into vehicles. Sometimes, it even transported finished vehicles to customers on its own rail cars.

Ford epitomized vertical integration as an operating model in the early 20th century (*Display 1*). Chery—whether or not it is ultimately successful—is the latest example of a new operating model that we call de-verticalization and that is now sweeping the global economy. A century after the shift to vertical integration revolutionized the business world, companies are segmenting horizontally and collaborating closely with suppliers and other partners in their industries, thereby challenging traditional notions of what constitutes a firm. Until fairly recently, this trend was confined primarily to manufacturing; it is now spreading to services

Display 1

### Auto Industry Past and Present: A Study in Organizational Contrasts

	Ford Motor 1920s and '30s	Chery Automobile 2010E
<b>Organizational model</b>	Vertically integrated	De-verticalized
<b>Primary responsibilities</b>	Executing end-to-end mass production	Assembling autos
<b>Partners</b>	Limited	Visionary Vehicles, Pininfarina, Bertone, Mitsubishi Automotive Engineering, AVL, Chengdu Huachuan Electric Parts, Long Ma Shen Auto Seating Company, Jiatong Tires, Shijiazhuang Joy Long Auto Safety
<b>Employees</b>	100,000 in one of several facilities (River Rouge)	8,340 (as of 2003)
<b>Vehicle models</b>	One at inception	16 at inception

Source: Company reports and Alliance Capital

as well. According to a Bain Consulting survey, more than 80% of all large firms worldwide already use outside partners.<sup>4</sup> Many perform functions that were once viewed as core.

The degree to which industries have thus far undergone this transformation varies greatly, but its progression is similar across functions and sectors. This report—the result of a year of intensive research and meetings with over 200 companies—focuses on investment implications of this trend. We offer a framework for understanding the transformation and the wholesale dislocations it is generating, as well as several real-world examples of the de-verticalization process and its consequences. We also offer a brief assessment of the macroeconomic and microeconomic implications. We conclude with an exploration of the pharmaceutical industry, where the process is just beginning.

### Revisiting Coase’s “The Nature of the Firm”

The make-or-buy decision lies at the heart of what constitutes a firm. As Nobel Prize-winning economist Ronald Coase postulated in “The Nature of the Firm,”<sup>5</sup> a fundamental reason for firms to exist and perform functions not based on market pricing is to reduce the transaction (or interaction) costs that can make it more expensive to buy from an outside vendor. Transaction costs include such items as finding and evaluating potential vendors, entering into contracts with them, monitoring their quality, communicating with them on an ongoing basis and transporting their products.

Subsequent writings and analysis by Oliver Williamson, Harold Demsetz and Steven Cheung (among others) have expanded on this microeconomic construct, but Coase’s basic theorem governed the size and structure of businesses throughout the 20th century.

Simple in principle, the construct can be difficult to apply to real business decisions. Interaction costs change frequently; individual corporate structures are far less fluid. Often, the cost of change is greater than the economic benefit, so no action is taken.

Occasionally, however, a massive shift in interaction costs completely changes the calculation, and wholesale reorganizations of companies and industries ensue. One

Display 2

### Two Industrial Revolutions: Similarities and Differences

Old Industrial Revolution	New Industrial Revolution
Lower interaction costs (rail, canal and steamship transportation) created incentives to vertically integrate	Lower interaction costs (communications and trade) drive de-verticalization
Command and control	Partnership and collaboration
Emphasis on physical infrastructure	Emphasis on virtual infrastructure
Company-based economies of scale	Industry-based economies of scale
High barriers to entry	Low barriers to entry

Source: Alliance Capital

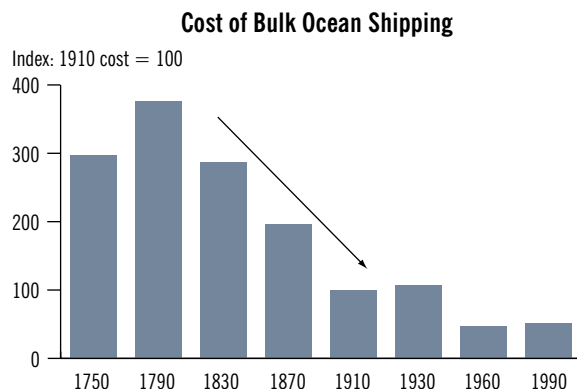
such seismic change gave rise to the industrial revolution a century ago. Another is leading to the de-verticalization revolution of today (*Display 2*).

### Cheaper Transportation, Power Drove First Revolution

For centuries, craft production was the pervasive business model. Prototypes served as guides to low-volume production, but each product was slightly different due to the lack of standard, interchangeable parts. There were few barriers to entry. To compete in a market, you just needed a few easily obtained tools and a set of skills generally acquired by way of an apprenticeship. Opportunities to gain economies of scale were limited, because it was difficult to buy materials in bulk and to segment processes efficiently—and the addressable market for goods and services was typically limited to locations no more than a horse-and-carriage ride away.

The advent of faster and cheaper transportation systems and more abundant power and electricity over the course of the 19th century made possible the economies of scale inherent in mass production. Improved transportation networks, such as canals and railroads, made it much easier to obtain larger quantities and varieties of materials from distant locations and expanded businesses’ addressable markets well beyond the neighboring towns. Later, improvements to the steamship, such as the screw propeller and steam turbine, made oceanic transport economically viable: The cost of transporting bulk commodities across oceans fell 50% between 1870 and 1910 (*Display 3*).

Display 3

**Plunging Ocean-Shipping Costs Enabled Mass Production**

Source: Rietveld/Vickerman (2004); *Transport in regional science, Papers Reg. Sci.* 83, 229-248

Meanwhile, the advent of the internal-combustion engine (1876), carbon arc lamp and dynamo (1879) and electric generator (1887) made mass production in large factories feasible.

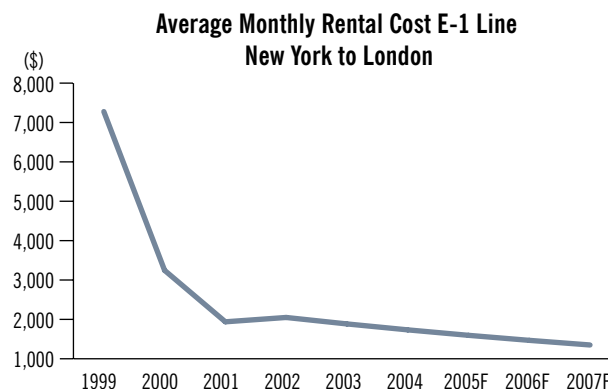
But mass production also requires dependable supplies of materials and components: If you're going to make large investments in plant, equipment and inventories, you need to ensure they don't sit idle because crucial components or services are unavailable—or late. Thus, ownership and control became crucial, and companies began to integrate vertically. The investments in plant, equipment and inventories required for mass production throughout the value chain also raised formidable barriers to entry in terms of capital and time to market.

**Cheaper Communications, Trade and Labor**

Today's industrial revolution, by contrast, is being enabled by three technological and economic developments that have dramatically reduced interaction costs, allowing firms to procure products and services much more cost-effectively from third parties on the open market, with few geographical or market constraints.

De-verticalization thus magnifies the economies of scale from mass production by using a market mechanism to create economies of scale on an *industry* basis rather than a *company* basis. Open corporate infrastructures enable a few companies to provide a specific function to an entire industry, eliminating the duplication of those functions in each company. Thus, it increases productivity.

Display 4

**Plummeting Broadband Costs Enable Global Communications**

Source: Telegeography and Alliance Capital

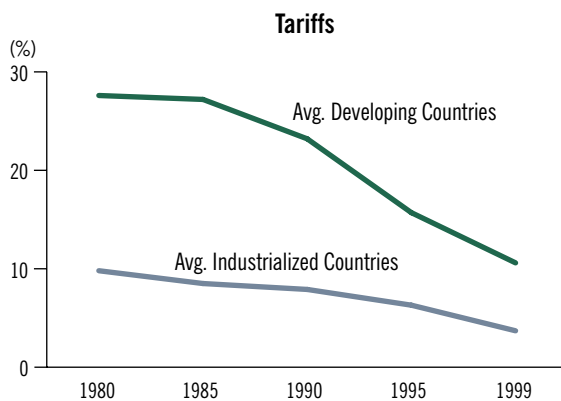
Winning in a world where firms are more narrowly focused, however, requires giving up some control and developing new organizational strategies, skill sets and tactics: It requires well-ordered *collaboration*. The emphasis of a de-verticalized company is on *being the best* and *buying the best* efficiently.

The three primary enablers of today's industrial revolution are cheaper communications, reduced trade barriers and the increased availability of low-wage skilled labor to private enterprise. Let's look at each in turn.

**Reduced Communications Costs** Virtual networks that enable companies to interconnect with suppliers or partners outside their walled gardens have become much cheaper in the last few years, in part because significant overinvestment in fiber-optic transmissions in the late 1990s helped drive down data transmission and telecommunications prices (*Display 4*). As a result, today it is easier than ever to find and collaborate with third parties on a real-time basis and to incorporate these partners into the production process. New applications, such as extensible markup language (XML) and secure virtual private networks (VPNs), are being developed to further facilitate interoperability.

**Reduced trade barriers** make it easier for companies to conduct business with geographically distant partners and suppliers. Tariffs in developing countries have been falling for 20 years; they fell more than 50% in the 1990s (*Display 5*). In addition, there are 158 trade agreements

Display 5

**Tariffs Have Fallen in Developing and Developed World**

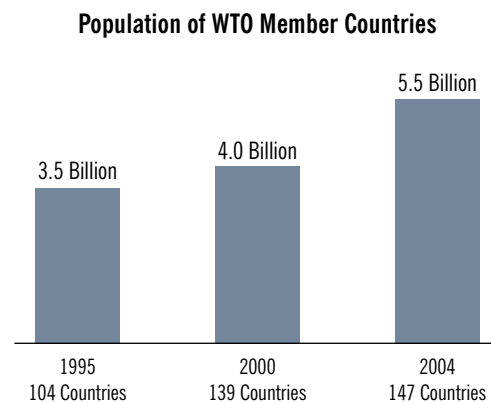
Source: University of Münster

in place today versus 50 in 1994, and the World Trade Organization (WTO) is making a forceful push to encourage multilateral, rather than regional, trade agreements. These changes are making managements feel increasingly comfortable about conducting business in a broader array of foreign countries. They also make it much more efficient to organize production through the market rather than within a particular firm.

*The pool of low-cost skilled and semiskilled labor available to private enterprise* has grown dramatically over the last 10 years as China, India and parts of Eastern Europe liberalized their economies and joined the WTO. Liberalization of these economies has made it easier for companies around the world to tap labor in these regions. In the past 10 years, countries with a combined population of more than two billion entered the WTO, increasing the labor pool within it by 65% (Display 6).

The desire to draw on this lower-cost skilled labor pool is triggering a systematic reorganization of service businesses, similar to the reorganization of manufacturing industries in the 1970s and 1980s. The vast market potential of these regions is also prompting companies in developed markets to expand their operations in developing markets. In 2003 China surpassed the US to become the country receiving the largest amount of foreign direct investment (FDI). We expect this trend to continue and intensify.

Display 6

**The Population Within the WTO Has Boomed**

Note: China joined in 2001.

Source: World Bank, WTO and Alliance Capital

**Outsourcing, Offshoring and De-verticalization**

Before we go further, let's clarify some terms that many people use interchangeably but that actually have different meanings.

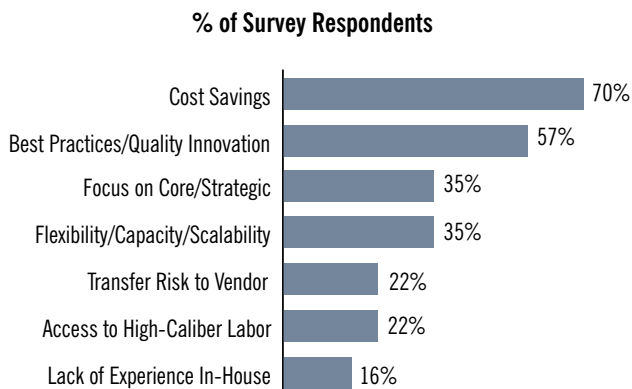
*Outsourcing* occurs when a company hires a third party to provide a good or service to its specifications, rather than performing the function in-house. The outsourced solution or service is typically provided on a retainer basis, with the buyer and seller agreeing in advance to specific terms and conditions. A manufacturing company, for example, can hire an information-technology firm to manage its customized corporate systems on site.

*Offshoring* occurs when a company moves some process overseas, usually to exploit a labor-rate or tax-rate arbitrage opportunity\* (or both). It describes *where* a function or service is performed, not *who* performs it: Either a third party or a foreign affiliate of the buyer could do the job. When a US or European company hires Infosys, an information-technology provider in Bangalore, India, to write code for a database application,

\*US multinational corporations increased profits taken in countries with no taxes or low rates by 68% to \$149 billion from 1999 to 2002, according to Commerce Department data. In the face of a difficult environment for pushing through price increases, multinational corporations have accelerated their effort to take advantage of tax-rate arbitrage in countries with rates below the statutory 35% bracket in the US. As long as these profits are not repatriated, they can be reinvested in the offshore business unit without having to pay tax on the differential between rates. This encourages investments in offshore capacity and, at the margin, stimulates incremental job growth in areas with favorable tax rates and/or labor rates. See article by David Cay Johnston in The New York Times, 9/13/2004, and Martin A. Sullivan's study in Tax Notes, [www.taxanalysts.com](http://www.taxanalysts.com) (2004).



Display 7

**Reasons for Outsourcing and De-verticalization**

Source: Deloitte Consulting Outsourcing Study 2004

it is offshoring. When Procter & Gamble has its Costa Rican affiliate process expense reports for the head office in Cincinnati, it is offshoring, too.

*De-verticalization* is the final disaggregation of the function or service so that it can be sold to multiple customers at a market price. This reduces the degree of customization offered in outsourced solutions, but enables the third-party provider to achieve significantly greater economies of scale, which usually reduces the cost to the customer as well. First Data, a leader in electronic-commerce solutions, was originally part of American Express: It provided back-office support for American Express' charge-card operations. Once separated from American Express, First Data became a key provider of transaction processing to the entire charge-card industry.

More often than not, companies initially outsource or offshore a function to improve their expense structure in the near term; improving quality is also a frequent consideration (*Display 7*). But once firms become comfortable separating a function and having it done either offshore or by a third party, they are more likely to go on to separate the function completely. In this sense, outsourcing and offshoring are leading indicators of de-verticalization.

In the late 1990s, for example, GE's wholly owned GE Capital unit established General Electric Capital International Services (GECIS). It provides various GE units worldwide with finance, accounting and other back- and middle-

office services that do not require face-to-face contact with the customer. The labor-rate arbitrage from offshoring, coupled with the economies of scale from centralization, saved GE about \$300 million per year. In 2004, however, GE realized that if it separated the business, it could sell its services to other companies as well, thereby achieving even greater economies of scale and potentially further lowering the cost of those services to the parent company. GE initiated this de-verticalization process by selling a 60% stake in GECIS to a group of private equity investors.

**Crunching the Numbers: The Risk/Reward Trade-Off**

It is our contention that ultimately, companies will have to assess every function they perform to determine whether the improved efficiencies of using a third-party supplier outweigh the interaction costs associated with it—or not. Furthermore, they will have to reevaluate their decisions periodically in light of changing interaction costs and the availability, skills and price of suppliers.

Various factors can enable or impede de-verticalization (*Display 8, next page*). Some, such as falling tariffs, are powerful enablers of de-verticalization in virtually all industries; the presence and importance of other factors vary widely from industry to industry. Standardization, for example, has been particularly instrumental in fostering de-verticalization in the technology industry; rigid labor-union contracts have been an impediment for the US auto industry.

The development of a supply chain is also a crucial factor: It is much easier to include partners in various stages of production if partners already exist. In many manufacturing industries, companies and investors now take for granted the availability of competent suppliers without necessarily appreciating how the development of that supply chain redefined their industry. In other industries—particularly service industries—supply chains are still primitive. The potential, however, is great.

The skill level of the suppliers is also critical. In the early stages of outsourcing or de-verticalization it is not uncommon for customers to be disappointed: Partners may promise too much and deliver too little, in terms of quality or timeliness. In time, however, due to their increased focus, supply-chain partners generally develop *superior* capabilities and cost structures.

Display 8

**Key Determinants of De-verticalization's Pace in an Industry**

Enablers	Impediments
<ul style="list-style-type: none"> <li>• Quality and low cost of communications</li> </ul>	<ul style="list-style-type: none"> <li>• Need for physical presence</li> </ul>
<ul style="list-style-type: none"> <li>• Falling tariffs and free trade</li> </ul>	<ul style="list-style-type: none"> <li>• Protectionism and subsidies</li> <li>• High degree of regulation</li> </ul>
<ul style="list-style-type: none"> <li>• Access to massive global pool of low-cost labor</li> </ul>	<ul style="list-style-type: none"> <li>• Unions/labor inflexibility</li> </ul>
<ul style="list-style-type: none"> <li>• Extensive outsourcing/offshoring</li> </ul>	
<ul style="list-style-type: none"> <li>• Standardization and commoditization</li> <li>• High degree of modularity in process or function</li> </ul>	<ul style="list-style-type: none"> <li>• Proprietary process or technology</li> </ul>
<ul style="list-style-type: none"> <li>• Capable supplier base</li> </ul>	<ul style="list-style-type: none"> <li>• Inadequate contract enforcement</li> <li>• Limited competition (monopoly or oligopoly structure)</li> </ul>
	<ul style="list-style-type: none"> <li>• Geopolitical risk</li> </ul>

Source: Alliance Capital

Indeed, once de-verticalization of an industry is well underway, the competitive pressure to follow suit can be intense. A firm that decides to stay vertically integrated rather than tap the expertise of suppliers must be best-in-class in all aspects of the value chain, or the difference between its internal capabilities and the best available in the marketplace must be less than the interaction costs related to procuring them from a third party. As interaction costs fall and the suppliers' skill base improves, this becomes an increasingly tall order.

For individual firms, other noneconomic factors may weigh heavily in the equation. Among these are hesitation to use partners that may become competitors, desire to protect trade secrets and practices, and other control issues that are sometimes hard to define and quantify. Although these risks and concerns may be well founded, we expect managements to learn over time to operate around these new risks in order to reap the benefits de-verticalization can bring. Frequently, they may not have a choice.

**What's Core?**

Some decisions on what processes to shed may be relatively easy, because the process is clearly extrinsic to the firm's core business. There is no particular reason why a manufacturer, a bank or a hospital should be in the food-preparation business. Thus, more and more companies hire food-service firms if they think it's important to have a cafeteria or dining room on the premises. Increasingly, many firms are also using suppliers for at least some of the less-sensitive aspects of human-resource management, such as processing expense reports, administering flexible spending and retirement-savings programs, and providing background and reference checks.

Other decisions may be—or seem—more difficult because they represent a more fundamental shift in business model. For decades, telephone-service companies made their own equipment, auto companies made their own parts, and most pharmaceutical companies did all of their own research, testing and marketing. In the last few decades, however, many vertically integrated companies have successfully redefined what's core to them. A few, such as Procter & Gamble, have systematically redefined their mission (*see box on facing page*).

In *Unbundling the Corporation*, business-strategy theorists John Hagel III and Marc Singer argue that most integrated companies perform at least three very different business functions: 1) product innovation, 2) infrastructure management and 3) customer management.<sup>6</sup> According to Hagel and Singer, the organizational requirements of each of these operations are distinct, making it difficult for a single company to organize each of them competitively in a world of low interaction costs. Thus, companies are likely to specialize to perform one of the above functions and rely on partners or suppliers to fulfill the others.

A *product-innovation* business—such as creating entertainment, inventing new technologies, designing more useful consumer products and discovering biological disease pathways—requires creativity as well as a deep understanding of the technical requirements and market opportunity for a particular product or service. Such businesses have to attract and retain talented, creative professionals; thus, they usually need to be based in geographically desirable areas. Product-innovation

businesses also need committed funding to see the development process to completion. Scale is usually *not* a critical factor.

An *infrastructure-management* business translates an idea into a product or service: It manufactures the goods or performs the service. These businesses typically either are labor-intensive or require large investments in fixed assets (or both). Thus, they need large-scale and high utilization rates to be economically successful. Because they typically entail managing high-volume, repetitive operations, these businesses are often located in regions with low labor costs, nonurban areas and places strategically close to a transportation hub. Examples of de-verticalized infrastructure-management businesses established in recent years include technology and textile manufacturers in Asia, database warehousing and stor-

age companies in India, and the UPS e-logistics “end-of-the-runway” supply-chain hub in Louisville, Kentucky.

A *customer-management* business performs sales, marketing and customer-service functions. Although the skills required to be successful in these tasks are distinct from the skills used in other business functions, companies today rarely use expert third parties to perform these duties. In other words, the important and complicated task of attracting, satisfying and retaining customers is currently duplicated with varying degrees of success in virtually every organization around the globe. Well-known and long-standing exceptions are auto dealers, travel agencies and retail brokerages. More recently, other forms of specialized distributors, such as mobile virtual-network operators (e.g., Virgin Mobile), have emerged. ■

## REDEFINING ITS MISSION: PROCTER & GAMBLE

Most companies have shed a few specific functions. Procter & Gamble has shed many. The consumer-products giant uses IBM to perform human-resource functions and La Salle to manage all of its properties around the world. Local manufacturing partners like Guangzhou Soap Factory in China make certain P&G products; P&G even partners with a few direct competitors that have a skill that would be difficult and expensive for P&G to replicate. For example, P&G licensed its Press N’ Seal technology to Clorox for use with its Glad products because Clorox had better manufacturing and branding capabilities in that particular household category.

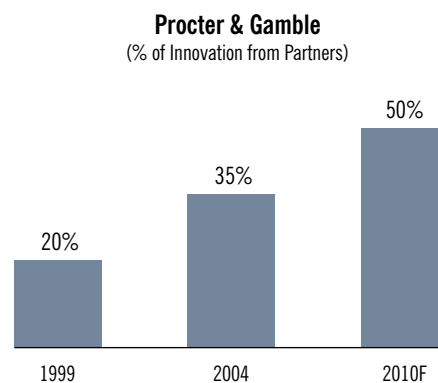
Among the more visionary aspects of P&G’s business model is its open-source approach to addressing research challenges. The company is reaching out to the broader scientific community to help it solve complex R&D questions and source new product innovations; it is also licensing more products from other companies. In effect, P&G has abandoned its former approach of relying exclusively on the research prowess of its own staff. In doing so, it has thereby greatly

expanded the number of new products in its pipeline and its probability of success. P&G’s goal is to have 50% of new innovation come from partners by 2010 compared to 35% today and 20% in 1999 (*Display 9*).

Recognizing that its greatest strength is in marketing and distribution, P&G’s mantra has become “Branding Innovation,” even the innovations of others. ■

Display 9

### P&G Brands Innovation—Even Innovations of Others



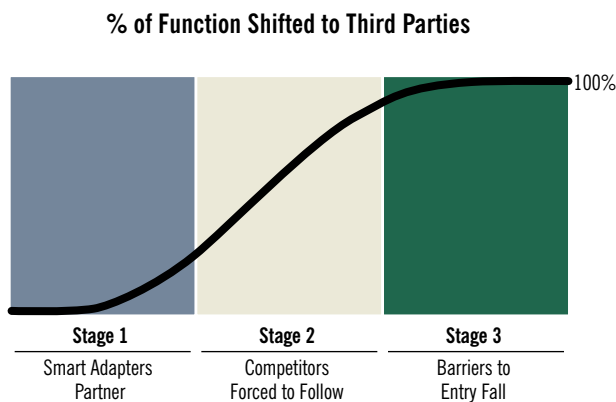
Source: Company reports

## THE DE-VERTICALIZATION PROCESS

As de-verticalization unfolds in an industry, the competitive dynamics change, with significant implications for investors. Our paradigm for these changing dynamics includes five categories of companies, or players, that have different competitive positions in each of three stages of the de-verticalization of a particular function.

Our de-verticalization curve presents this process schematically, with time represented along the x axis and the percent of a function or service performed by third parties along the y axis (*Display 10*). Of course, no two industries are exactly alike, so their de-verticalization processes will not be exactly alike, either.

Display 10  
How De-verticalization Unfolds



Source: Alliance Capital

### The Players

There are five categories of companies that participate in the de-verticalization process.

**Smart adapters** are companies that recognize an opportunity to use a third-party supplier to gain an advantage over their competitors.

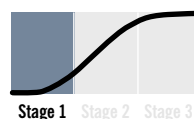
**Fulfillment partners** are the third-party providers the smart adapters use. They tend to be narrowly focused on one or a few related functions.

**Orchestrators** are a special type of fulfillment partner: They coordinate and direct other fulfillment partners, usually in highly fragmented industries.

**New niche competitors** are companies that take advantage of the supply chain developed by the smart adapter and its established rivals. Typically, these companies focus on one part of the value-creation process and use supply partners for everything else.

**Laggards** are companies that are slow to change their business practices and fall behind their more nimble competitors.

### The Stages of De-verticalization



In Stage 1 of the de-verticalization process, smart adapters begin to use third-party suppliers to gain a competitive advantage in cost, quality or some other differentiating feature. Whatever the advantage, the smart adapter has the opportunity to gain market share by selling a better product or service or by selling the same product or service at a lower price.

Smart adapters may eventually also reap other advantages. Relying on third parties to perform noncore functions may allow management to devote more time and resources to the functions they retain (presumably their core competencies). They may also be able to get to market faster than competitors with innovations or new products by capitalizing on new technologies and process improvements employed by their more focused supply partners.

Smart adapters can be new entrants like Dell with an extraordinary vision (*see box on facing page*) or incumbents like Procter & Gamble with the foresight to get ahead of competitors.

Vertically integrated rivals in the same industry do not reap these advantages and often start to lose share. As a result, most rivals are forced in time to copy the smart adapters. Those that resist tend to lose their leadership, at least in certain categories.

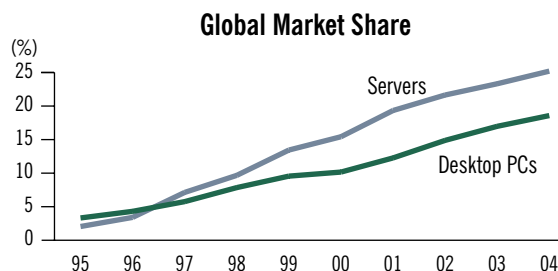
## DELL: THE CLASSIC SMART ADAPTER

Computer companies once did all their own design, manufacturing and distribution, thereby creating production and inventory-channel inefficiencies. However, with PC components standardizing and the industry segmenting into specialized suppliers of various components (chips, software, memory, modems, etc.), a visionary named Michael Dell recognized that he could add value to the consumer through increased customization and reduce the cost of the product through supply-chain efficiencies *without sacrificing quality or economies of scale.*

In 1988, Dell pioneered the direct “build-to-order” model.<sup>7</sup> The company relied on best-in-class independent suppliers of the various discrete components of the PC and assembled them in Dell facilities to satisfy individual customer requirements. It bypassed the third-party distribution network, which typically held products for four to six weeks. Instead, Dell used premier shippers such as FedEx to deliver products directly to the consumer. Having less inventory in the distribution channel is a meaningful competitive advantage in an industry characterized by rapidly declining prices.

As a result of increased customization and lower prices, Dell garnered a significant competitive advantage and experienced rapid revenue growth and market-share

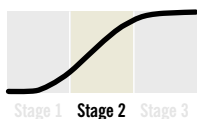
Display 11  
Dell Gained Share as PC Industry De-verticalized



Source: International Data Corporation and company reports

gains. Dell’s global share of desktop computers grew to 18.6% in 2004 from 3.3% in 1995 (*Display 11*), yet it maintained strong gross margins and significantly reduced working capital requirements. Over time, Dell’s more efficient and value-added production model forced competitors to either copy its practices or leave the business. IBM, the one-time market leader, opted for the latter: It sold its PC division to China’s Lenovo just a few months ago.

Dell has successfully applied the same strategy to network servers, increasing its share to 25.2% in 2004 from 2% in 1995. It continues to apply this model today to new markets, such as laser printers and consumer electronics. ■



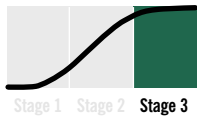
In Stage 2, other industry participants begin to follow the business practices of the smart adapters. Thus, the fulfillment partners rapidly increase revenues and market share, and their skills and efficiencies rapidly improve. In accordance with Say’s Law,<sup>8</sup> supply creates its own demand in a virtuous cycle. As more companies within a segment use fulfillment partners, the partners’ economies of scale and skill increase, ratcheting up the pressure on other industry participants to use them, too. This is the period when fulfillment partners often become terrific investment opportunities (*see box on Taiwan Semiconductor on page 12*).

As the trend develops, more fulfillment partners emerge to seize the new business opportunity. Competition

among fulfillment partners forces them to improve their skills even further; often, they become more skilled in their own domain than integrated players. Eventually, however, competition also tends to force down prices and lead to abundant capacity. Therefore, once the majority of the industry adopts a de-verticalized operating model, pricing often falls to commodity-like levels. At this point, fulfillment partners may no longer be compelling growth investments.

To offset or partially offset commoditization at the end of Stage 2, fulfillment partners often try to protect their margins and customer relationships by assuming additional value-added responsibilities that command higher margins. Similarly, smart adapters often seek to find a new edge by de-verticalizing other business processes.





In Stage 3, the de-verticalization of the function is largely complete. At this point, an industry of vertically integrated companies with parallel

functions has been disaggregated: Highly skilled specialists now sell products or services at “arm’s-length” or market-based prices to many industry participants.

At this juncture, new niche competitors enter the fray, capitalizing on the availability of a low-cost and highly skilled supplier base. Niche competitors differ from smart adapters because they don’t instigate the industry transition; they take advantage of it. By developing a supplier base, the smart adapters—and their followers—lowered the barriers of entry for these new competitors.

In the semiconductor industry, the existence of pure-play manufacturing companies allowed pure-play design firms to emerge. In the networking-equipment industry, contract manufacturers first stimulated by Cisco Systems and other smart adapters made it significantly easier for former Cisco programmers to establish a highly focused Internet-router company called Juniper Networks (*see box below*). Many other niche businesses in other industries were able to enter a market quickly because of the existence of well-established supplier bases (*Display 12*).

Display 12

**For Every New Niche Competitor, Key Fulfillment Partners**

New Niche Competitor	Fulfillment Partners
Juniper Networks	Plexus, Celestica
QUALCOMM	IBM, TSMC, Amkor
Broadcom	Magna Design, Chartered Semiconductor
Chery Automobile	Pininfarina, Visionary Vehicles
American Eagle Outfitters	Li & Fung, UPS
Vonage	Cisco Systems, Comp USA, cable and telecom carriers
Virgin Mobile	Sendo, Sprint PCS
e-tailers: Williams-Sonoma, Harry and David, L.L. Bean, GAP	Amazon, GSI Commerce, IBM
Biotechnology and specialty pharmaceuticals: Genzyme, Amylyn, Sepracor, Forest Laboratories	Covance, Thermo Electron, Ventiv
Hedge funds	Goldman Sachs, Morgan Stanley

Source: Alliance Capital

**JUNIPER NETWORKS: NEW NICHE COMPETITOR RAPIDLY GAINING SHARE**

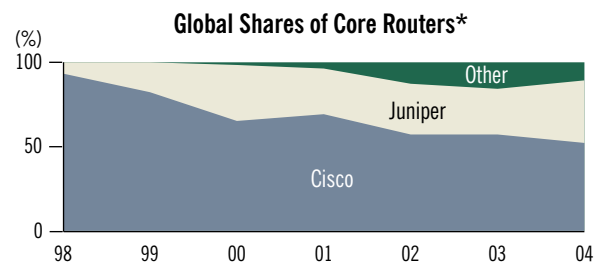
De-verticalization of the telecom-equipment industry allowed Juniper, a leader in Internet Protocol routers, to compete effectively with established network equipment companies, most notably Cisco Systems. In just eight years since its founding, Juniper has gained 37%<sup>9</sup> share of the worldwide market for core routers sold to service providers (*Display 13*). The company now garners \$2 billion in annual revenues from customers in 75 countries, yet carries no inventory and very little plant and equipment on its books.

Juniper has been able to catapult itself into this position as a leading vendor of critical network equipment by relying on a sophisticated supplier base of application-specific integrated circuit (ASIC) producers and contract manufacturers with expertise in manufacturing,

inventory management, testing, quality control and logistics. The existence of this supplier base significantly reduced Juniper’s time to market and played a critical role in the successful execution of its business plan. ■

Display 13

**Juniper Networks Rapidly Took Share from Cisco**



\*For telecom-service providers; excludes enterprise systems  
Source: Gartner

Also in Stage 3, the laggards, companies that have not adjusted successfully to the new environment, find themselves in a precarious position. Some may decide to protect parts of their business by belatedly following the industry trend: In telecom equipment, for example, Lucent, Tellabs, Nortel and Alcatel have all shed internal manufacturing facilities and now use contract manufacturers.

Other laggards decide to refocus. Most famously, in the 1990s IBM found itself unable to compete with more nimble, less vertically integrated competitors in certain product areas. Facing heavy losses, IBM decided to capitalize on its strong brand and relationships with customers and refocused the company on selling technology-related services. Services account for 48% of revenues today, compared to 15% in 1994.

Unfortunately, it isn't always possible to shift focus. Sometimes, company-specific impediments—from man-

agement reluctance to cede control of certain functions to rigid labor contracts or local law—may create insurmountable exit barriers. In such cases, the laggards are likely to lose market share, perhaps downsizing painfully.



Orchestrators can enter the de-verticalization process at any stage, assuming different roles at different times. As a specialized form of fulfillment partner, they help their customers to achieve the benefits of de-verticalization by brokering arrangements with various fulfillment partners (*see box below*). These value-added service providers are most needed in complex, fragmented industries, where they can organize a disparate supply chain to meet a smart adapter's or niche competitor's dynamic needs. Consolidation of the industry they serve, however, may displace them in the longer term. ■

## LI & FUNG: THE QUINTESSENTIAL ORCHESTRATOR

Li & Fung, a 100-year-old Hong Kong trading company, now manages a global network of 65 offices in 38 countries, fulfilling a vital role in the apparel, hard goods and toy industries (*Display 14*). It provides customized supply-chain management services, linking retailers and manufacturers with its internally vetted global network of suppliers. It ensures its customers receive competitive pricing for quality goods on a timely basis.

Li & Fung works closely with customers to understand their needs for specific supplies and services. By deploying small teams on each account, Li & Fung effectively has become the product-development, procurement and logistics arm for a wide variety of retail chains, replacing the internal teams at Abercrombie & Fitch, American Eagle Outfitters, The Limited, Sainsbury's and Kohl's. It acts as their agents in production, and by performing the function for multiple customers, it gives each more purchasing power than they would have working on their own.

Li & Fung also provides invaluable market access for its manufacturing partners, connecting them with order flow that they might not get working on their

own, while reducing their need to fund sales and marketing functions.

Li & Fung carries almost no inventory on its books and has been able to expand its scale with few production assets. Its revenues nearly doubled from \$3.2 billion in 2000 to \$6 billion in 2004; the company expects revenues to reach \$10 billion by 2007. We estimate that by 2010, Li & Fung's US soft-goods revenue may reach 6.3% of total US soft goods imports, up from 3.8% today. ■

Display 14

### Li & Fung: Unknown Orchestrator of Famous Brands



Source: Li & Fung

## TAIWAN SEMICONDUCTOR: FULFILLMENT PARTNER TRANSFORMS ITS INDUSTRY

Twenty years ago, the semiconductor industry was completely vertically integrated: Firms like Intel, Philips, Texas Instruments and Infineon performed their own research, design and development, testing, manufacturing, and sales. The need for expertise and for funding large-scale activities in each of these areas was a formidable barrier to entry in the industry. Just building a manufacturing facility costs \$2 billion to \$3 billion in capital today and requires orders for more than 20,000 wafer starts per month to reach optimal utilization. Moreover, continual investment is required to prevent rapid obsolescence.

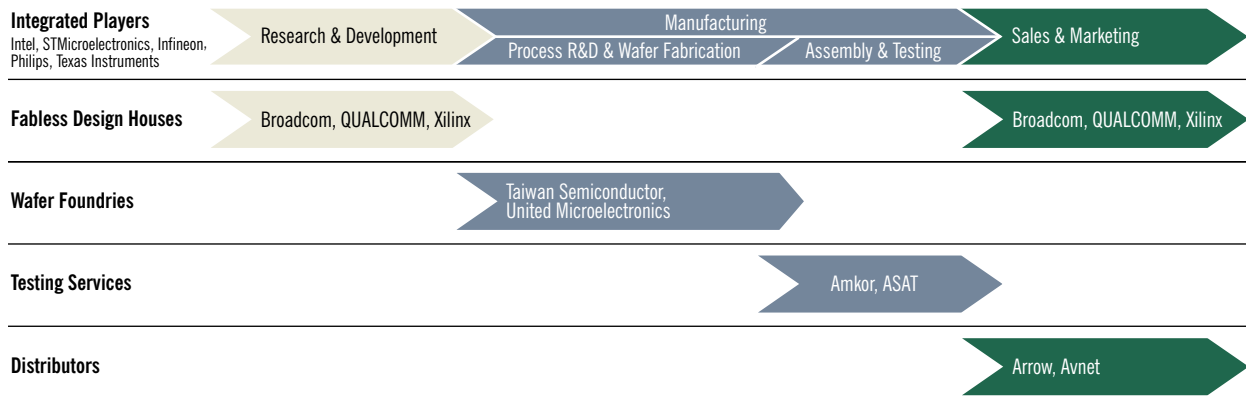
The founding of Taiwan Semiconductor Manufacturing in 1987 changed all that. Taiwan Semi manufactures chips that others design. By focusing only on manufacturing, Taiwan Semi (and other pure-play manufacturers that followed suit) quickly became very efficient. It employed the latest technology

and best-in-class processes and thus garnered a significant cost advantage over smaller integrated companies that could not afford that investment. Eventually, Taiwan Semi gained economies of scale even relative to the bigger integrated semiconductor firms because it had many customers and could spread its fixed investment over a greater volume. Its search for efficiency did not compromise quality: Taiwan Semi’s chips are best in class.

The existence of these specialized semiconductor manufacturers made it possible for pure-play semiconductor design companies to enter the fray. Companies like QUALCOMM and Broadcom could now compete with Intel and Texas Instruments, without having the scale or the capital needed to build their own manufacturing facilities. And they could do so quickly: Not having to raise capital or build a plant sped up the time to market of their designs.

Display 15

### In Semiconductor Industry, De-verticalization Is Very Advanced



Source: Bernstein



Today, there are specialists competing at each stage of the value-creation process (*Display 15*): Taiwan Semiconductor Manufacturing and United Microelectronics just do manufacturing. QUALCOMM and Broadcom just do design, testing and marketing. Arrow and Avnet handle distribution. New entrants no longer need expertise or scale in all areas; they can enter just one. As a result, start-up costs are significantly lower and time to market much more rapid.

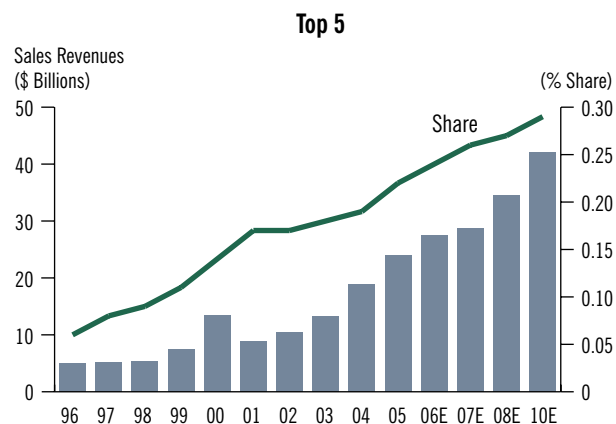
As the barriers to entry fell, overall revenues for the pure-play semiconductor manufacturers as a group grew at an 18% rate (*Display 16*), more than five times the overall industry growth rate of 3.4%, as

many of the vertically integrated industry participants moved toward the “fabless” (fabrication-less) model, exiting the manufacturing part of their business to focus on design and testing.

Specialized semiconductor companies’ greater focus and agility also translated into superior return on equity and stock returns. Shares of Taiwan Semiconductor, a pure-play manufacturer, compounded at 22% a year between 1996 and 2004, compared to 7% for the Philadelphia Semiconductor Index and 4% for Intel. Similarly, shares in the pure-play semiconductor design companies delivered compound annual returns of 17%\* over the same period. ■

Display 16

### Pure-Play Semiconductor Manufacturers Are Growing Fast



Source: Gartner and AllianceBernstein

\*Average of the compound average growth rate for share prices of QUALCOMM, Altera, Xilinx, Broadcom, Nvidia, Marvell and Silicon Laboratories

## ECONOMIC AND INVESTMENT IMPLICATIONS

We see three principal macroeconomic implications of de-verticalization: It accelerates growth in global trade, prompts job creation in emerging markets and increases global productivity.

### Increasing Global Trade

Offshoring and de-verticalization have contributed to the massive growth in trade over the past 20 years (*Display 17*)—and are likely to continue to speed its pace. This is a natural outcome as companies begin to include partners, potentially located in other countries, into the value-creation process.

Further, in recent years, trade in components has outpaced trade in finished goods. Building on a study conducted by the World Bank in the late 1990s<sup>10</sup> using WTO data, we estimate that global trade in components rose from \$1 trillion, or 33% of global trade, in 1980 to \$5.4 trillion, or 38% of global trade, in 2003.

Of course, trade statistics are at best a rough, but revealing, proxy of de-verticalization's progress: They don't distinguish offshoring from outsourcing and de-verticalization, and they don't capture either outsourcing or de-verticalization at all if the function doesn't move offshore.

### Job Creation in Emerging Markets

Offshoring, by definition, means using overseas labor, usually in emerging markets with lower labor costs. De-verticalization furthers this trend because many of the new fulfillment partners—for both manufacturing and services—are located in emerging markets. The McKinsey Global Institute estimates that jobs related to offshore services will grow from their admittedly low base at a 30% compound annual rate between 2003 and 2006.<sup>11</sup>

India, in particular, has been rapidly increasing its capabilities in the pharmaceutical arena. It currently has more facilities approved by the US Food and Drug Administration than any country other than the US and is rapidly becoming one of the more important global production centers, particularly for generic drugs. Pharmaceutical companies are also using global contract research organizations (CROs) with operations in India for testing and clinical trials and are partnering with India-based firms for drug discovery.

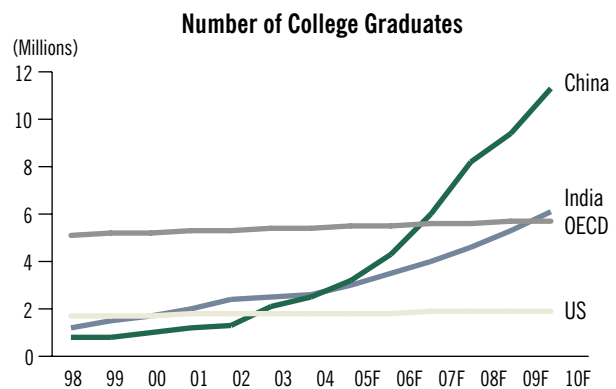
India, China and Eastern Europe have all gained a comparative advantage in providing fulfillment services from their large and rapidly growing number of college graduates hungry for jobs and willing to work long hours at relatively low wages. On average, wages in these regions are one-tenth the wages for equivalent jobs in developed countries. Furthermore, the number of college graduates in India, China and Eastern Europe is growing at 5% per year, versus 1% in developed markets.

Display 17  
**Trade Volumes Have Soared**



Source: International Monetary Fund (IMF)

Display 18  
**India and China: Global Suppliers of Educated Labor**



Source: China Statistical Yearbook, OECD, Government of India, US National Science Foundation and Alliance Capital

Statistics on the supply of educated labor in the developing world are staggering: More than half of India's one billion people are under age 25, and its universities produce 2.5 million graduates annually, compared to 1.7 million in the US and 5 million in all OECD countries combined (*Display 18*).<sup>12</sup> Furthermore, 40% of Indian college graduates have degrees in science and engineering, compared to less than 10% in the US.

China produces around two million college graduates annually, but is set to outstrip India soon. The current student population on campus is estimated to be more than 20 million<sup>13</sup> and China's State Development Planning Commission plans to recruit 4.75 million college students in 2005.<sup>14</sup> By 2010, the number of students graduating from college is likely to reach above 11 million a year. In addition, approximately half of all undergraduates take entrance exams for postgraduate study, suggesting the potential for a vast increase in technical talent by 2015.

Given this supply differential, the labor-rate arbitrage between developed and emerging markets will not close anytime soon. Although wage inflation in the mid-teens is now the norm for midlevel positions in some urban regions, such as Shanghai, China, and Bangalore and Chennai, India, abundant supply is keeping wages down in others. Some Indian information-technology companies have recently said that they are seeing *deflation* in entry-level salaries. There are also dozens of tier-two cities with populations of more than one million that are only now emerging as attractive locations for fulfillment partners; thus, job growth in emerging markets is likely to occur for a very long period of time.

In addition to a competent, economical and eager workforce, other factors are also important in determining where jobs are created. Indian companies have been successful in service businesses such as programming and pharmaceutical research and testing in part because virtually all educated Indians speak English. India's well-developed communications infrastructure, cultural and business skills, and rule of law are also powerful benefits. To (somewhat) level the playing field with India, the Chinese government has made English a mandatory part of its national education curriculum and increased

its emphasis on higher education and on enforcing intellectual property laws. China has an advantage versus India, however, in terms of physical infrastructure, such as developed roads, airports and utilities.

India's and China's research and development businesses have also benefited from the repatriation of seasoned professionals who have spent most of their careers in the West but now see favorable opportunities in their native countries.

Of course, not all fulfillment partners are located in the developing world. In some manufacturing industries, suppliers have increased their expertise so much that their complex manufacturing capabilities have become competitive differentiators. If the industry is not highly labor-intensive, and if there are particularly strong benefits in that industry of being close to customers and other suppliers, manufacturing partners may emerge and flourish in developed markets.

One example is Magna Steyr, an engineering and vehicle assembly firm that operates a flexible manufacturing facility in relatively high-wage Austria. Magna produces low-volume vehicles for DaimlerChrysler, BMW and GM more efficiently and cost-effectively than any one of them could on its own.

### **Enhancing Global Productivity**

By fostering some migration of jobs to the emerging world, de-verticalization has been painful for many individuals and communities in the developed world; it may also be partially responsible for the slower-than-expected aggregate job growth in the US and Europe in recent years.

Nonetheless, de-verticalization is largely positive for the developed world. By reducing redundancy and increasing efficiency, de-verticalization frees up resources to be deployed to fund new innovations, devise more effective branding strategies and add value to products and services in other ways. On balance, firms are able to do more with less, which increases productivity—and thus aggregate wealth. Improved productivity is always enormously beneficial for global economic growth and prosperity.

De-verticalization is also likely to lead to greater macroeconomic stability in developed economies. When companies de-verticalize manufacturing and/or services, they tend to shift inventory accumulation, extra capacity and fixed-asset investment to their fulfillment partners, which then bear the brunt of cyclical downturns. To the extent that fulfillment operations continue to shift to lower-wage, emerging markets, developed markets should become more stable.

Reduced macroeconomic volatility in developed markets should encourage more entrepreneurial risk taking and credit expansion, which, if not excessive, are also positive influences on economic and employment growth.

### Microeconomic and Investment Implications

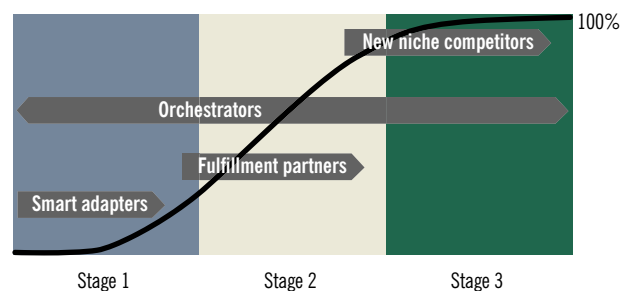
We have demonstrated several microeconomic implications of de-verticalization: Organizational structures change, and value chains become more expansive and capable. Company managements need to continually reexamine their positions within the de-verticalization process in their industries and streamline operations and business strategies accordingly.

In both manufacturing and service industries, many companies will rely more heavily on best-in-class partners and learn how to relinquish control of processes prudently and manage new business risks. Many businesses in the developed markets will take the form of so-called platform companies that organize and execute ideas and products made by a chain of qualified fulfillment partners. Almost across the board, barriers to entry will fall, increasing competition. Managements must be prepared to meet these challenges.

The investment implications of de-verticalization are also clear: Understanding where an industry lies on the de-verticalization curve and a particular company's position within it are vital to investment success.

Display 19

### Timing Is Key as Industries De-verticalize



Source: Alliance Capital

In Stage 1, smart adapters are the companies with the competitive advantage (*Display 19*). It is typically here that underappreciated opportunities lie. The corollary, of course, is to avoid those competitors that are hurt by the smart adapters' market share gains.

But it is important not to stay with Stage 1 winners for too long. Competitors will mimic their strategies, reducing their competitive edge. Thus, in most of Stage 2, fulfillment partners offer the greatest growth potential. By the end of Stage 2, however, the fulfillment partners' success attracts too much competition, and excess capacity erodes margins.

By Stage 3, the best growth opportunities frequently lie with new niche competitors that emerge to take advantage of the large supply of low-cost but highly skilled fulfillment partners.

Throughout the process, however, orchestrators can be good investments. The risk is that fulfillment partners may encroach on their business as fragmented industries consolidate.

In short, timing is crucial to investment success as the de-verticalization process unfolds. ■

## ADDENDUM: PHARMACEUTICAL INDUSTRY ON THE CUSP

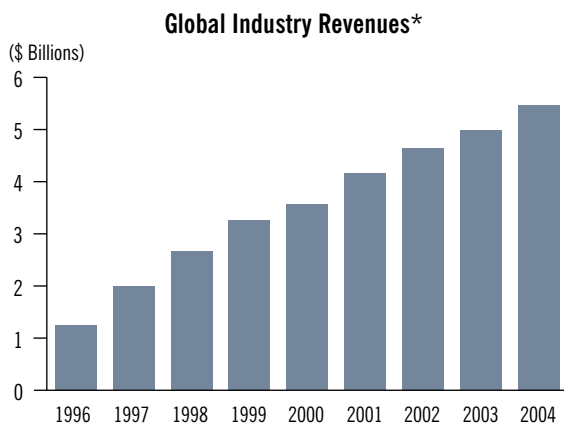
To date, de-verticalization has primarily been a phenomenon of the manufacturing sectors under the greatest competitive pressures. Recently, it has also begun to unfold in service sectors, including information-technology services and business-process outsourcing services, such as human-resources functions. Of late, it has even begun to permeate industries formerly considered immune to such trends. In particular, the pharmaceutical industry has slowly and quietly begun to de-verticalize, as sustained periods of strong profitability have drawn to a close.

There is significant scope for this transformation to improve processes and increase productivity in the pharmaceutical industry. This is one industry to watch: We offer a brief overview of the process underway so far.

Pharmaceutical companies have come under severe pressure in recent years, after decades of strong profitability derived from a host of new therapies and the shift from hospital-based care to drug treatment. Lack of research success in identifying new molecules; rising research, development and testing costs; and pricing pressures from regulators have made it imperative for drug companies to restrain the growing cost of bringing a drug to market, now estimated at about \$800 million on average for a branded product.

Display 20

### Revenues for Contract Research Organizations Have Surged



\*Includes Quintiles, Covance, Charles River Labs, PPD & Parexel International  
Source: Company reports and Alliance Capital

Consequently, many management teams are reviewing their value chain from top to bottom. Unlike in prior cost-cutting efforts, Pfizer CEO Hank McKinnell recently told analysts, no “sacred cows” will be spared as Pfizer seeks to slash \$4 billion in annual costs by 2008.

While limited in scope, the steps toward de-verticalization of the pharmaceuticals industry taken to date touch almost every step in the value chain, from basic research to development, testing, manufacturing, wholesaling, logistics, sales and marketing.

Increasingly, companies have moved internal research and development efforts and manufacturing to low-wage regions, particularly India, and they are beginning to use fulfillment partners more effectively as well. In particular, third-party CROs have increased their revenues rapidly over the past several years (*Display 20*), as they have demonstrated their efficient management of costly global testing and development networks. For example, Covance, a leading CRO, is able to estimate project feasibility and monitoring parameters for prospective customers based on trials it has run for other customers. In 2004, it provided a prospect with a quantitative analysis showing that the prospect’s rheumatoid arthritis trial could be conducted more quickly and at lower cost in Poland than in France or Germany.

In addition, many firms are moving away from relying purely on their own basic research to the branding-innovation approach that Procter & Gamble has taken in consumer products. Some 10% to 40% of the drugs in the current pipeline at the big pharmaceutical firms were licensed from other firms (*Display 21, next page*).

A 2004 McKinsey study has found that licensing is both cheaper and more successful. The average present-value cost of a licensed preclinical compound is about two-thirds of the cost of an internally developed compound. And licensed compounds have significantly higher survival rates in Phase II and III trials.<sup>15</sup>

The industry has also begun to tackle the unsustainable redundancy created over the past 10 years as the major players increased their vertically integrated sales forces:

Display 21

**US Drugmakers Fill Pipelines with Other Firms' Innovations**

	Number of Drugs in Pipeline			% In-licensed
	In-licensed	Internally Developed	Total	
Pfizer	9	13	22	41%
Bristol-Myers Squibb	6	10	16	38%
Merck	4	10	14	29%
Schering-Plough	2	9	11	18%
Eli Lilly	3	16	19	16%
Wyeth	5	39	44	11%

Source: UBS and Alliance Capital

The total number of sales representatives more than doubled, while global launches of new molecules fell by half.<sup>16</sup> Recently, Bristol-Myers Squibb has teamed up with Merck to market Muraglitazar and other follow-on compounds within its diabetes franchise, and Roche has begun to use the Glaxo sales force to help it detail Boniva, its new osteoporosis product. We expect to see more such partnerships in the future.

The industry's gradual embrace of the partnership model has already begun to lower barriers to entry in the industry. Specialty pharmaceutical firms and niche players focused only on development are beginning to license compounds and use CROs and contract sales partners in order to compete successfully with the vertically integrated giants of the industry.

We expect many more specialized companies to emerge and work in conjunction with experts in other functions throughout the various links in the value chain. The vertically integrated firms will need to choose carefully which functions they retain and which they purchase from third-party partners. Perhaps some day, Pfizer, like P&G, will decide that its core competency is branding and distribution rather than innovation! The only certainty is that the transition will create many investment opportunities. ■

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## End Notes

<sup>1</sup> <http://www.just-auto.com/proactive/pdf/lotus-newsletter-issue-6.pdf>

<sup>2</sup> [http://vvcars.com/release\\_042905.html](http://vvcars.com/release_042905.html)

<sup>3</sup> [http://www.greencarcongress.com/2005/01/bricklin\\_in\\_maj.html](http://www.greencarcongress.com/2005/01/bricklin_in_maj.html)

<sup>4</sup> [http://www.bain.com/management\\_tools/tools\\_outsourcing.asp?groupCode=2](http://www.bain.com/management_tools/tools_outsourcing.asp?groupCode=2)

<sup>5</sup> "The Nature of the Firm," R.H. Coase (1937)

<sup>6</sup> "Unbundling the Corporation," John Hagel III and Marc Singer, *Harvard Business Review*, March-April 1999

<sup>7</sup> *Direct from Dell*, Michael Dell with Catherine Fredman (1999), p. 21

<sup>8</sup> *Treatise on Political Economy*, Jean-Baptiste Say (1803), pp. 138-9

<sup>9</sup> Gartner estimate 4Q04

<sup>10</sup> *Just How Big Is Global Production Sharing?*, Alexander J. Yeats, *Development Research Group*, World Bank (1998), p. 38

<sup>11</sup> [http://www.mckinsey.com/mgi/reports/pdfs/emerginggloballabormarket/MGI\\_introduction\\_offshoring.pdf](http://www.mckinsey.com/mgi/reports/pdfs/emerginggloballabormarket/MGI_introduction_offshoring.pdf) (p. 9)

<sup>12</sup> *OECD. Mobilizing Human Resources for Innovation*, p. 19

<sup>13</sup> *China Education and Resource Network*, <http://www.edu.cn/20050128/3128068.shtml>

<sup>14</sup> *Ibid*

<sup>15</sup> "Improving the Pharma Research Pipeline," *The McKinsey Quarterly*, August 2004, <http://www.mckinseyquarterly.com/PDFDownload.aspx?L2=12&L3=62&ar=1479>

<sup>16</sup> *IMS Health Estimates*, [http://www.corporate-ir.net/media\\_files/nys/rx/London\\_ID\\_2004\\_Oct14.pdf](http://www.corporate-ir.net/media_files/nys/rx/London_ID_2004_Oct14.pdf)

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