

services in the United States at 8% of annual gross domestic product. That means American businesses and consumers spend approximately \$1 trillion every year on assets they already own. It also means that the U.S. aftermarket is bigger than all but the world's eight largest economies. No wonder executives at the Wharton-Stanford Service Supply Chain Thought Leaders Forum in October 2004 said that their firms generate between 29% and 50% of their revenues by servicing products.

After-sales services are a high-margin business, and they account for a large chunk of corporate profits. According to a 1999 AMR Research report, businesses earn 45% of gross profits from the aftermarket, although it accounts for only 24% of revenues. An Accenture study, for instance, reveals that GM earned relatively more profits from \$9 billion in after-sales revenues in 2001 than it did from \$150 billion of income from car sales. Wall Street tracks companies' aftermarket prowess, and studies show that there's a direct correlation between stock prices and the quality of firms' after-sales services. Corporations such as ABB, Caterpillar, GE, and Saturn have won customers' undying loyalty by providing top after-sales services. In fact, one number that tells a company how loyal its customers are likely to be is how high they rate the firm's after-sales services.

Despite the aftermarket's obvious charms, however, most organizations squander its potential. They perceive after-sales services to be a necessary evil and behave as though big business-to-business service contracts, small business-to-consumer warranties, and everything in between were—like taxes—a needless expense. That's mainly because after-sales support is notoriously difficult to manage, and only companies that provide services efficiently can make money from them. It's shocking

to see how poorly large companies manage service networks, which the production and sales functions treat as stepchildren. Some years ago when we studied the after-sales network of one of America's biggest automobile manufacturers, we found little coordination between the company's spare-parts warehouses and its dealers. Roughly 50% of consumers with problems faced unnecessary delays in getting vehicles repaired because dealers didn't have the right parts to fix them.

Although original equipment manufacturers (OEMs) carry, on average, 10% of annual sales as spares, most don't get the best out of those assets. People and facilities are often idle, inventory turns

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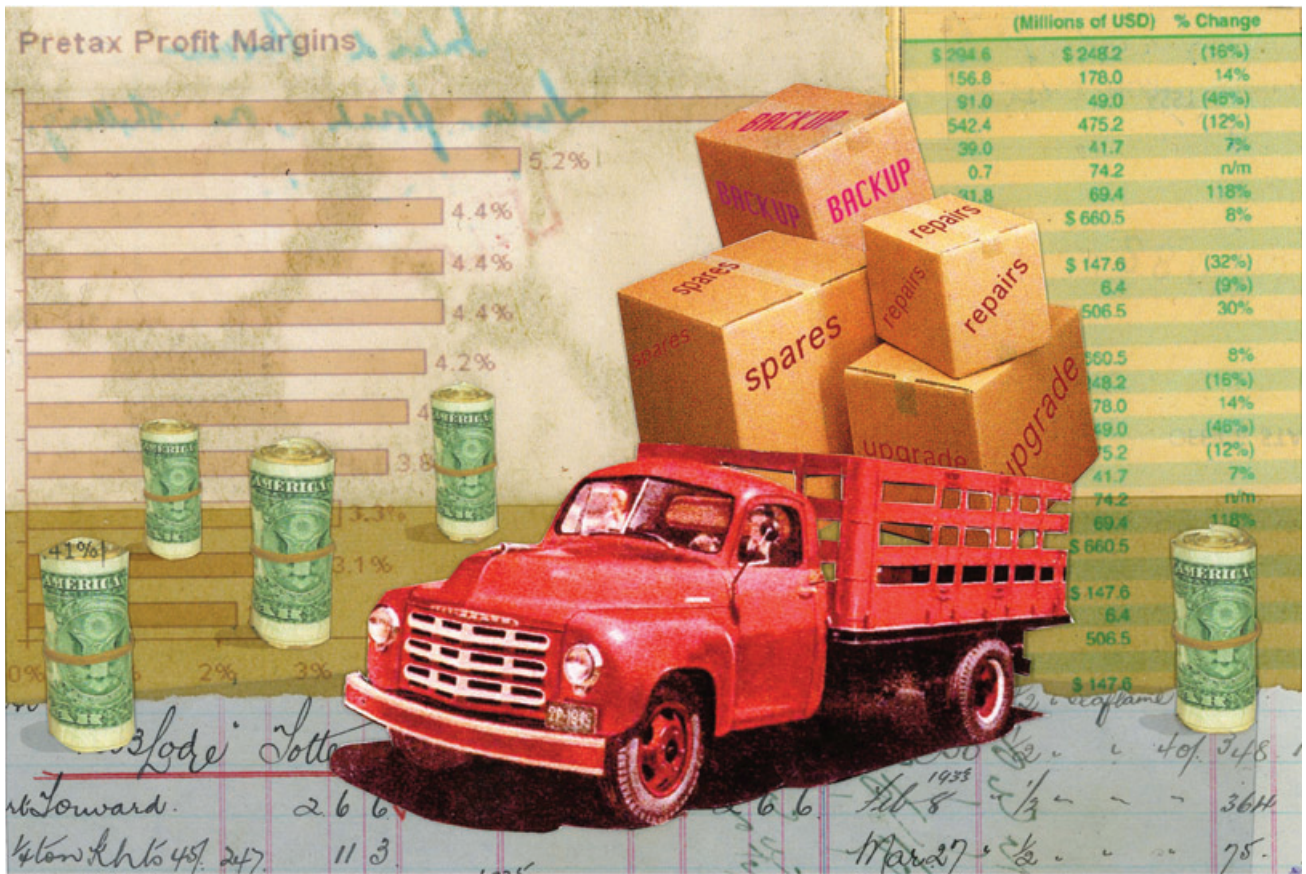
of just one to two times annually are common, and a whopping 23% of parts become obsolete every year. Some OEMs are content to let independent service providers cater to customers. Indeed, third-party vendors have become so price competitive that OEMs lose most of the aftermarket the moment the initial warranty period ends.

Customers don't expect products to be perfect, but they do expect manufacturers to fix things quickly when they break down. Not surprisingly, customers are usually unhappy with the quality of after-sales support. In 1997, when we conducted the first ever study on the links between after-sales services and customer satisfaction, we found that satisfaction levels were between 10% and 15% below customers' expectations. The divergence would probably be higher

today, since customer expectations have shot up over the years. In the 1980s, for instance, semiconductor manufacturers were content with a two-day response time if equipment failed; today, they expect suppliers to respond to requests for help within 15 minutes. In fact, some newcomers have even managed to topple incumbents by providing better after-sales services. In the automobile industry, for example, there's a distinct correlation between the quality of after-sales service and customer intent to repurchase. Brands like Lexus and Saturn inspire repeat purchases by providing superior service, and, consequently, they have overtaken well-established rivals like Ford and Chrysler.

Companies can benefit in several strategic ways by focusing on after-sales services. Providing support generates a low-risk revenue stream over a long period of time. Aircraft manufacturers, for instance, can reap additional revenues for as long as 25 years after a sale. The longer the life of the asset, the more opportunities companies will find down the line. Also, increasing sales of parts and service-related products costs businesses far less than finding new customers, though they can successfully cross sell and up sell only if the support they offer satisfies existing customers. After-sales services can be a source of differentiation as well. Companies' use of contract manufacturers and the development of global manufacturing standards have led to the homogenization of products. Being on par with your rivals in performance, price, and quality gets you into the game; after-sales services can win you the game. Finally, when businesses provide aftermarket support, they gain a deep understanding of customers' technologies, processes, and plans—knowledge that rivals can't easily acquire. That provides companies with an unlikely, but sustainable, competitive advantage.

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Tackling Aftermarket Challenges

It isn't surprising, though, that companies find it tough to compete in the aftermarket. Across industries, delivering after-sales services is more complex than manufacturing products. When delivering service products, executives have to deploy parts, people, and equipment at more locations than they do to make products. An after-sales network has to support all the goods a company has sold in the past as well as those it currently makes. Each generation has different parts and vendors, so the service network often has to cope with 20 times the number of SKUs that the manufacturing function deals with. Businesses also have to train service personnel, who are dispersed all over the world, in a variety of technical skills. Moreover, after-sales networks operate in an unpredictable and inconsistent marketplace because demands for repairs crop up unexpectedly and sporadically. On top of that, companies have to handle—

in an environmentally safe fashion — the return, repair, and disposal of failed components.

Most businesses don't appreciate those myriad challenges. They blindly apply enterprise-resource-planning thinking, processes, and software solutions to tackle the complexity of support networks. In our experience, that doesn't deliver results; the processes and tools that companies use to manufacture goods in a cost-effective manner don't work well in the support business. Here's a simple example. In manufacturing, a quantity and a due date represent a forecast, and the manager's goal is to schedule deliveries so that materials are available just in time. In after-sales support, forecasts for spare parts appear only as probability distributions because breakdowns occur unexpectedly. Executives have to draw up forecasts that can help mitigate risk — not schedules that match forecasts. Most companies don't realize that distinction, and they use a deterministic approach

when predicting demand. As a result, companies face mismatches between supply and demand, deliver poor service to customers, and leave profits behind on the table.

We've been studying after-sales service networks for more than two decades. We've worked with giants such as Boeing, Cisco Systems, IBM, KLA-Tencor, and Tellabs to help them improve the quality of the services they offer customers and to increase their financial returns from the businesses. Our research shows that to win in the aftermarket, executives need to recognize that after-sales services are a commitment companies make to respond within a specific time frame to the customer's need for support. That definition has three important managerial implications.

First, companies must approach the promises they make as products that they design, price, produce, and deliver to customers in order to generate revenues. Many businesses don't understand

that fundamental idea. For example, executives and engineers at an American semiconductor equipment manufacturer believed until recently that reliability was a core characteristic of products and that they were obliged to help customers get the best out of their machines. Therefore, they offered customers free after-sales services. Only when the company's costs shot through the roof did top management become aware of the strategy's shortcomings. The firm almost went broke before it started charging customers who, incidentally, were happy to pay for post-sale services. Remember that service products, like insurance policies, have well-defined terms that entitle the customer to benefits under specific conditions.

Second, companies must design a portfolio of service products. Different customers have different service needs even though they may own the same product. For example, when a mainframe computer in a stock exchange fails, the financial impact will be more severe than when a mainframe in a library goes down, so the supplier has to offer different kinds of services to the two customers. Service needs also vary

at different times. A grounded aircraft means more to the U.S. Air Force during a war than it does during the course of a training exercise. OEMs must study customers' needs, create products that satisfy different segments, and price them according to customers' willingness to pay.

In addition, executives need to design service products based on customer-focused metrics such as machine uptime—not on internally focused metrics

such as the part-fill rate, which is the yardstick that most companies use. The level of demand that can be fulfilled through parts at the manufacturer's warehouse has no meaning to the customer if her product hasn't been repaired.

Third, companies should visualize a distinctive after-sales services supply chain that delivers service products to customers through a network of resources: materials (parts), people (engi-

neers, call center staff, depot and warehouse staff, and transportation staff), and infrastructure (for materials movement and storage, repair, transportation, information systems, and communications). Services supply chains and manufacturing supply chains both consist of entities and assets linked by the flow of materials, information, and money, but they differ in many ways. The services supply chain has to handle more SKUs than the manufacturing

supply chain; deliver people, parts, and infrastructure rather than just raw materials or finished products; and contend with reverse flows of failed parts. (See the exhibit "Two Chains Compared.") Still, the surface similarities between the two drive management decisions, and that creates inefficient after-sales services supply chains.

Despite the aftermarket's obvious charms, most organizations squander its potential.

Our studies suggest that one crucial distinction between the two kinds of supply chains should differentiate the

Two Chains Compared

Companies neglect after-sales services supply chains because they're tougher to manage than manufacturing supply chains. Their performance suffers by comparison, too.

PARAMETER	MANUFACTURING SUPPLY CHAIN	AFTER-SALES SERVICES SUPPLY CHAIN
Nature of demand	Predictable, can be forecast	Always unpredictable, sporadic
Required response	Standard, can be scheduled	ASAP (same day or next day)
Number of SKUs	Limited	15 to 20 times more
Product portfolio	Largely homogeneous	Always heterogeneous
Delivery network	Depends on nature of product; multiple networks necessary	Single network, capable of delivering different service products
Inventory management aim	Maximize velocity of resources	Pre-position resources
Reverse logistics	Doesn't handle	Handles return, repair, and disposal of failed components
Performance metric	Fill rate	Product availability (uptime)
Inventory turns (The more the better)	Six to 50 a year	One to four a year

operating philosophies applied to them. Companies fulfill demand for after-sales services through physical assets such as spare parts, repair depots, and field engineers. Unlike factories, though, businesses can't produce services in advance of demand. They can manufacture them only when an unpredictable event, such as a product failure, triggers a need. Even when the event is predictable, as in the case of scheduled maintenance, the need for parts or engineers isn't easy to forecast. Unlike in product manufacturing, companies must deploy physical resources in advance of events to respond with the speed promised to customers, and they use up those resources when they cope with demands for support.

Based on that dynamic, we've developed a new paradigm for managing services networks. Our approach involves treating the delivery of services as real options; that is, companies have to make investments to "purchase" options to deliver services to customers, and random events that occur determine how they exercise those options to fulfill demand. This framework recognizes that it isn't enough for the services supply chain to react to mismatches between supply and demand. Executives must plan for those frequent responses and acknowledge that the company has to manage its services network in a dynamic fashion. When companies implemented our ideas, they boosted service quality levels by 10% to 15%, reduced investments in service assets by 25% to 50%, and lowered operating costs by 10%. That's why we believe that companies that don't adopt the following six-step approach are doomed to mediocrity in the aftermarket. (See the sidebar "Six Steps for Managing Service Networks.")

Identify the products. As a first step, companies must decide whether to support all the products they sell or only some. For instance, Kodak supports its digital cameras but not its disposables. Many PC manufacturers, such as Dell and Hewlett-Packard, support all the products they currently make but discontinue support for products they

Six Steps for Managing Service Networks

Companies should use a systematic approach to improve after-sales service quality levels, reduce investments in service assets, and cut operating costs.

- 1 Identify which products to cover.**
Support all, some, complementary, or competing products.
- 2 Create a portfolio of service products.**
Position service products according to response times and prices.
- 3 Select business models to support service products.**
Use different models for different products and life cycle stages.
- 4 Modify after-sales organizational structures.**
Provide visibility, incentives, and focus for services.
- 5 Design and manage an after-sales services supply chain.**
Decide location of resources, prioritize resource utilization, and plan for contingencies.
- 6 Monitor performance continuously.**
Evaluate against benchmarks and customer feedback.

have stopped manufacturing. Some businesses choose to service complementary products as well as their own. Others may support competing products in addition to their own to generate economies of scale from the service technologies they've developed. ABB, for instance, supports all the process control equipment in factories that have installed its automation systems, thereby providing a one-stop service solution to customers.

Before companies decide to provide service for products they don't manufacture, though, they must determine whether they can generate synergies in the process. They must ask themselves: Do the assets and skills that we would need to service all those products have anything in common? Do customers really want a one-stop service provider? How critical is support to retaining customers? Will we dilute our brand if we service rival products? Toyota, for example, wouldn't want to be caught servicing Ford trucks. If there aren't many synergies across the products they want

to support, businesses should service only the products they make. Firms should be warned that few companies have made money by becoming one-stop service providers.

Design a portfolio of service products. As we stated earlier, businesses must design a portfolio of service products. To do that, they need to analyze the parameters that govern after-sales support from the customer's viewpoint as well as from their own. On the one hand, customers measure a service provider's performance by the amount of time it takes to restore a failed product. They have to weigh the levels of response they need against the prices they are willing to pay. On the other hand, to respond quickly to breakdowns, manufacturers have to locate spare parts close to customers and invest in larger stockpiles. The faster the response that manufacturers promise, the greater their costs will be. Thus, instead of segmenting customers by sales volumes, geography, or technological capabilities, companies must create a variety of

service products that meet customers' needs and willingness to pay. Service products usually range from those that are fast and expensive – platinum services, as they're commonly known – to those that are slow and economic – silver services.

Developing too few or too many service products reduces quality levels and profits. Many companies provide a one-size-fits-all product, which often increases costs. A Silicon Valley-based semiconductor company, for instance, offered the same high level of support to all its customers at a throwaway price. The demand for those services drained the company's human resources, and it had to bring in design engineers to help resolve problems. That caused delays in the development of new products, and, less than seven years after starting up, the business filed for bankruptcy. Yet developing customized products for every customer or product would be

prohibitive because of the delivery costs. For example, an American telecommunications company signed 15 same-day service contracts with customers, promising response times that ranged from one hour to eight hours. But the corporation couldn't live up to its agreements, and its reputation took a beating in the aftermarket. Businesses should develop products that maximize synergies between the resources required to provide the services. For example, Sears sells white goods made by several manufacturers and offers after-sales support for them. The retailer makes money only because it uses the same repair centers and technicians to service all of those products.

Use multiple business models. Companies can support service products by deploying one or more business models at the same time. When customers want low levels of service, companies can use an ad hoc business model, which al-

lows customers to pay per use. When a product's functioning is critical, companies can use a performance-based model, whereby customers pay for services according to the way products perform. In general, business models differ by product ownership. As shown in the exhibit "Models of After-Sales Services," they may range from conventional ownership-based models to performance-based models for customers that don't own the products they use. For instance, many commercial airlines pay GE and Rolls-Royce an hourly fee for using those companies' aircraft engines instead of buying them.

The business models that a company chooses is important because it drives the incentives of all the players in the services supply chain: manufacturer, service provider, logistics provider, and customer. When customers pay manufacturers for the parts and services they provide to keep products working, for

Models of After-Sales Services

The value companies place on after-sales services will determine the business models that firms can use to deliver them. When services are all-important, manufacturers may choose to sell services rather than the products that generate them.

SERVICE PRIORITY	BUSINESS MODEL	TERMS	EXAMPLE	PRODUCT OWNER
None	Disposal	Dispose of products when they fail or need to be upgraded	Razor blades	Consumer
Low	Ad hoc	Pay for support as needed	TVs	Consumer
Medium-high	Warranty	Pay fixed price as needed	PCs	Consumer
Medium-high	Lease	Pay fixed price for a fixed time; option to buy product	Vehicles	Manufacturer; leasing company
High	Cost-plus	Pay fixed price based on cost and prenegotiated margin	Construction	Customer
Very high	Performance based	Pay based on product's performance	Aircraft	Customer
Very high	Power by the hour	Pay for services used	Aircraft engines	Manufacturer; service provider

example, a conflict of interest arises. Suppliers would like to sell more parts and services, but customers would like to minimize costs. Performance-based models, however, usually align incentives better than ownership-based ones because customers compensate service providers according to the output they deliver. In general, companies should choose performance-based business models when the product is very expensive, the supplier can bear the risk of owning the asset, and both manufacturers and customers can monitor the outcomes of using the product.

The suitability of a business model sometimes depends on the nature of the product. For example, customers may be more inclined to lease computers, which become obsolete quickly, than refrigerators, which are more durable. In some cases, businesses may use different models for the same asset at various stages of its life cycle. The U.S. Department of Defense, for instance, uses a cost-plus service model when it purchases new equipment because it can't predict failure rates. As the product is used more and more, the agency demands performance-based service contracts. When the uncertainty about maintenance costs diminishes, the DOD asks suppliers for fixed-price service contracts.

Determine after-sales organizational structures. Most companies don't pay much attention to the way after-sales services are organized. Consequently, the products division is often nominally responsible for products that are covered by warranties, but the services department, which sells post-warranty services, actually delivers warranty-related support. This overlap leads to organizational tension. For example, if the products division wants to extend the period of the initial warranty, the services department will object because it will lose revenues in the process. Since companies use the same stockpiles of spare parts to provide both warranty-related and non-warranty-related services, the two divisions constantly bicker about which one is responsible for inventory-carrying costs. To resolve

those issues, some businesses, such as Saturn, have set up teams of managers from both functions to determine priorities for the use of parts.

Other companies have outsourced the delivery of after-sales services to third-party providers. If a company's objective is to turn service into a core competence, it should retain control of the services function. However, when the opportunities for generating synergies, pooling risks, and achieving economies of scale make third-party service

providers a competitive option, manufacturers may have no choice but to outsource the delivery of after-sales services. However, each bears a different cost and entails its own response time. Replacing a failed product with a standby end product is faster but more expensive than replacing a module. Replacing a module is faster and more expensive than replacing a submodule. Companies should keep this product hierarchy in mind when deciding what spares to stock.

Similarly, corporations can draw up a hierarchy of locations from which they can supply parts. The central distribution center, which is located farthest away from customers, would be at the top of the geographical hierarchy. Regional and field stocks would be located closer to customers, and manufacturers could also stock parts right on customers' premises. The farther stockpiles are from customers, the slower firms' responses and the lower their costs will be. (See the exhibit "What Hierarchies Reveal.")

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To manage the after-sales services business effectively, most companies require skills and knowledge they don't yet possess. For instance, suppliers must know exactly how their products create value for customers, which means greater interaction between manufacturers and customers as well as new technological capabilities. Changes in strategy might also involve nudging the sales organization away from selling products at the best possible prices and toward generating income from services over a long period of time. That, in turn, might necessitate lowering the price of the basic product – the razor blade strategy, as it is known. Companies should develop new metrics for evaluating the marketing, services, and manufacturing departments to help prevent discord. For example, companies should measure potential aftermarket revenues while evaluating sales of new products.

Create an after-sales services supply chain. Next, companies must match the supply of resources with demand. The right materials, people, and infrastruc-

ture have to be delivered to the right place within an agreed-upon time at the lowest possible cost. Executives find it tough to decide which resources to deploy and where to deploy them because both spares and locations are hierarchical. There's a pecking order to parts and places that complicates stocking decisions.

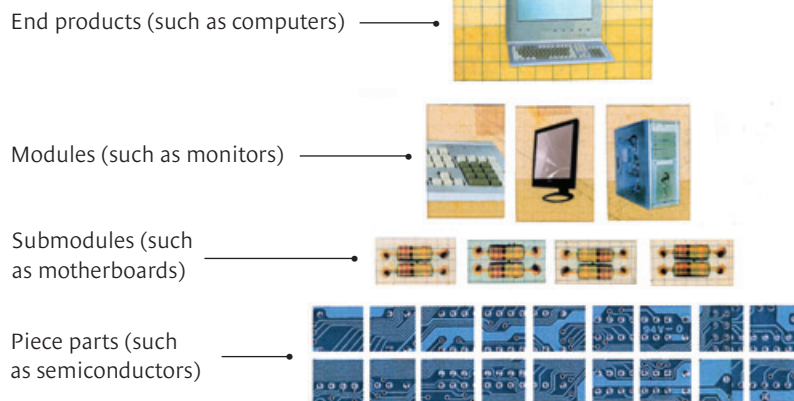
Companies can break products down into end products, modules, submodules, and piece parts, all of which they can use interchangeably to deliver after-

The interplay between the product and geographical hierarchies helps companies decide how to deploy assets. The quickest way for companies to meet response targets would be to replace failed products with standby units that they have positioned on customers' premises. To do that, companies would have to put resources from the top of

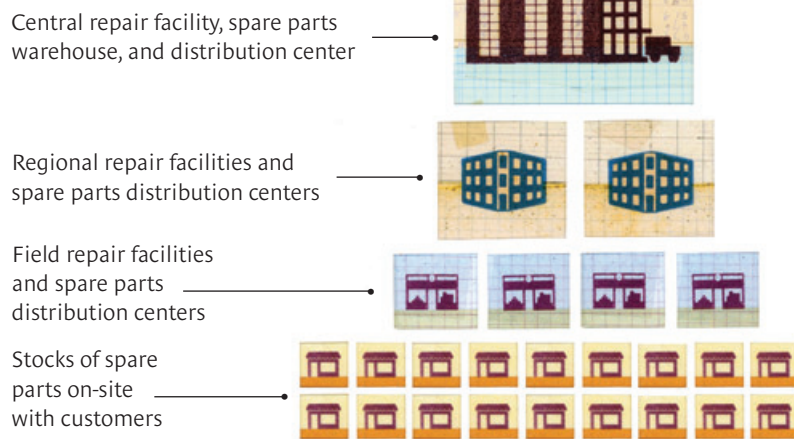
What Hierarchies Reveal

When a product fails, the supplier can repair or replace it in different ways and from different locations. In the product hierarchy, the higher a spare is ranked, the more expensive it is likely to be. In the geographical hierarchy, the higher a location is ranked, the farther it is likely to be from the customer.

THE PRODUCT HIERARCHY



THE GEOGRAPHICAL HIERARCHY



the product hierarchy (complete products) at locations on the bottom of the geographical hierarchy (customer sites). That would be the most expensive way to meet a demand for service, but, depending on the customer's needs, it may well be the most appropriate. For example, a stock exchange that uses Cisco Systems' routers will incur a huge

cost if a router fails. Therefore, Cisco should make sure there's a spare router in the customer's office to minimize downtime.

By contrast, the most economical way to meet a service demand is to replace, from the central facility, only the broken parts. That means companies would have to position resources from the bot-

tom of the product hierarchy (components) at locations at the top of the geographical hierarchy (central distribution centers). This would be the slowest option because suppliers would need time to diagnose the problem. Since companies can't easily forecast the demand for resources, they must develop demand probability distributions and make allocation decisions after calculating the trade-offs of stocking different resources at different locations.

These resource deployment decisions are interrelated. An investment in an item at one location will influence investment decisions for many other items in other locations. For instance, positioning a spare unit at a customer's site will decrease the emergency demand for parts from field and regional locations. Similarly, investing in additional stock at a central depot will reduce companies' lead times for replenishing regional and field stockpiles. However, decisions are often limited by the service organization's budget. Assigning a particular asset to a specific location affects decisions about which other parts can be assigned to other locations. A high level of service for one customer may therefore necessitate a lower level of service for another.

The best way for companies to realize economies of scale is to pool spare parts. Companies often create supply chains for each service product. They mandate that their networks should serve premium customers from nearby locations and nonpremium customers from distant locations. But maintaining multiple supply chains is an inefficient solution because businesses can use the same materials and human resources to support different service products. An engine can serve as the replacement for a premium service contract as well as for a standard service contract. In the services business, an asset is an asset, regardless of who uses it. The problem, though, is the free-rider phenomenon: The manufacturer may sometimes allocate a spare part held to serve the needs of a premium customer to a lower-paying customer simply because the latter demand occurred first. Alternatively,

a manager may divide the available resources equally between the two customers, thereby giving the premium customer a lower-than-promised priority and the standard buyer a higher-than-promised priority.

To overcome this dilemma, companies must draw up prioritization rules. Consider a situation where the service chain allocates the available inventory of a spare part on a first come, first served basis to any customer until the inventory drops to a threshold level. Below that level, the network will reserve the inventory only for higher-paying customers, and lower-paying customers must wait their turn. Thus, the company maintains a higher priority for the premium customer while simultaneously ensuring a common stockpile. In the white goods industry, where products last a long time and prices don't drop rapidly, the rules-based approach may be cost-effective. Another approach would be for the service network to satisfy demand from a premium customer for a failed product—say, a 30-GB hard drive—by providing a better product, such as a 60-GB drive. In that case, the company would pool risk across products through substitution

even as it ensured a higher degree of service for that customer. For example, in the PC industry, the benefits of using new drives as spares are greater than the costs of stocking inventories of old drives, since the price of hard drives can fall rapidly.

Once companies have figured out where to stock which spares, they can calculate the costs of responding to breakdowns. Then firms can create a

plexity involved in managing service assets, companies should break the decision-making process into three planning periods. At the most immediate level of planning (days), companies should worry about repositioning decisions such as replenishment, allocation, and transshipment of resources. At the next level (weeks or months), managers should address the strategic positioning of material, human, and knowledge

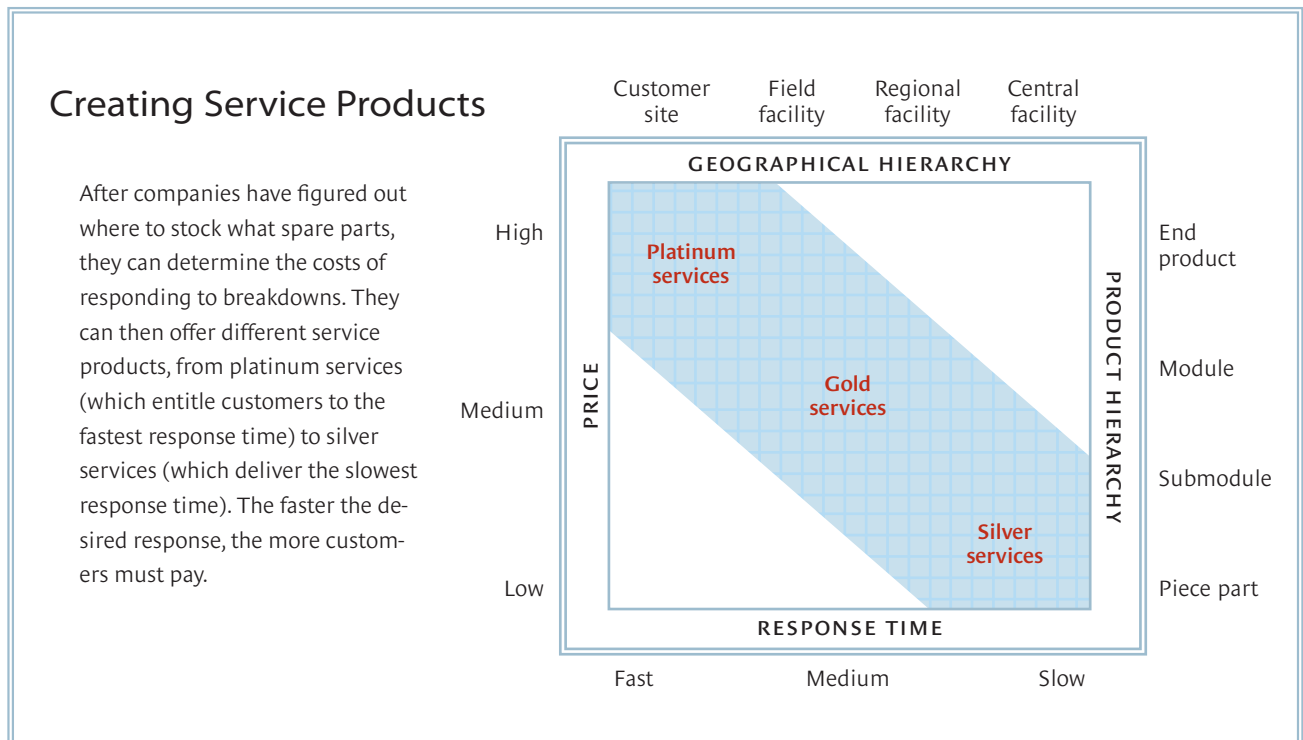
Executives find it tough to decide which resources to deploy and where to deploy them because both spares and locations are hierarchical.

range of service products, from platinum to silver. (See the exhibit “Creating Service Products.”)

Business strategies, product technologies, and information about product failure rates, which drive many businesses’ allocation decisions, will change over time. As a result, executives must sense shifts in the environment and respond with forecasts that allow them to reposition resources. Given the com-

resources. At the furthest level of planning (years), companies must make decisions about the services strategy.

A simple way to understand the importance of fine-tuning services supply chains is to watch ESPN. Whether playing ice hockey or tennis, the best athletes can move quickly in response to opponents’ plays. Though they have great real-time response capabilities, these competitors rarely hustle at the



last moment. They are masters at making strategic moves long before events take place, anticipating opponents' moves and pre-positioning themselves for winning plays. That's precisely the approach companies should use when they design their after-sales services supply chains.

Monitor performance. Companies must monitor the performance of services supply chains because customer needs are always changing. Lockheed Martin, for example, has to cope with a fluid network of facilities to maintain the electronics on F-18 fighter jets, since the jets fly from aircraft carriers that are constantly on the move. And every time Dell gains a commercial customer with computers in many locations, it has to alter the structure of its service network.

Two kinds of metrics prove useful in these cases. Customer-focused metrics—such as the waiting time for technical assistance, the waiting time for diagnosis, and the waiting time for the delivery of parts—can help determine how efficiently a company creates value for its customers. Internally focused metrics—such as fill rates and parts obsolescence costs—can quantify the way companies use their service assets.

Smart businesses keep track of technologies that may force changes in service strategies. In some industries, for instance, wireless two-way communications equipment now allows companies to diagnose, monitor, and proactively solve problems. Companies that use such technologies need to develop new kinds of support networks. Companies would also do well to watch out for new kinds of rivals. Consider, for example, the meteoric rise of Geek Squad in the not-so-exciting world of PC services. Starting with a single person on a bicycle in 1994, Geek Squad has grown into an organization of more than 10,000 Agents driving around America's cities in Geekmobiles (the Volkswagen Beetle is the model of choice). Geek Squad, which Best Buy acquired in 2002, reported revenues of \$650 million in 2005, indicating that PC makers should revisit their service strategies.

Learning from Cisco

Cisco Systems, the world's leading manufacturer of networking equipment, lavishes attention on after-sales services, but it faced a challenge some years ago. The company's customer advocacy division, which generated \$3.9 billion in revenues in 2005, offers customers troubleshooting services as well as hardware and software support for the hundreds of products it supplies. These products include warranty services that require Cisco to provide spare parts to customers as well as service contracts under which the company must deliver spare parts and field engineers as needed. To fulfill the tens of thousands of contracts it has signed, Cisco uses field engineers from Dimension Data, HP, and IBM.

A high level of service for one customer may necessitate a lower level of service for another.

It uses Choice Logistics, DHL, FedEx, Flash Global Logistics, Ryder System, and UPS for logistics services. And it uses Celestica, Foxconn Electronics, Jabil Circuit, Solectron, and Teleplan to repair parts. Cisco has created a large infrastructure, including 800 fulfillment centers, seven country distribution centers, 18 repair centers; and five materials return-processing centers. The scale of the operation is impressive, but it is a nightmare to monitor and manage, especially since Cisco has to deliver an average of 720,000 spare parts and repair 530,000 parts every year.

Cisco used to manage this services supply chain with easy-to-implement heuristics. For instance, the company met service demands from high-priority customers from nearby (or forward) locations and supplied other customers from depots or central locations, such as warehouses, that were located farther away. The company neglected, however, to coordinate the stocking policy between forward and central locations. It also chose stocking levels for each part

and for each location based on the number of parts used in the equipment that was located in the area the service center supported. As time went by, Cisco found that the network was becoming less flexible, and inventory levels were rising.

Cisco's executives decided to improve the management of the business's spare parts inventory, and they implemented a new system based on the principles that we have described in this article. The company drove the process by using demand histories to generate probability-based forecasts of parts requirements. Because Cisco has to field thousands of service calls every day, the company started calculating its resource allocation options daily instead of intermittently. The company also started accounting for the interactions between forward stocking locations and central stocking locations. That sped up the deployment of resources, lowered costs, and shrank response times. The redesigned system helped Cisco reduce its spare parts inventory by 21% while boosting customer satisfaction. Clearly, Cisco has mastered the science of after-sales services.

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As we all know, corporations compete by delivering customer value, which they can influence at three stages of a product's life. Some businesses focus on the design phase, which determines a product's raw materials, capabilities, and performance. (In fact, 80% of a product's costs are determined when it is designed.) Most businesses compete in the next phase, production. Because a majority of businesses adopt the same standards in manufacturing, it's difficult for them to distinguish themselves at this stage. The final stage is customer support, which spans the longest part of a product's life. Although few executives realize it, after-sales support is the longest-lasting source of revenues to sellers and requires the smallest investment. Companies that ignore the aftermarket do so at their peril. 

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