As a strategic weapon, time is the equivalent of money, productivity, quality, even innovation.

Time—The Next Source of Competitive Advantage

by GEORGE STALK, JR.

Like competition itself, competitive advantage is a constantly moving target. For any company in any industry, the key is not to get stuck with a single simple notion of its source of advantage. The best competitors, the most successful ones, know how to keep moving and always stay on the cutting edge.

Today, *time* is on the cutting edge. The ways leading companies manage time—in production, in new product development and introduction, in sales and distribution—represent the most powerful new sources of competitive advantage. Though certain Western companies are pursuing these advantages, Japanese experience and practice provide the most instructive examples—not because they are necessarily unique but because they best illustrate the evolutionary stages through which leading companies have advanced.

In the period immediately following World War II, Japanese companies used their low labor costs to gain entry to various industries. As wage rates rose and technology became more significant, the Japanese shifted first to scale-based strategies and then to focused factories to achieve advantage. The advent of just-in-time production brought with it a move to flexible factories, as leading Japanese companies sought both low cost and great variety in the market. Cutting-edge Japanese companies today are capitalizing on time as a critical source of competitive advantage: shortening the planning loop in the product development cycle and trimming process time in the factory—managing time the way most companies manage costs, quality, or inventory.

In fact, as a strategic weapon, time is the equivalent of money, productivity, quality, even innovation. Managing time has enabled top Japanese companies not only to reduce their costs but also to offer broad product lines, cover more market segments, and upgrade the technological sophistication of their products. These companies are time-based competitors.

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From Low Wages to Variety Wars

Since 1945, Japanese competitors have shifted their strategic focus at least four times. These early adaptations were straightforward; the shift to time-based competitive advantage is not nearly so obvious. It does, however, represent a logical evolution from the earlier stages.

In the immediate aftermath of World War II, with their economy devastated and the world around them in a shambles, the Japanese concentrated on

achieving competitive advantage through low labor costs. Since Japan's workers were still productive and the yen was devalued by 98.8% against the dollar, its labor costs were extraordinarily competitive with those of the West's developed economies.

Hungry for foreign exchange, the Japanese government encouraged companies to make the most of their one edge by targeting industries with high labor content: textiles, shipbuilding, and steel – businesses where the low labor rates more than offset low productivity rates. As a result, Japanese companies took market share from their Western competition.

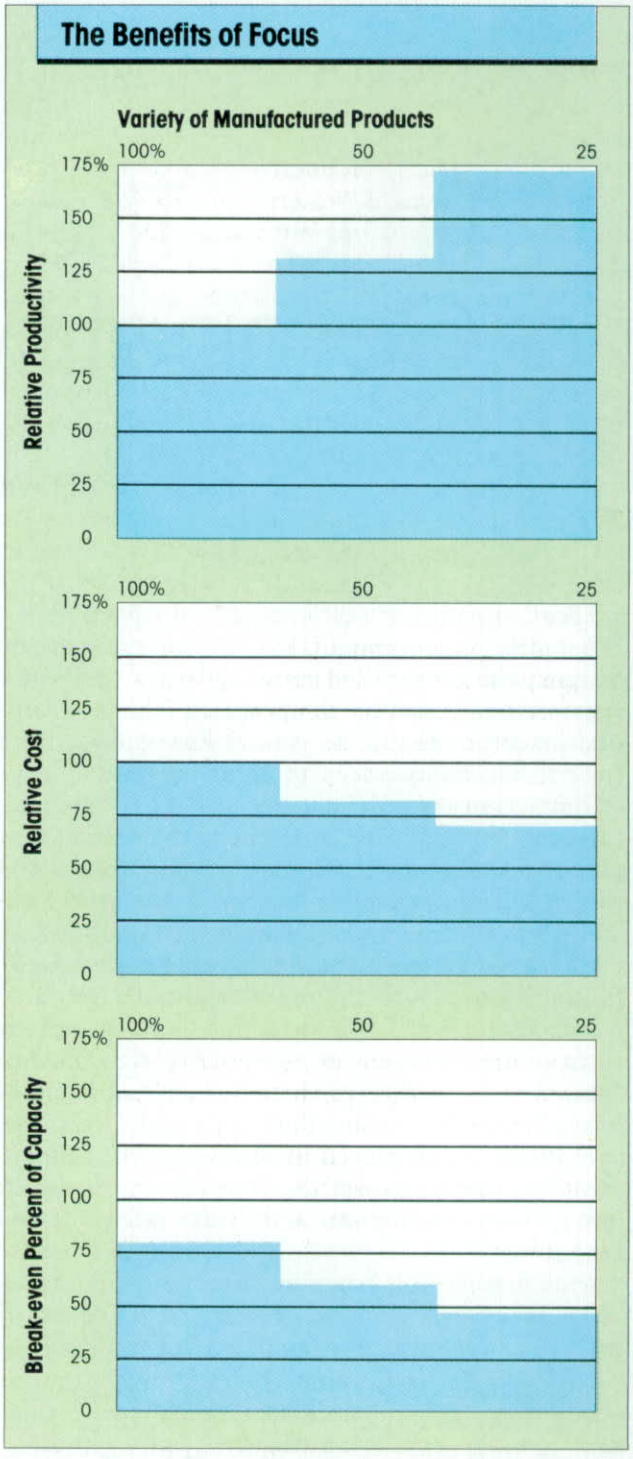
But this situation did not last long. Rising wages, caused by high inflation, combined with fixed exchange rates to erode the advantage. In many industries, manufacturers could not improve their productivity fast enough to offset escalating labor costs. By the early 1960s, for instance, the textile companies – comprising Japan's largest industry – were hard-pressed. Having lost their competitive edge in world markets, they spiraled downward, first losing share, then volume, then profits, and finally position and prestige. While the problem was most severe for the textile business, the rest of Japanese industry suffered as well.

The only course was adaptation: in the early 1960s, the Japanese shifted their strategy, using capital investment to boost work-force productivity. They inaugurated the era of scale-based strategies, achieving high productivity and low costs by building the largest and most capital-intensive facilities that were technologically feasible. Japanese shipbuilders, for example, revolutionized the industry in their effort to raise labor productivity. Adapting fabrication techniques from mass production processes and using automatic and semiautomatic equipment, they constructed vessels in modules. The approach produced two advantages for the Japanese. It drove up their own productivity and simultaneously erected a high capital-investment barrier to others looking to compete in the business.

> Using focused factories, the Japanese achieved high productivity and low costs.

The search for ways to achieve even higher productivity and lower costs continued, however. And in the mid-1960s, it led top Japanese companies to a new source of competitive advantage – the focused factory. Focused competitors manufactured products either made nowhere else in the world or located in the high-volume segment of a market, often in the heart of their Western competitors' product lines. Focusing of production allowed the Japanese to remain smaller than established broad-line producers, while still achieving higher productivity and lower costs – giving them great competitive power.

Factory costs are very sensitive to the variety of goods a plant produces. Reduction of the product-line



Cutting variety yields higher productivity, lower costs, and reduced break-even points.

variety by half, for example, raises productivity by 30%, cuts costs 17%, and substantially lowers the break-even point. Cutting the product line in half again boosts productivity by 75%, slashes costs 30%, and diminishes the break-even point to below 50%. (See "The Benefits of Focus.")

In industries like bearings, where competition was fierce in the late 1960s, the Japanese fielded product lines with one-half to one-quarter the variety of their Western competitors. Targeting the high-volume segments of the bearing business – bearings for automobile applications was one – the Japanese used the low costs of their highly productive focused factories to undercut the prices of Western competitors.

SKF was one victim. With factories scattered throughout Europe, each geared to a broad product line for the local market, the Swedish company was a big target for the Japanese. SKF reacted by trying to avoid direct competition with the Japanese: it added higher margin products to serve specialized applications. But SKF did not simultaneously drop any low-margin products, thereby complicating its plant operations and adding to production costs. In effect, SKF provided a cost umbrella for the Japanese. As long as they operated beneath it, the Japanese could expand their product line and move into more varied applications.

Avoiding price competition by moving into higher margin products is called margin retreat – a common response to stepped-up competition that eventually leads to corporate suicide. As a company retreats, its costs rise as do its prices, thus "subsidizing" an aggressive competitor's expansion into the vacated position. The retreating company's revenue base stops growing and may eventually shrink to the point where it can no longer support the fixed cost of the operation. Retrenchment, restructuring, and further shrinkage follow in a cycle that leads to inevitable extinction.

SKF avoided this fate by adopting the Japanese strategy. After a review of its factories, the company focused each on those products it was best suited to manufacture. If a product did not fit a particular factory, it was either placed in another, more suitable plant or dropped altogether. This strategy not only halted SKF's retreat but also beat back the Japanese advance.

At the same time, however, leading Japanese manufacturers began to move toward a new source of competitive advantage – the flexible factory. Two developments drove this move. First, as they expanded and penetrated more markets, their narrow product lines began to pinch, limiting their ability to grow. Second, with growth limited, the economics of the focus strategy presented them with an unattractive choice: either reduce variety further or accept the higher costs of broader product lines.

In manufacturing, costs fall into two categories: those that respond to volume or scale and those that are driven by variety. Scale-related costs decline as volume increases, usually falling 15% to 25% per unit each time volume doubles. Variety-related costs, on the other hand, reflect the costs of complexity in manufacturing: setup, materials handling, inventory, and many of the overhead costs of a factory. In most cases, as variety increases, costs increase, usually at a rate of 20% to 35% per unit each time variety doubles.

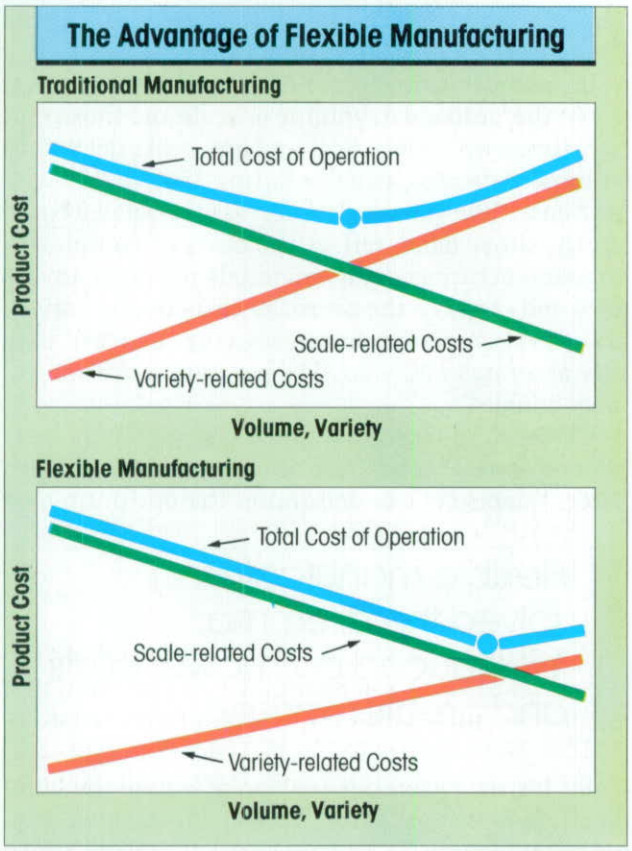
The sum of the scale- and variety-related costs represents the total cost of manufacturing. With effort, managers can determine the optimum cost point for their factories – the point where the combination of volume and variety yields the lowest total manufacturing cost for a particular plant. When markets are good, companies tend to edge toward increased variety in search of higher volumes, even though this will mean increased costs. When times are tough, companies pare their product lines, cutting variety to reduce costs.

> Flexible manufacturing solved the dilemma; it produced both lower costs and greater variety.

In a flexible factory system, variety-driven costs start lower and increase more slowly as variety grows. Scale costs remain unchanged. Thus the optimum cost point for a flexible factory occurs at a higher volume and with greater variety than for a traditional factory. A gap emerges between the costs of the flexible and the traditional factory – a cost/variety gap that represents the competitive advantage of flexible production. Very simply, a flexible factory enjoys more variety with lower total costs than traditional factories, which are still forced to make the trade-off between scale and variety. (See "The Advantage of Flexible Manufacturing.")

Yanmar Diesel illustrates how this process works. In 1973, with the Japanese economy in recession, Yanmar Diesel was mired in red ink. Worse, there was no promise that once the recession had passed, the existing strategy and program would guarantee real improvement in the company's condition.

As a Toyota supplier, Yanmar was familiar with the automaker's flexible manufacturing system. Moreover, Yanmar was impressed with the automaker's ability to weather the recession without losing



For flexible factories, the optimum cost points occur at a higher volume and with higher variety than for traditional factories.

money. Yanmar decided to install the Toyota procedure in its own two factories. The changeover took less than five years and produced dramatic results: manufacturing costs declined 40% to 60%, depending on the product; factory break-even points dropped 80% to 50%; total manufacturing labor productivity improved by more than 100%.

But it was Yanmar's newfound capability in product variety that signaled the arrival of a unique strategic edge: during the restructuring Yanmar more than quadrupled its product line. With focused factories, Yanmar could have doubled productivity in such a short time only by reducing the breadth of the product line by 75%. The Toyota system made Yanmar's factories more flexible, reducing costs and producing a greater variety of products.

As its inventor, Taiichi Ohno, said, the Toyota production system was "born of the need to make many types of automobiles, in small quantities with the same manufacturing process." With its emphasis on just-in-time production, total quality control, employee decision making on the factory floor, and close supplier relations, the Toyota system gave the many Japanese manufacturers who adopted it in the mid-1970s a distinct competitive advantage.

A comparison of a U.S. company with a Japanese competitor in the manufacture of a particular automotive suspension component illustrates the nature and extent of the Japanese advantage. The U.S. company bases its strategy on scale and focus: it produces 10 million units per year–making it the world's largest producer–and offers only 11 types of finished parts. The Japanese company's strategy, on the other hand, is to exploit flexibility. It is both smaller and less focused: it manufactures only 3.5 million units per year but has 38 types of finished parts.

With one-third the scale and more than three times the product variety, the Japanese company also boasts total labor productivity that is half again that of its American competitor. Moreover, the unit cost of the Japanese manufacturer is less than half that of the U.S. company. But interestingly, the productivity

> Yanmar's flexible factories cut costs and more than quadrupled its product line.

of the Japanese direct laborers is not as high as that of the U.S. workers, a reflection of the difference in scale. The Japanese advantage comes from the productivity of the overhead employees: with one-third the volume and three times the variety, the Japanese company has only one-eighteenth the overhead employees. (See "Flexible Manufacturing's Productivity Edge.")

In the late 1970s, Japanese companies exploited flexible manufacturing to the point that a new competitive thrust emerged–the variety war. A classic example of a variety war was the battle that erupted between Honda and Yamaha for supremacy in the motorcycle market, a struggle popularly known in Japanese business circles as the H-Y War. Yamaha ignited the H-Y War in 1981 when it announced the opening of a new factory which would make it the world's largest motorcycle manufacturer, a prestigious position held by Honda. But Honda had been concentrating its corporate resources on the automobile business and away from its motorcycle operation. Now, faced with Yamaha's overt and public challenge, Honda chose to counterattack.

Honda launched its response with the war cry, "Yamaha wo tsubusu!" ("We will crush, squash, slaughter Yamaha!") In the no-holds-barred battle that ensued, Honda cut prices, flooded distribution channels, and boosted advertising expenditures. Most important–and most impressive to consumers –Honda also rapidly increased the rate of change in its product line, using variety to bury Yamaha. At the start of the war, Honda had 60 models of motor-

cycles. Over the next 18 months, Honda introduced or replaced 113 models, effectively turning over its entire product line twice. Yamaha also began the war with 60 models; it was able to manage only 37 changes in its product line during those 18 months.

Honda's new product introductions devastated Yamaha. First, Honda succeeded in making motorcycle design a matter of fashion, where newness and freshness were important attributes for consumers. Second, Honda raised the technological sophistication of its products, introducing four-valve engines, composites, direct drive, and other new features. Next to a Honda, Yamaha products looked old, unattractive, and out of date. Demand for Yamaha products dried up; in a desperate effort to move them, dealers were forced to price them below cost. But even that didn't work. At the most intense point in the H-Y War, Yamaha had more than 12 months of inventory in its dealers' showrooms. Finally Yamaha surrendered. In a public statement, Yamaha President Eguchi announced, "We want to end the H-Y War. It is our fault. Of course there will be competition in the future but it will be based on a mutual recognition of our respective positions."

Honda didn't go unscathed either. The company's sales and service network was severely disrupted, requiring additional investment before it returned to a stable footing. However, so decisive was its victory that Honda effectively had as much time as it wanted to recover. It had emphatically defended its title as the world's largest motorcycle producer and done so in a way that warned Suzuki and Kawasaki not to challenge that leadership. Variety had won the war.

Time-Based Competitive Advantage

The strength of variety as a competitive weapon raises an interesting question. How could Japanese companies accommodate such rapid rates of change? In Honda's case, there could be only three possible answers. The company did one of the following:

1. Began the development of more than 100 new models 10 to 15 years before the attack.
2. Authorized a sudden, massive spending surge to develop and manufacture products on a crash basis.
3. Used structurally different methods to develop, manufacture, and introduce new products.

In fact, what Honda and other variety-driven competitors pioneered was time-based competitiveness. They managed structural changes that enabled their operations to execute their processes much faster. As a consequence, time became their new source of competitive advantage.

Flexible Manufacturing's Productivity Edge

(Automobile Suspension Component)

	U.S. Competitor	*Japanese Competitor*
Annual Volume	10M	3.5M
Employees		
Direct	107	50
Indirect	135	7
Total	242	57
Annual Units/Employee	43,100	61,400
Types of Finished Parts	11	38
Unit Cost for Comparable Part (index)	$100	$49

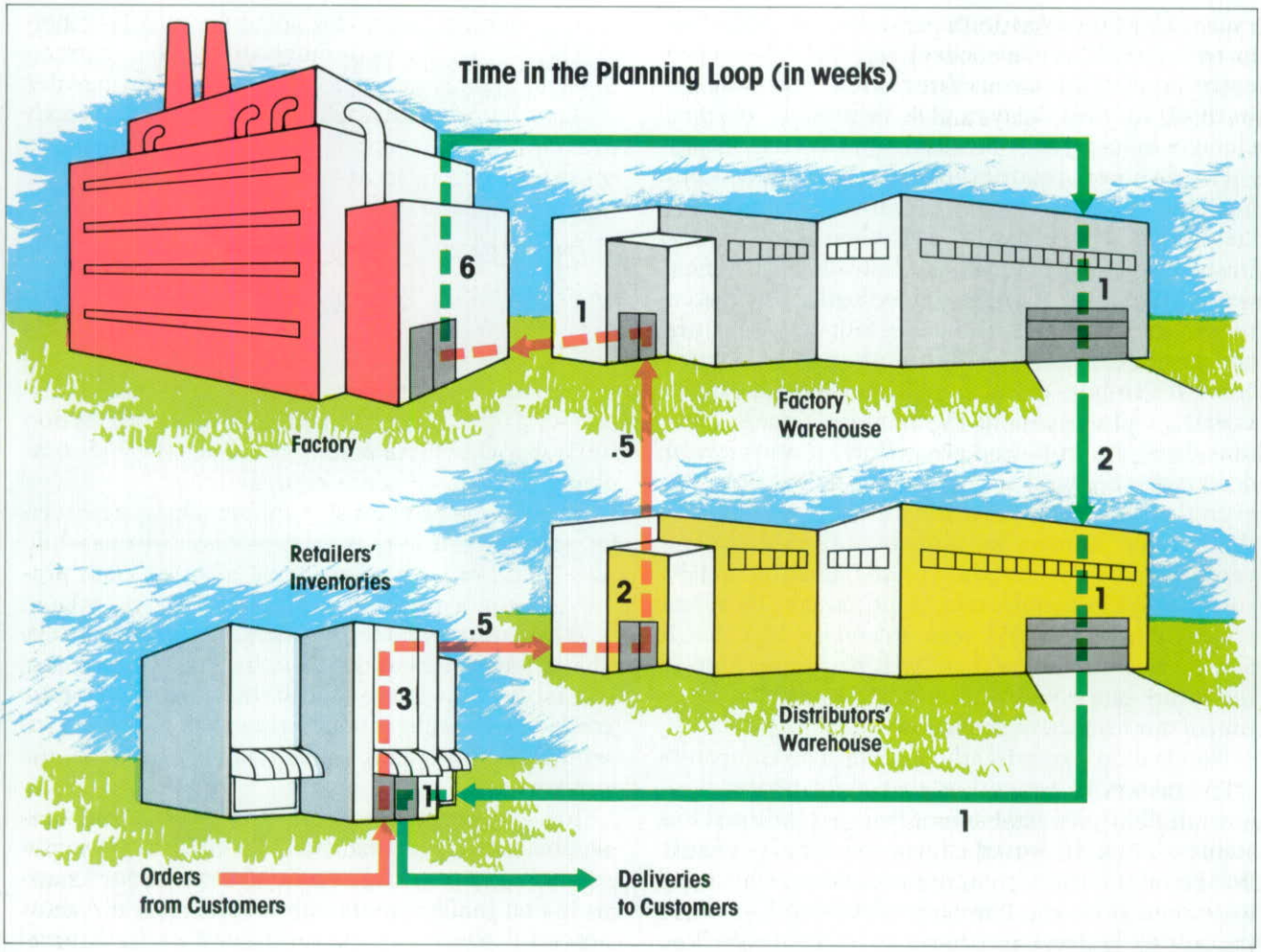
(1987 figures)

While time is a basic business performance variable, management seldom monitors its consumption explicitly—almost never with the same precision accorded sales and costs. Yet time is a more critical competitive yardstick than traditional financial measurements.

Today's new-generation companies compete with flexible manufacturing and rapid-response systems, expanding variety and increasing innovation. A company that builds its strategy on this cycle is a more powerful competitor than one with a traditional strategy based on low wages, scale, or focus. These older, cost-based strategies require managers to do whatever is necessary to drive down costs: move production to or source from a low-wage country; build new facilities or consolidate old plants to gain economies of scale; or focus operations down to the most economic subset of activities. These tactics reduce costs but at the expense of responsiveness.

In contrast, strategies based on the cycle of flexible manufacturing, rapid response, expanding variety, and increasing innovation are time based. Factories are close to the customers they serve. Organization structures enable fast responses rather than low costs and control. Companies concentrate on reducing if not eliminating delays and using their response advantages to attract the most profitable customers.

Many—but certainly not all—of today's time-based competitors are Japanese. Some of them are Sony, Matsushita, Sharp, Toyota, Hitachi, NEC, Toshiba, Honda, and Hino; time-based Western companies include Benetton, The Limited, Federal Express, Domino's Pizza, Wilson Art, and McDonald's. For these leading competitors, time has become the overarching measurement of performance. By reducing



the consumption of time in every aspect of the business, these companies also reduce costs, improve quality, and stay close to their customers.

Breaking the Planning Loop

Companies are systems; time connects all the parts. The most powerful competitors understand this axiom and are breaking the debilitating loop that strangles much of traditional manufacturing planning.

Traditional manufacturing requires long lead times to resolve conflicts between various jobs or activities that require the same resources. The long lead times, in turn, require sales forecasts to guide planning. But sales forecasts are inevitably wrong; by definition they are guesses, however informed. Naturally, as lead times lengthen, the accuracy of sales forecasts declines. With more forecasting errors, inventories balloon and the need for safety stocks at all levels increases. Errors in forecasting also mean more unscheduled jobs that have to be expedited, thereby crowding out scheduled jobs. The need for longer lead times grows even greater and the planning loop expands even more, driving up costs, increasing delays, and creating system inefficiencies.

Managers who find themselves trapped in the planning loop often respond by asking for better forecasts and longer lead times. In other words, they treat the symptoms and worsen the problem. The only way to break the planning loop is to reduce the consumption of time throughout the system; that will, in turn, cut the need for lead time, for estimates, for safety stocks, and all the rest. After all, if a company could ever drive its lead time all the way to zero, it would have to forecast only the next day's sales. While that idea of course is unrealistic, successful time-based competitors in Japan and in the West have kept their lead times from growing and some have even reduced them, thereby diminishing the planning loop's damaging effects.

Thirty years ago, Jay W. Forrester of MIT published a pioneering article in HBR, "Industrial Dynamics: A Major Breakthrough for Decision Makers" (July-August 1958), which established a model of time's

impact on an organization's performance. Using "industrial dynamics"—a concept originally developed for shipboard fire control systems—Forrester tracked the effects of time delays and decision rates within a simple business system consisting of a factory, a factory warehouse, a distributors' inventory, and retailers' inventories. The numbers in the illustration "Time in the Planning Loop" are the delays in the flow of information or product, measured in weeks. In this example, the orders accumulate at the retailer for three weeks, are in the mail for half a week, are delayed at the distributor for two weeks, go back into the mail for another half a week, and need eight weeks for processing at the factory and its warehouse. Then the finished product begins its journey back to the retailer. The cycle takes 19 weeks.

> What distorts the system is time: lengthy delays inevitably create an inaccurate view of the market.

The system in this example is very stable—as long as retail demand is stable or as long as forecasts are accurate 19 weeks into the future. But if unexpected changes occur, the system must respond. The chart, also taken from the Forrester article, shows what happens to this system when a simple change takes place: demand goes up 10%, then flattens. Acting on new forecasts and seeking to cut delivery delays, the factory first responds by ramping up production 40%. When management realizes—too late—that it has overshot the mark, it cuts production 30%. Too late again it learns that it has overcorrected. This ramping up and cutting back continue until finally the system stabilizes, more than a year after the initial 10% increase.

What distorts the system so badly is time: the lengthy delay between the event that creates the new demand and the time when the factory finally receives the information. The longer that delay, the more distorted is the view of the market. Those distortions reverberate throughout the system, producing disruption, waste, and inefficiency.

These distortions plague business today. To escape them, companies have a choice: they can produce to forecast or they can reduce the time delays in the flow of information and product through the system. The traditional solution is to produce to forecast. The new approach is to reduce time consumption.

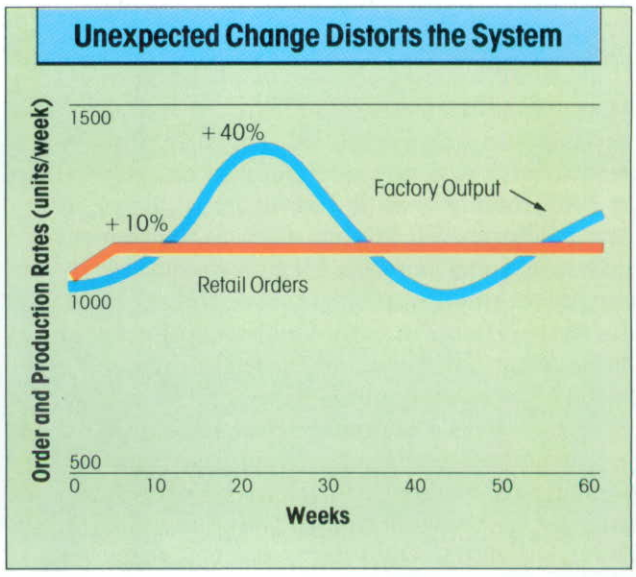
Because time flows throughout the system, focusing on time-based competitive performance results in improvements across the board. Companies generally become time-based competitors by first correcting their manufacturing techniques, then fixing sales and distribution, and finally adjusting their approach to innovation. Ultimately, it becomes the basis for a company's overall strategy.

Time-Based Manufacturing

In general, time-based manufacturing policies and practices differ from those of traditional manufacturers along three key dimensions: length of production runs, organization of process components, and complexity of scheduling procedures.

When it comes to lot size, for instance, traditional factories attempt to maximize production runs while time-based manufacturers try to shorten their production runs as much as possible. In fact, many Japanese companies aim for run lengths of a single unit. The thinking behind this is as simple as it is fundamental to competitive success: reduced run lengths mean more frequent production of the complete mix of products and faster response to customers' demands.

Factory layout also contributes to time-based competitive advantage. Traditional factories are usually organized by process technology centers. For example, metal goods manufacturers organize their factories into shearing, punching, and braking departments; electronic assemblers have stuffing, wave soldering, assembly, testing, and packing departments. Parts move from one process technology center to the next. Each step consumes valuable time: parts sit, waiting to move; then move; then



wait to be used in the next step. In a traditional manufacturing system, products usually receive value for only .05% to 2.5% of the time that they are in the factory. The rest of the time products sit waiting for something to happen.

Time-based factories, however, are organized by product. To minimize handling and moving of parts, the manufacturing functions for a component or a product are as close together as possible. Parts move from one activity to the next with little or no delay. Because the production process eliminates the need to pile and repile parts, they flow quickly and efficiently through the factory.

In traditional factories, scheduling is also a source of delay and waste. Most traditional factories use central scheduling that requires sophisticated materials resource planning and shop-floor control systems. Even though these systems are advanced, they still waste time: work orders usually flow to the factory floor on a monthly or weekly basis. In the meantime, parts can sit idle.

In time-based factories, local scheduling enables employees to make more production control decisions on the factory floor, without the time-consuming loop back to management for approval. Moreover, the combination of the product-oriented layout of the factory and local scheduling makes the total production process run more smoothly. Once a part starts through the production run, many of the requirements between manufacturing steps are purely automatic and require no intermediate scheduling.

> Toyota went to work with its too-slow supplier, cutting response time from 15 days to 1.

These differences between traditional and time-based factories add up. Flexible factories enjoy big advantages in both productivity and time: labor productivity in time-based factories can be as much as 200% higher than in conventional plants; time-based factories can respond eight to ten times faster than traditional factories. Flexible production means significant improvements in labor and net-asset productivity. These, in turn, yield reductions of up to 20% in overall costs and increases in growth for much less investment.

Toyota offers a dramatic example of the kinds of improvements that leading time-based competitors are making. Dissatisfied with the response time of a supplier, Toyota went to work. It took the supplier 15 days to turn out a component after arrival of the raw materials at its factory. The first step was to cut lot sizes, reducing response time to 6 days. Next Toyota streamlined the factory layout, reducing the number of inventory holding points. The response time fell to 3 days. Finally Toyota eliminated all work-in-progress inventories at the supplier's plant. New response time: 1 day.

Toyota, of course, is not alone in improving manufacturing response times. Matsushita cut the time needed to make washing machines from 360 hours to just 2; Honda slashed its motorcycle fabricating time by 80%; in North America, companies making motor controllers and electrical components for unit air conditioners have improved their manufacturing response times by 90%.

Time-Based Sales and Distribution

A manufacturer's next challenge is to avoid dissipation of factory performance improvements in other parts of the organization. In Jay Forrester's example of the planning loop, the factory and its warehouse accounted for roughly one-half of the system's time. In actuality today, the factory accounts for one-third to one-half of the total time—often the most "visible" portion of time. But other parts of the system are just as important, if less apparent. For example, in the Forrester system, sales and distribution consume as much or more time than manufacturing.

What Forrester modeled, the Japanese experienced. By the late 1970s, leading Japanese companies were finding that inefficient sales and distribution operations undercut the benefits of their flexible manufacturing systems. Toyota, which at that time was divided into two separate companies, Toyota Motor Manufacturing and Toyota Motor Sales, again makes this point. Toyota Motor Manufacturing could manufacture a car in less than 2 days. But Toyota Motor Sales needed from 15 to 26 days to close the sale, transmit the order to the factory, get the order scheduled, and deliver the car to the customer. By the late 1970s, the cost-conscious, competition-minded engineers at Toyota Manufacturing were angry at their counterparts at Toyota Motor Sales, who were frittering away the advantage gained in the production process. The sales and distribution function was generating 20% to 30% of a car's cost to the customer—more than it cost Toyota to manufacture the car!

Finally, in 1982 Toyota moved decisively to remedy the problem. The company merged Toyota Motor Manufacturing and Toyota Motor Sales. The company announced that it wanted to become "more

marketing driven." While Toyota assured the public that the reorganization only returned it to its configuration in the 1950s, within 18 months all the Toyota Motor Sales directors retired. Their jobs were left vacant or filled by executives from Toyota Motor Manufacturing.

The company wasted no time in implementing a plan to cut delays in sales and distribution, reduce costs, and improve customer service. The old system, Toyota found, had handled customer orders in batches. Orders and other crucial information would accumulate at one step of the sales and distribution process before dispatch to the next level, which wasted time and generated extra costs.

To speed the flow of information, Toyota had to reduce the size of the information batches. The solution came from a company-developed computer system that tied its salespeople directly to the factory scheduling operation. This link bypassed several levels of the sales and distribution function and enabled the modified system to operate with very small batches of orders.

Toyota expected this new approach to cut the sales and distribution cycle time in half–from four to six weeks to just two to three weeks across Japan. (For the Tokyo and Osaka regions, which account for roughly two-thirds of Japan's population, the goal was to reduce cycle time to just two days.) But by 1987 Toyota had reduced system responsiveness to eight days, including the time required to make the car. In the Forrester example, this achievement is equivalent to cutting the 19-week cycle to 6 weeks. The results were predictable: shorter sales forecasts, lower costs, happier customers.

Time-Based Innovation

A company that can bring out new products three times faster than its competitors enjoys a huge advantage. Today, in one industry after another, Japanese manufacturers are doing just that to their Western competition:

- In projection television, Japanese producers can develop a new television in one-third the time required by U.S. manufacturers.
- In custom plastic injection molds, Japanese companies can develop the molds in one-third the time of U.S. competitors and at one-third the cost.
- In autos, Japanese companies can develop new products in half the time–and with half as many people–as the U.S. and German competition.

To accomplish their fast-paced innovations, leading Japanese manufacturers have introduced a series of organizational techniques that precisely parallel their approach to flexible manufacturing:

- In manufacturing, the Japanese stress short production runs and small lot sizes. In innovation, they favor smaller increments of improvement in new products, but introduce them more often–versus the Western approach of more significant improvements made less often.
- In the organization of product development work, the Japanese use factory cells that are cross-functional teams. Most Western new product development activity is carried out by functional centers.
- In the scheduling of work, Japanese factories stress local responsibility, just as product development scheduling is decentralized. The Western approach to both requires plodding centralized scheduling, plotting, and tracking.

The effects of this time-based advantage are devastating; quite simply, American companies are losing leadership of technology and innovation–supposedly this country's source of long-term advantage.

> Unless U.S. companies cut new product cycles by 300%, Japanese manufacturers will easily out-innovate them.

Unless U.S. companies reduce their new product development and introduction cycles from 36-48 months to 12-18 months, Japanese manufacturers will easily out-innovate and outperform them. Taking the initiative in innovation will require even faster cycle times.

Residential air conditioners illustrate the Japanese ability to introduce more technological innovation in smaller increments–and how in just a few years these improvements add up to remarkably superior products. The Japanese introduce innovations in air conditioners four times faster than their American competitors; in technological sophistication the Japanese products are seven to ten years ahead of U.S. products.

Look at the changes in Mitsubishi Electric's three-horsepower heat pump between 1975 and 1985. From 1975 to 1979, the company did nothing to the product except change the sheet metal work, partly to improve efficiency but mostly to reduce materials costs. In 1979, the technological sophistication of the product was roughly equal to that of the U.S. competition. From this point on, the Japanese first established, and then widened the lead.

In 1980, Mitsubishi introduced its first major improvement: a new product that used integrated cir-

cuits to control the air-conditioning cycle. One year later, the company replaced the integrated circuits with microprocessors and added two important innovations to increase consumer demand. The first was "quick connect" freon lines. On the old product (and on the U.S. product), freon lines were made from copper tubing and cut to length, bent, soldered together, purged, and filled with freon—an operation requiring great skill to produce a reliable air conditioner. The Japanese substituted quick-connect freon lines—precharged hoses that simply clicked together. The second innovation was simplified wiring. On the old product (and still today on the U.S. product) the unit had six color-coded wires to connect. The advent of microprocessors made possible a two-wire connection with neutral polarity.

These two changes did not improve the energy-efficiency ratio of the product; nor were they intended to. Rather, the point was to fabricate a unit that would be simpler to install and more reliable, thereby broadening distribution and increasing demand. Because of these innovations, white-goods outlets could sell the new product, and local contractors could easily install it.

In 1982, Mitsubishi introduced a new version of the air conditioner featuring technological advances related to performance. A high-efficiency rotary compressor replaced the outdated reciprocating compressor. The condensing unit had louvered fins and inner fin tubes for better heat transfer. Because the balance of the system changed, all the electronics had to change. As a result, the energy-efficiency ratio improved markedly.

In 1983, Mitsubishi added sensors to the unit and more computing power, expanding the electronic control of the cycle and again improving the energy-efficiency ratio.

> Mitsubishi's time-based approach left U.S. air-conditioner companies ten years behind.

In 1984, Mitsubishi came out with another version of the product, this time with an inverter that made possible an even higher energy-efficiency ratio. The inverter, which requires additional electronics for the unit, allows unparalleled control over the speed of the electric motor, dramatically boosting the appliance's efficiency.

Using time-based innovation, Mitsubishi transformed its air conditioner. The changes came incrementally and steadily. Overall they gave Mitsubishi—and other Japanese companies on the same track—the position of technological leadership in the global residential air-conditioning industry.

In 1985, a U.S. air-conditioner manufacturer was just debating whether to use integrated circuits in its residential heat pump. In view of its four- to five-year product development cycle, it could not have introduced the innovation until 1989 or 1990—putting the American company ten years behind the Japanese. Faced with this situation, the U.S. air-conditioner company followed the example of many U.S. manufacturers that have lost the lead in technology and innovation: it decided to source its air conditioners and components from its Japanese competition.

Time-Based Strategy

The possibility of establishing a response time advantage opens new avenues for constructing winning competitive strategies. At most companies, strategic choices are limited to three options:

1. Seeking coexistence with competitors. This choice is seldom stable, since competitors refuse to cooperate and stay put.

2. Retreating in the face of competitors. Many companies choose this course; the business press fills its pages with accounts of companies retreating by consolidating plants, focusing their operations, outsourcing, divesting businesses, pulling out of markets, or moving upscale.

3. Attacking, either directly or indirectly. The direct attack involves the classic confrontation—cut price and add capacity, creating head-on competition. Indirect attack requires surprise. Competitors either do not understand the strategies being used against them or they do understand but cannot respond—sometimes because of the speed of the attack, sometimes because of their inability to mount a response.

Of the three options, only an attack creates the opportunity for real growth. Direct attack demands superior resources; it is always expensive and potentially disastrous. Indirect attack promises the most gain for the least cost. Time-based strategy offers a powerful new approach for successful indirect attacks against larger, established competitors.

Consider the remarkable example of Atlas Door, a ten-year-old U.S. company. It has grown at an average annual rate of 15% in an industry with an overall annual growth rate of less than 5%. In recent years, its pretax earnings were 20% of sales, about five times the industry average. Atlas is debt free. In its tenth year the company achieved the number one competitive position in its industry.

The company's product: industrial doors. It is a product with almost infinite variety, involving limitless choices of width and height and material. Because of the importance of variety, inventory is almost useless in meeting customer orders; most doors can be manufactured only after the order has been placed.

Historically, the industry had needed almost four months to respond to an order for a door that was out of stock or customized. Atlas's strategic advantage was time: it could respond in weeks to any order. It had structured its order-entry, engineering, manufacturing, and logistics systems to move information and products quickly and reliably.

First, Atlas built just-in-time factories. These are fairly simple in concept. They require extra tooling and machinery to reduce changeover times and a fabrication process organized by product and scheduled to start and complete all of the parts at the same time. But even the performance of the factory—critical to the company's overall responsiveness—still only accounted for 2½ weeks of the completed product delivery cycle.

Second, Atlas compressed time at the front end of the system, where the order first entered and was processed. Traditionally, when customers, distributors, or salespeople called a door manufacturer with a request for price and delivery, they would have to wait more than one week for a response. If the desired door was not in stock, not in the schedule, or not engineered, the supplier's organization would waste even more time, pushing the search for an answer around the system.

> The industry needed almost four months to respond. Atlas could fill any order in just weeks.

Recognizing the opportunity to cut deeply into the time expenditure in this part of the system, Atlas first streamlined, then automated its entire order-entry, engineering, pricing, and scheduling processes. Today Atlas can price and schedule 95% of its incoming orders while the callers are still on the telephone. It can quickly engineer new special orders because it has preserved on computer the design and production data of all previous special orders—which drastically reduces the amount of re-engineering necessary.

Third, Atlas tightly controlled logistics so that it always shipped only fully complete orders to construction sites. Orders require many components. Gathering all of them at the factory and making sure that they are with the correct order can be a time-consuming task. It is even more time-consuming, however, to get the correct parts to the job site *after* they have missed the initial shipment. Atlas developed a system to track the parts in production and the purchased parts for each order, ensuring arrival of all necessary parts at the shipping dock in time—a just-in-time logistics operation.

When Atlas started operations, distributors were uninterested in its product. The established distributors already carried the door line of a larger competitor; they saw no reason to switch suppliers except, perhaps, for a major price concession. But as a start-up, Atlas was too small to compete on price alone. Instead, it positioned itself as the door supplier of last resort, the company people came to if the established supplier could not deliver or missed a key date.

Of course, with industry lead times of almost four months, some calls inevitably came to Atlas. And when it did get a call, Atlas commanded a higher price because of its faster delivery. Atlas not only got a higher price but its time-based processes also yielded lower costs: it thus enjoyed the best of both worlds.

In ten short years, the company replaced the leading door suppliers in 80% of the distributors in the country. With its strategic advantage the company could be selective, becoming the house supplier for only the strongest distributors.

In the wake of this indirect attack, the established competitors have not responded effectively. The conventional view is that Atlas is a "garage shop operator" that cannot sustain its growth: competitors expect the company's performance to degrade to the industry average as it grows larger. But this response—or nonresponse—only reflects a fundamental lack of understanding of time as the source of competitive advantage. The extra delay in responding only adds to the insurmountable lead the indirect time-based attack has created. While the traditional companies track costs and size, the new competitor derives advantage from time, staying on the cutting edge, leaving its rivals behind.

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