Do Trade-offs Exist in Operations Strategy? Insights from the Stamping Die Industry

Mark Pagell, Steve Melnyk, and Robert Handfield

One of the basic concepts underlying operations strategy is that of the trade-off. Since the early days of this field, researchers have focused on the "inherent" trade-offs present between the various elements of value. Some focused on the trade-offs between efficiency and flexibility, or between cost and quality, arguing that those transformation systems that performed extremely well on one dimension of value (such as quality) could not simultaneously perform equally well on the other dimensions (cost, lead time, and flexibility). As a result, managers were left with the ongoing task of determining which dimensions of value they would emphasize. Ideally, these dimensions would be the same ones desired by the targeted customers.

However, recent developments have caused researchers and managers to reexamine the concept of trade-offs and its impact on both the firm and its competitive stance. The introduction and acceptance of such developments as Just-in-Time production (JIT) and Total Quality Management (TQM) have resulted in situations in which the expected trade-offs have not been observed. Under TQM, improvements in quality have improved lead times, cost, and flexibility as well. Under JIT, activities aimed at reducing lead times have also simultaneously resulted in lower costs, high quality, and greater flexibility. Although this evidence would seem to say that trade-offs are no longer a relevant concept, others argue that they are still important in today's world.

As our discussion indicates, managers formulating and implementing manufacturing strategy face a serious quandary involving trade-offs. How this quandary is resolved can have major implications for research and practice in operations strategy. We can resolve it by drawing on a structured case study of three companies.

These companies provide a unique, richly homogeneous setting for this study because of their strong similarities. They make the exact same product for sale to the same customers; they operate in the same geographic area; they use most of the same shop floor equipment; and their operational employees are of equivalent skill levels. In addition, they are among the largest companies in their industry niche. Despite these similarities, however, they have responded differently in such areas as outsourcing, amount of capital intensity, demand management, and market competition.

Must firms compete on all dimensions of value simultaneously? Or can managers "pick and choose" among market segments and deploy a variety of strategies to meet customer needs?

Using the data drawn from these three firms, we will set out to show that while simultaneity may exist at operational levels, trade-offs exist at strategic levels. And these trade-offs are often a result of the resources management chooses to invest in, with serious competitive implications.

THE TRADE-OFF QUANDARY

Underlying the notion of a trade-off is the premise of compromise. Such a view states that operational systems cannot simultaneously excel on all dimensions of value (where value is defined in terms of its four deter-

minants—cost, lead time, quality, and flexibility). As an operational system is increasingly focused on excelling in the dimension of cost, for example, compromises must be made on one or more of the remaining dimensions.

The trade-off concept was formally introduced and described by Wickham Skinner (1969) as a means of resolving one of the paradoxes that surround the understanding of operations management (OM): that of a plant being able to perform well simultaneously on the dimensions of cost, lead time, and quality. To Skinner, such performance was not possible because it ignored the realities imposed by trade-offs. Once introduced, this concept became a hallmark of thinking in OM until the early 1980s.

During this time period, several new developments took place in the OM area, including JIT, TQM, and time-based competition. These developments provided managers with a new way of viewing the tasks of designing and producing a product or service. They also shed a different light on areas that managers traditionally considered to be constraints. Areas such as setup and inventory were now seen not as constraints but as variables—issues that could be changed if management was willing to invest the necessary time, effort, and thought. Thus, the new developments forced a reexamination of these and other areas and their associated practices, resulting in a series of impressive improvements in performance. Just as important, the new developments also challenged the traditional view of trade-offs.

In practice, firms working under these new developments found that improvements in one area, such as quality, also generated improvements in the other areas, such as cost and flexibility. Such positive correlations, which ran counter to the traditional view of trade-offs, were captured under the term *simultaneity*. Some researchers extended this concept. Ferdows and DeMeyer (1990), describing competitive priorities as a "sand cone," argued that simultaneity was a result of building on successive foundations. The starting foundation was quality. Developments such as flexibility or speed built upon quality. Companies preserved their quality gains while adding new gains in the areas of lead time, waste reduction, and greater flexibility.

By the end of the 1980s, management was faced with a crucial contradiction. The expected trade-offs from the investments in all these values did not occur. Many have responded to the results by suggesting that there need not be trade-offs anymore, which would result in a never-ending attempt to improve companies along multiple dimensions simultaneously—obviously a laudable goal. However, trade-offs may continue to exist in other guises. If they do still exist, many proponents of simultaneity are traveling down a path that will dead-end in unexpected trade-offs that may hamper a company's competitive edge far more than any trade-off it plans for and understands.

One attempt at resolving this quandary was presented by Porter (1996), who introduced the concepts of a productivity frontier and operating efficiencies. The experiences of the firm are determined by its position relative to the productivity frontier, which Porter defines as

> [t]he sum of all existing best practices at any given time...the maximum value that a company delivering a particular product or service can create at a given cost, using the best available technologies, skills, management techniques, and purchased inputs.

Porter also notes that this frontier is a moving target because new innovations can shift it outward. The closer one gets to the frontier, the more likely one will experience traditional trade-offs. On the frontier, there are only trade-offs. However, the farther back from the frontier the firm is, the more likely it will experience simultaneity. In other words, simultaneity is indicative of slack in the existing processes. This is an intriguing and interesting resolution to the quandary. But to succeed with this approach, one must first establish the productivity frontier and then be able to position the firm's systems relative to it. This task is not yet possible given the state of current research tools and instruments.

Our approach is to examine three very similar companies. By addressing their differences, we will show that even in a very homogeneous group of companies, trade-offs do indeed exist. What's more, these trade-offs have serious implications for how the company is able to compete.

THE COMPANIES STUDIED

Consistent with the guidelines and recommendations set down by many researchers, several considerations were used in developing the sampling strategy and selecting the firms for our study. First, the selection was purposeful. We were interested in identifying companies and settings in which trade-offs were most likely to occur and in which different approaches to managing these trade-offs would become evident. Second, a multiple case study strategy was selected to provide a larger scope to examine the issue of trade-offs. Within this strategy, the multiple firms were regarded as replications.

Again, to help focus on the issues pertaining to trade-offs, the firms were chosen to emphasize commonality: in the same industry; located in

approximately the same geographic area; serving similar markets and with access to the same technological options and systems. There were several reasons for this emphasis on commonality. The first was to control for the potential presence of confounding variables. We also tried to maximize the potential for alternative explanations to exist (thereby providing an opportunity for falsification) by looking for firms that have installed a manufacturing technology—computer numerical control, or CNC—that can eliminate at least part of the traditional trade-off between flexibility and efficiency, as well as looking for industries that have been exposed to TQM, JIT, and/or time-based competition systems over a number of years. If trade-offs are identified in such a sample, then this finding will not likely be the result of the firms having limited exposures to such innovations that are frequently associated with the emergence of simultaneity. Simultaneous improvements along multiple fronts after firms adopt these innovations may be due to a movement of productivity frontiers or because these innovations truly do eliminate trade-offs. Exposure to many of the innovations that gave rise to the simultaneity proposition makes for a much stronger test because the existence of trade-offs in these environments is contrary to what is suggested by many of the proponents of simultaneity. In addition, the differences will not likely be due to differences in the firms' competitive space.

Figure 1
Criteria for Study Firms

Criteria	*Justification*
Use advanced manufacturing technology	These technologies have been described as mitigating the trade-off between flexibility and efficiency, so the existence of trade-offs in these settings provides a stronger test.
Exposure to JIT, TQM, and/or time-based competition	To test the concept of simultaneity, the firms had to be aware of programs that might enable simultaneous improvements on multiple elements of value.
Same geographic location	Eliminates possible complications from culture, local economic conditions, availability of skilled labor, and the like.
Same customers	Eliminates possible complications from different customer requirements across various competitive priorities.
Ability to make body dies	Requires equipment and capabilities beyond the average tool and die shop, effectively limiting the size of the strategic group.
Prototyping capabilities	Requires equipment and capabilities beyond the average tool and die shop, effectively limiting the size of the strategic group.

We were able to identify three companies satisfying these requirements. The three make metal stamping dies primarily for automotive applications. Specifically, they make and sell body dies used to stamp out the exterior sheet metal for cars assembled in North America. This product line is critical because it effectively limits the number of firms that can be considered. It also reduces the opportunities for introducing complicating factors. **Figure 1** details the selection criteria for the three companies.

The overall metal stamping industry is very large and fragmented, with thousands of tool and die shops located in the United States. In general, the cost of entry into this general category of business is fairly low. The capital requirements are relatively modest. Any firm can buy a CNC machine center and a few other general purpose tools for under half a million dollars (less if the equipment is preowned). And the labor requirements are also modest. All that is needed is at least one machinist and a tool and die maker. Once these elements are in place, the firm can start making stamping dies.

Not all firms are able to make and sell exterior auto body dies. These dies are very large, often large enough to stamp out the entire side of a car or van. The equipment necessary to machine this size of die is huge, with table sizes reaching 30 square feet or more. The machining and material handling capabilities needed to move parts this size are far beyond the capabilities of most die-making firms.

Tolerances and contours are also important issues. The exterior sheet metal of a car may have a number of complex curves that must be cut to tight tolerances. Producing these unique shapes to the proper contour (especially with the size of the parts being produced) requires a great deal of skill and relatively high investments in capital equipment. In general, these machining capabilities are also beyond the levels found in most small tool and die shops.

Such a firm must also be able to provide prototype parts. Most contracts for these dies require the supplier to provide pre-production stampings to be used in building prototypes of the new models. To make pre-production parts for stampings of this size, the companies must have not only the machining abilities to cut the die but also the stamping equipment to produce the sheet metal parts made from the dies. Al-

Figure 2
Company Characteristics

Characteristic	*Description*
Customers	Generally the "Big Three" North American Auto Assemblers
Equipment	Very large computer controlled machine centers—generally the same age and from same supplier
Employee skill levels	Machinist and die assemblers at all three companies went through state-recognized apprenticeship programs
Unions	All non-union
Location	All located in large cities in Michigan
Size	200–600 employees

though many tool and die shops have one or two small presses on which to make prototype parts, few have the size of press required to make such large parts. Even fewer have their own stamping lines, consisting of between 10 to 40 presses—a feature of the firms in our sample.

By focusing on firms making and selling exterior body dies, we essentially limited the population to a relatively small number of unique firms, enabling closer comparisons. The industry SIC code for these firms is 3544.

Two other issues influenced the choice of firms. First is their focus on manufacturing. The vast majority of resources are tied up in manufacturing or design processes. Without extensive support staffs, generally every decision made regarding structure or infrastructure is an operational decision. So issues that are arguably not specific to operations, such as one firm's decision to have lifetime employment, are being made by management mainly to improve the way operations perform. They have no impact on operational strategy. By focusing on companies whose primary functions are operational, it is easier to examine how trade-offs are induced by the investments in various resources.

The final criterion in choosing these companies is their long-term survival. Although none of them has been profitable every year, they have all survived for at least 20 years. In addition, their primary customers, the Big Three North American auto manufacturers, have been aggressively cutting back on the number of suppliers they use. In other words, the fact that these companies still exist to serve this market suggests that they have been and remain competitive.

The three companies are among the largest 25 firms in their industry group and are also in the top five main suppliers of stamping dies for exterior sheet metal in the United States. **Figure 2** details the similarities among them. They use very similar types of machining equipment, although they differ in terms of how the equipment is used. Extensive use is made of large CNC machine centers to do the bulk of the machining of the die faces, which is the only capital-intensive step in the process. Most of this equipment comes from the same supplier and is roughly of the same age. The result is that the type of machining equipment is almost identical among the three firms.

The skill level of the operational work force among the companies is roughly identical. The two key functions performed in the three plants are that of machining and assembling the dies. All three companies (non-unionized) use state-recognized apprenticeship programs to train employees for their jobs. The extent to which the labor is equivalent among the firms can be determined by noting that two of them are located in the same city and frequently "poach" workers from each other.

Finally, the firms are located within 150 miles of each other. To protect their anonymity—a requirement, since their managements provided access to sensitive information—the names of the companies have been changed to Capital, Lifetime, and Overtime. These names reflect a key decision choice made at each company.

Capital

The largest company in the sample, Capital employs some 600 employees. At the time of data collection, it was the largest maker of dies for automotive applications in the United States. Like the other two firms, Capital is located in a large city in Michigan and has been in the same location for more than 20 years. At the time of our visit, the owners had been in control for about 2.5 years. In addition, the firm had recently gone through a decertification process, which coincided with the sale of the company.

Capital's unique competencies are speed and capacity, which it has achieved primarily through heavy capital investments. This was the only company in the sample that made dies from blanks rather than castings. A blank is a solid block of steel that is machined to the final shape of the die. Using blanks made Capital much faster than its competitors, but at a cost. Machining dies from blocks of steel requires the removal of a great deal of metal. The block of steel must have dimensions as large as the largest dimension of the finished product. So a die with a high point that is six inches higher than the low point may mean removing a few inches of metal across a 100-square-foot area, requiring a serious investment in equipment.

Capital made about the same number of dies as the other two companies in the sample combined, but with about five times as many machine centers. The ultimate impact of this investment was that the average machine time to go from blank to finished die was about 30 hours. This was in marked contrast to the 12 weeks the other two companies required to obtain a casting from a forge.

To offer this speed advantage, the company needs enough capacity to avoid having dies waiting for a machine or die assembler. Its assembly capacity is equal to the maximum level of production. Because of the presence of excess capacity (in all but the busiest periods), Capital was the only company that actively sought work outside the automotive industry, such as in aircraft and pleasure craft, to try and maintain high levels of use.

The heavy investments in equipment have led to the key trade-off for Capital. Its machining capacity gives it a speed advantage and the ability to seek work in other industries, but at a cost both in dollars and in lost commitment from the work force. In dollar terms, Capital has the highest fixed costs of the group. It must actively seek work in other industries to try and pay for its overhead.

The other cost is the lost commitment from the work force. To help cover high overhead costs, Capital has a work force policy that necessitates large fluctuations in employment. When management can find the work, it will run three shifts with all the overtime it can squeeze in; the end goal is to be running 24 hours a day, seven days a week. When the plant is this busy, it is making money because it can cover the fixed costs. It only outsources when it is fully loaded for the foreseeable future. Such a policy helps guarantee that the fixed costs are spread over as much work as possible. However, to control costs, it has to lay off employees when work is slow.

Over the three years prior to our data collection, Capital's employment had fluctuated from 500 to 700 employees. Because the firm is in a major industrial city where many of the skills it requires are in great demand, many of its laid-off employees do not come back when they are recalled because they have found other work. The company has relatively high turnover and is usually looking for skilled employees.

A final human resource problem Capital encounters is that it is hard to grow talent internally. The seniority system that remains from its union days has some loopholes, but in general the last person hired is the first fired. With every downturn, the people who are most likely to have recently received training are also those most likely to be laid off—often to take their new skills elsewhere. So the company prefers to hire journeymen who have already completed all their training, rather than grow their own talent. This tends to strain the ties between the company and its employees.

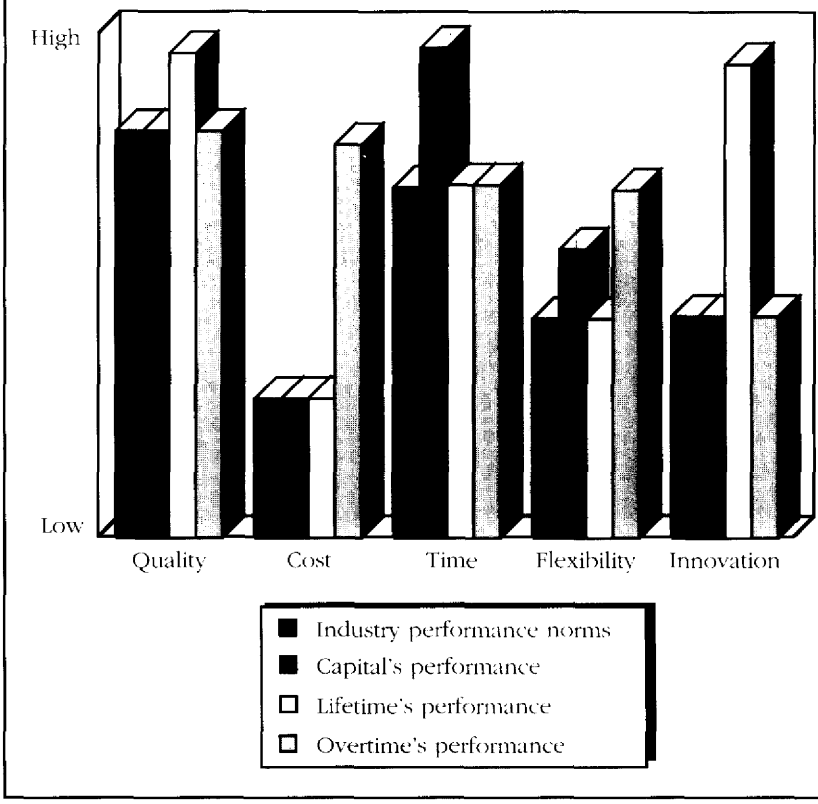
By investing heavily in such structural resources as equipment, Capital incurs a number of strategic trade-offs (see **Figure 3**). It is faster than the competition. Its excess capacity allows it to enter other markets. But the equipment must be paid for. So Capital trades off speed and flexibility for higher fixed costs and low work force commitment.

There are two key competitive implications for this system. First, the speed and capacity enable Capital to make more money than the competition in good times, but it risks losing more in downturns as well. Second, the hiring and firing of employees, most of whom will gain their skills elsewhere, means the work force does not have a strong link to the firm and cannot be relied on to help make it more competitive.

Lifetime

In many ways, Lifetime is the opposite of Capital. It has a very limited investment in equipment, but a large investment in its work force. Its

Figure 3
Comparison of Company Performances to Each Other and to Industry Norms



unique competency is the ability to leverage the knowledge of its work force to create innovative and/or high-quality products.

Die manufacturing is a very mature industry. However, customers do look for innovations, such as the ability to stamp different materials—aluminum, say, or thin-walled steel. In addition, customers are often looking for new ways to increase the efficiency of stamping lines, often by combining multiple steps (hence multiple dies). These increases in efficiency require the die maker to create dies with new capabilities. Finally, customers may require a die that is a shape, size, or contour never before made. Of the studied firms, only Lifetime has the ability to consistently design and build dies that can be used in these innovative ways, especially at the levels of quality demanded. This competency is directly related to the company's policy of no layoffs, which drives many of its decisions—from the speed with which it grows (or does not grow) to the way it invests and makes dies.

Once hired at Lifetime, a person essentially has a job for life (assuming he performs adequately) at a set number of hours per week. This number of hours is never exceeded and is almost never reduced. The end result is effectively a fixed level of human capacity that does not use all the available machine capacity. Moreover, the company invests only in the level of equipment needed to maintain operations running two shifts a week. Demand in excess of this level is outsourced or refused.

Lifetime machines dies from castings—not, as Capital does, from blanks. However, the equipment used to machine a blank is identical to that used to machine a casting. What differs is the amount of machining that needs to be done. A casting is made by a supplier who pours steel into a styrofoam mold (made in house). Because the casting is much closer to the final shape than a blank, it requires less machining. And the machining that must be done is mainly the skilled work of getting a die to the exact shape needed. Thus, using a casting allows the firm to ensure that its machinists are using all their skills most of the time. Unfortunately, it also requires a castings supplier and approximately 12 weeks lead time.

Because of the presence of long-term employment, Lifetime is very careful about how it hires people. Management expects its employees to be willing to work outside their trade, such as in other parts of the plant. Because jobs are essentially guaranteed, Lifetime has very low turnover. What turnover it has is most likely to occur during upturns in demand, when some workers leave to take jobs at plants offering more overtime. However, most employees realize that those firms offering extra overtime when busy are usually the same ones that will lay off employees when demand falls. So the employees who stay at Lifetime are those who like the idea of a steady paycheck.

Lifetime essentially develops its employees. The company rarely hires a journeyman. Instead, it relies on its apprenticeship program to develop highly skilled employees who have a strong connection to the firm. From the beginning, management tries to identify in each employee the types of jobs he is best able to do. This applies to both the highest and lowest performers. By keeping an employee for many years, management can learn what his unique skill set is. To management, this certainty is very important.

By investing primarily in its people, Lifetime incurs a different set of strategic trade-offs than Capital (see Figure 3). Its work force can be leveraged for competitive advantage, but it can not take advantage of large upswings in demand. Moreover, its focus on people has led to a flexible work force but a small base of capital equipment. So it has to buy castings, which increases lead times but allows employees to focus on the work that requires the most skill—the work they are best at.

The competitive implications of this system differ from those of Capital. Lifetime is profitable over the long run, but it cannot take advantage of short-term changes in demand (low-volume flexibility). It has traded speed and capacity for the ability to leverage its employees' knowledge to create high-quality products that often incorporate innovations its competitors cannot duplicate.

Overtime

The third company, the smallest in the sample, uses a system that has elements of both Capital and Lifetime. It has made low levels of investment in equipment, yet it also chases demand. Nor does Overtime make as many large dies as the other two companies. Nevertheless, it still gets orders for such dies. Located in the same city as Capital, it often finds itself in competition for the same people. And Overtime's management considers both Lifetime and Capital major competitors for the "best" work.

Overtime uses a different method for making dies. Like Lifetime, it makes its dies from castings. However, both the castings and the molds are outsourced, which results in Overtime having the longest lead time of the three companies studied. It also has the lowest equipment investments and associated fixed costs.

Overtime prefers to run operations 24 hours a day, seven days a week, if possible. Each day consists of two shifts. This means the average employee works six or seven 12-hour shifts a week. The reason for running two shifts a day compared to the more normal three is that man-

agement believes it would not be able to recruit enough qualified people for three shifts. The combination of limited capital investments and extreme reliance on overtime results in two effects. The first is that Overtime runs its equipment in full use, nonstop. Equipment, not employees, is treated as the bottleneck. Second, Overtime has a cost structure characterized by relatively low fixed costs and high variable costs.

Figure 4
Summary of Critical Dimensions Among Firms Studied

Company	*Key Strategic Advantages*	*Critical Disadvantage*	*Relative Fixed Costs*	*Relative Lead Time*	*Employee Commitment*
Capital	Capacity and lead time	High fixed costs, low employee commitment	High	Short	Low
Lifetime	Ability to leverage work force and its knowledge base	Difficulty in adjusting internal capacity in response to changes in industrial demand	Medium	Medium	High
Overtime	Low costs and volume flexibility	Long lead times and low employee commitment and knowledge	Low	Long	Low

Labor turnover at Overtime is very high. Being a small company located in the same city as Capital (often competing for the same employees), Overtime must pay the same wage rate, but with lower benefit levels. It attracts people who are either unable to find work in more secure places (often new journeymen), or people who are very motivated by money. When the company is busy, its competitors are generally busy as well. So people who hired on because they wanted that type of work, but not a 70-hour week, leave. Then, when the work slows down, those who are primarily "money hogs" lose a large share of their motivation. Management's choice to make the equipment the bottleneck leads to high turnover and little or no employee commitment.

Overtime has made two key trade-offs (see Figure 3). One is the decision to have low levels of investment in equipment, which leads to the longer lead times associated with using castings. The second is related to the first: trading a stable work force for full use of the equipment it has invested in. These trade-offs have significant competitive implications for Overtime. On the one hand, it has lower costs to spread over each die, making it the lowest-cost producer in the sample. On the other hand, it also has the longest lead times due to outsourcing castings and molds. And it cannot leverage its employees for higher levels of quality or innovation.

DISCUSSION

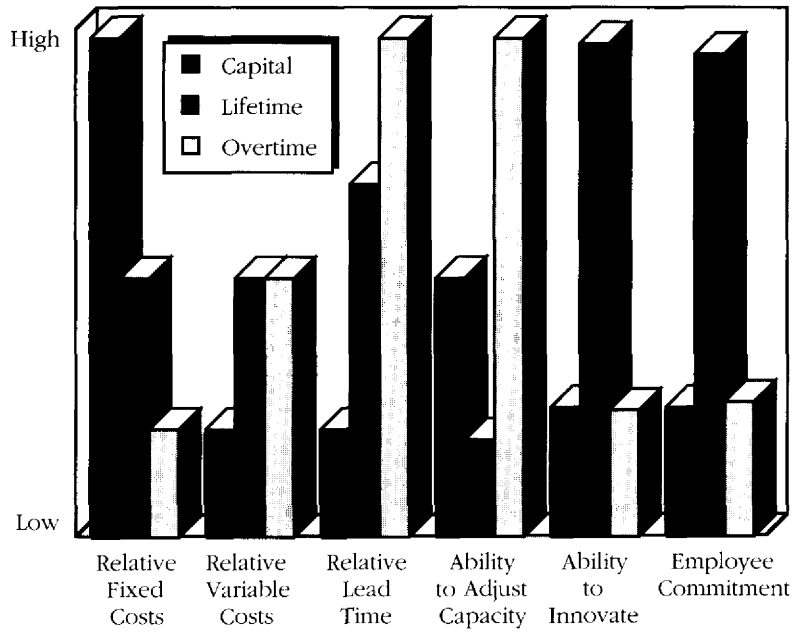
Several of the critical dimensions differentiating the three companies we studied are summarized in **Figures 4** and **5**. As we can see, even though the three firms compete for the same customers, they have strongly differentiated themselves. The managements of all three firms recognize that they must satisfy the same set of industry norms: quality and on-time delivery. One reason they make extensive use of machine centers is to provide the capability of cutting contours to very tight tolerances. This capability reflects the quality norm.

In addition to meeting these industry norms, the firms have developed a unique set of capabilities or core competencies that reflect the interaction between investment strategies and management skill sets. They also reflect the impact of "niching," or the identification of a unique set of market needs that cannot easily be met by other firms and that offer opportunities for survival and growth. Management identifies a unique strategy or method of offering value to its customers. This strategy, in turn, drives the resulting technological investments. Within the environment defined by these investments, management develops, implements, and refines strategies for surviving and growing.

As long as these strategies are successful (as observed in the three firms studied), they affect future investments, which are continuations of past investment practices. In other words, Capital will likely continue investing in equipment, Lifetime will likely continue investing in the knowledge base of its employees, and Overtime will likely avoid making any investments in either equipment or knowledge development.

Of the three firms, Capital is the only one to compete effectively in shorter lead times. Its investment in technology that can make dies from solid blanks has enabled it to overcome the casting bottleneck affecting the other two firms. As a result, it is not constrained by the 12-week lead time facing the other two firms. However, this increased level of investment has created its own burdens. Given the high overhead costs Capital faces, its management has developed a strategy of seeking out new markets for its capabilities in

Figure 5
Comparison of Firms' Characteristics



order to reduce the firm's dependence on the automotive industry and the associated problems when demand suddenly drops. The more Capital invests, the less able is it to tolerate any downturns in business, so the more aggressively it must seek out new markets.

In contrast, Lifetime, by investing primarily in the skills and expertise of its work force, has implemented what can be described as a "knowledge factory." For management, the key to success at Lifetime is the knowledge possessed by its employees. To encourage workers to develop and share this knowledge with customers, Lifetime has relied on two tactics. The first is the promise of constant employment in number of work hours per week, which not only makes labor a fixed cost but also provides worker security (resulting in more loyal employees). Second, management has tried to identify the capabilities of all its employees, then assign each employee to an area or areas of the plant where his capabilities can best be used and developed.

This strategic stance brings with it several important implications for Lifetime. First, the company has a strategic advantage in situations where flexibility and knowledge are critical. Second, it is least able to adjust quickly to changes in short-term demand. It takes time to recruit new employees and allow for the knowledge generation process to take place. Short-term variations in demand are accommodated either by relying on its vendors and using subcontracted capacity or by simply refusing the order.

Overtime, with limited investments in technology and equipment, competes in the marketplace by offering volume flexibility. That is, of the three firms, it is the best at responding to sudden upswings in demand. It can do this by relying on overtime for its employees. As demand goes up, overtime increases; as demand drops, so does the overtime. Because of less equipment combined with almost completely variable labor costs, Overtime is also the lowest dollar cost supplier (as measured in terms of direct dollars per die).

This strategic stance has created several liabilities for Overtime. First, a lot of overtime work is essentially a short-term solution. After a period of time, employees experience fatigue. There is a limit to the number of 70-hour weeks they can work. Second, the loyalty of the work force is limited primarily to money. This means that when the demand drops, turnover increases as employees leave (either by personal choice or because of company layoffs). Finally, Overtime does not have the same type of strategic assets found in Capital and Lifetime. It exists primarily because of its ability to accommodate sudden short-term variations in demand and offer low prices.

The three cases presented here show not only that trade-offs still exist, but that they have significant competitive implications. Companies taking advantage of innovations such as TQM, JIT, and the like have indeed experienced simultaneous improvements along multiple competitive dimensions. However, our research suggests that to expect these improvements to accrue indefinitely or at all levels would be a serious error.

For example, every company in our sample invested in CNC equipment at about the same time, which lowered the cost of making a die because the equipment was faster and more accurate. In essence, improvements were made along all competitive dimensions. From a tactical standpoint, no trade-offs exist with the investment in the CNC. However, when one looks at the entire system from a strategic standpoint, trade-offs can still be found.

The new equipment must be paid for. Capital and Overtime try to pay for it by running it as close to 100 percent of the time as possible. Lifetime cannot spread its fixed costs over as much work without risking its investment in people. Moreover, machine time may be reduced, but the decision to use blanks is still not viable for Lifetime or Overtime—hence, they still cannot compete on time, even if their lead time has been decreased somewhat.

Trade-offs are often strategic in nature and have major implications for how a company competes. To retain its competitive advantage, Life-

time must continue to invest in people—usually at the expense of investing in equipment. If it wanted to be both the fastest company and the most innovative, it would need to expand its investment in equipment significantly to allow for machining from blanks. Investing in both equipment and people simultaneously would be extremely expensive and not cost-competitive, since the new equipment would often be idle to ensure that the company did not lose employee commitment.

This is not to suggest that in some industries there are no companies that manage to be the best along many, if not all, applicable competitive dimensions. However, even for these companies, which constantly get better along every dimension, trade-offs should be expected. Firms may hit the productivity frontier, or they may hit another wall—namely, that investment in one capability necessitates investing less in another. The limitations in available investments is a classic trade-off that is unlikely to disappear. ❐

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Mark Pagell is an assistant professor of management at Kansas State University, Manhattan, Kansas. **Steve Melnyk** is a professor of marketing and supply chain management at Michigan State University, East Lansing, Michigan. **Robert Handfield** is the Bank of America University Distinguished Professor of Supply Chain Management at North Carolina State University, Raleigh, North Carolina.