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Supply Chain Management: Built on Chaos?

W. Rocky Newman
Editor-in-Chief

If only we knew what the customer wanted, life would be much less complicated. Decision making, both long and short term, would be much easier if we just knew what people wanted from us. Knowing when, where, how many, and what our customers demand would be a good start. Getting a handle on the demands of our customers can be key to making decisions in marketing, operations, purchasing, finance, accounting, human resources, management information systems, engineering, and every other functional area within business.

We spend time and resources trying to forecast customer demand, but in many cases we just sit by the phone waiting for it to ring. Piles of inventory, extra capacity, or inflated delivery time quotations can help buffer against the uncertainty of when or what customers will want when the phone does ring; but buffers like that can be very expensive. Flexible technologies can help but they are expensive and like buffers, may only smooth over unnecessarily complex issues. In many ways it would be nice if we only had to worry about "plain vanilla" orders, say from one customer asking for one thing in one color made from material brought in one form from one vendor. Is that usually profitable? Realistic?! There is no doubt in the real world that it's the complexity of the typical business environment in which we compete that creates the uncertainty we face waiting for that phone to ring. Therefore, I suggest that it is how we deal with complexity that can make the difference in our ability to compete successfully.

Traditional thinking is to take the demand uncertainty we face and treat it as a random variable. We can forecast customer orders, estimate delivery times of our suppliers, compute standard costs and processing times within our own business, or estimate usage or yield rates from our raw materials but in the long run, we know that we must protect ourselves from what we consider to be random variation around these estimates and standards. James Gleick, in his best selling book *Chaos* (Penguin Books, 1987) posits that much, if not all, of what we treat as a random phenomena (like the weather) is really more deterministic than we can see. He argues that it is our inability to understand relationships and/or if we do, our inability to process the information needed to extrapolate relationships into the future that forces us to deal with them as random phenomena. If this is true, the more we can simplify our worlds or more efficiently we can process information about our worlds, the more we can treat with certainty and the less we have to deal with uncertainty. Thus, saving all of the costs and baggage associated with the buffers mentioned earlier.

Traditional thinking, again, is to circle the wagons around our organizations. The JIT and TQM revolution called for us to look inward within our organizations and to minimize the use of buffers to smooth over unnecessary complexity and its resulting uncertainty. These concepts encourage us to better understand our internal processes and continuously streamline, integrate, and simplify them. They suggest that we then use strategically placed flexibility or buffers to deal with any remaining uncertainty. Now we are hearing about Supply Chain Management (SCM). SCM experts ask us to look outside the wagons circling our businesses, toward our customers, our suppliers, our customer's customers, and our supplier's suppliers. By applying the lessons learned from improving our internal processes, they suggest we can streamline, integrate, and simplify the external relationships that tie us to our supply chain.

Gleick maintains the world is more deterministic and less random than we think. JIT and TQM and now SCM

experts would agree. They suggest that we sort out what we can before dealing with what we can't. They would have us first "factor out the constants" as your old algebra teacher might say, then put the computers and other technology to work on the rest. Gleick argues that increasingly more powerful computers will let us see the patterns behind what we now think is random. SCM experts would have us rethink the relationships between firms and to restructure them as to be ready for the technology when it comes.

The Executive Viewpoints in this issue offer excellent testimony to this effect and are part of a larger conversation going on in business today. They suggest the same process of streamlining, integrating, and simplification within the supply chain may get us to a point where we can treat inter-firm relationships with more certainty and use technology to better deal with remaining uncertainty. This is a good conversation and one that academics should be listening to with a keen ear.

Russ Bunio and Katherine Beck have sounded a call for us to look at the practices of Boeing and engage in a conversation about supply chain relationships. The Editorial Board of the MAJB has begun this conversation and has issued a call for a special issue on SCM to be published in the Fall of 2000 (see page 4). We feel that our journal is a good place to continue the conversation about SCM. We invite you to participate.

Building World-Class Supplier Relationships

How To Turn A Business Supplier Into A Lifetime Partner

Russ Bunio
Vice president and general manager, Materiel Division
Boeing Commercial Airplane Group

Our factory doesn't end at our factory doors. It extends around the world to the processes, products, and property of every one of our suppliers. In fact, about 50 percent of the cost of building our airplanes comes from our suppliers. That's why organizations simply cannot reach aggressive goals such as outstanding quality, cost, and cycle time unless they continuously improve their relationship with their suppliers.

I believe that if Boeing is going to succeed as a company, the only way to be successful is for our suppliers to be successful. By forging a new kind of working relationship, Boeing and its suppliers can help each other achieve great success. Our suppliers are very valuable to us. The key is figuring out how to bring them in as part of the operation.

Suppliers as Partners

Fundamental to working with suppliers is working *with* suppliers; developing a strong relationship that has trust, respect, and understanding. Some people look at suppliers as the enemy. I look at them as our ally. In fact, to have a successful relationship with our suppliers, we must even learn to look at them as partners. Partners in a process of improvement.

Partnership is not the way many American businesses view their relationship with their suppliers. In Japan, businesses work very closely with their suppliers. In Japanese business, if a supplier runs into trouble, the reaction is to go help it. In the United States, however, the first reaction sometimes is to fire the supplier and find someone else. When a company does that, it misses a huge opportunity to invest in the supplier relationship.

My experience at other companies has taught me that a partnership approach pays off. When I worked at General Motors, we spent a great deal of time working on mutual issues with our suppliers. We viewed suppliers as part of the solution, not part of the problem. At Cummins Engine Company, we established ten companywide practices, such as "the customer is always first" and "build quality in, don't inspect it in." One of our ten practices was "treat suppliers as partners." In fact, we created a "roadmap" on the subject called "Suppliers as Partners" that was required reading for all Cummins factory managers worldwide. We wanted people to have something in front of them at all times to remind them that partnership is the best way to deal with suppliers.

Suppliers are very valuable to us. The key is figuring out how to bring them in as part of the operation.

This is the kind of commitment I believe we need at Boeing. We need to spend time with our suppliers to understand where they're going and to have them understand where we want to go. Getting that alignment is the key to an improved relationship.

The first step in building this kind of relationship is to get out there and get to know our suppliers better. Face-to-face communication. We, as the customer, need to meet with each of our suppliers and discuss what we expect from them. For example, at Boeing we expect 100 percent quality. If a supplier has a quality problem, it must shut down its line and fix the problem immediately. We expect suppliers to continuously cut costs. We expect them to deliver parts on time. And we expect them to use the latest technology.

At Boeing we also need to listen to our suppliers. We need to understand our suppliers' goals, challenges, and problems. Maybe there's a process that we at Boeing need to improve or a problem we can help them solve. We may get some surprising results.

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For example, when I was at Cummins in 1992, we were having our first meeting with a supplier to discuss forming a strategic alliance, and we weren't sure where we wanted the discussion to go. We asked the supplier team, "What would you like to get out of this partnership?" One of the team members said, "Well, we're having problems keeping our health care costs down. We'd like to learn what you've learned about that and pull something from it." This was unrelated to our business relationship, but it was a critical issue for their company. So Cummins provided the information and resources to help the supplier improve its health care costs. Finding solutions like this is not rocket science, but it's a way to make sure we're working together. It's a way we can both win.

Providing Feedback

Not only do company managers need to let suppliers know what is expected of them, they also need to tell suppliers how they're doing. One of the initiatives that my team is developing at Boeing involves giving suppliers regular, honest performance feedback every year.

We did this at Cummins for about seven years, and it was very effective. One of the first evaluations our organization did was with one of our largest suppliers. We filled out an evaluation—much like a report card—and took the chairman of the supplier company through it. He said it was the most complete and thorough feedback he'd ever received. He took the evaluation back to his plants, and within three months he and his team developed improvement plans for all the areas that had an average or unacceptable rating.

Another supplier took his report card very seriously, as well. He took it back to his staff and said, "This report card is unacceptable. If my daughter came home with a report card like this, she'd be locked in her room for six months." The supplier's team then set to work on improving the trouble spots.

Most companies are not very good at providing this type of regular feedback to their suppliers. We have processes in place to do that with our own employees, and we need to do that with our suppliers also.

In addition to providing feedback on poor performance, I believe that companies need to develop a process to give suppliers credit for what they do above and beyond what's required. If you have suppliers who do all kinds of extra work above and beyond producing parts—proactive, value-added work—how do you give them credit? Once such a system is in place, it can be used to put a value on everything suppliers do.

Projects to Improve our Relationship

To improve our relationship with our suppliers, we in Boeing Commercial Airplane Group Materiel plan to build on the processes that are already in place and add some different approaches. As explained in the adjoining article, "Getting Lean: We Can't Do It Alone," we are sharing our Lean Manufacturing principles with suppliers to help them eliminate waste and reduce cycle time. We are also starting to develop strategic alliances with certain key suppliers. We will align our goals and processes to optimize their capabilities. When we get that to work, we will discover that our suppliers can do much more than we ever thought.

If you have suppliers who do all kinds of extra work above and beyond producing parts…how do you give them credit?

One new initiative we are introducing for Boeing Commercial Airplane Group is the Continuous Cost Improvement Process. In CCIP, we will work with suppliers to identify what drives their costs and how we can work together on improvement projects to reduce those costs. What's different about this process is that it will never end. Continuous means we'll do it forever. Cost means we'll go after all costs that affect us. Improvement means we want to see improvement every year. And process means it's ongoing. After close coordination among our Materiel employees and our suppliers, we plan to set target cost reductions for these suppliers to achieve. We will then work with them to help them reach these target goals.

Another way we will improve supplier relationships is by establishing different "councils." We will have a purchasing council—initially made up of all Boeing Commercial Airplane Group purchasing groups and, later, all purchasing groups across Boeing—to leverage our buying power. We will also have a supplier council made up of suppliers and materials people. The members of the supplier council will meet regularly at alternating locations with an agenda of helping each other improve. We will listen to them to help us get better, and they can listen to us to help them get better. I was on a supplier council at Cummins, which was a very positive experience. There was a tremendous amount of sharing and trust on that council. The supplier members were supposed to rotate every two years, but after the first two years no one wanted to leave the council. They thought it was that valuable.

To help our suppliers run their businesses profitably over the long term and accommodate the peaks and valleys of Boeing production requirements, our Materiel team has a new initiative to provide improved production rate forecasts on a quarterly basis. This will allow our

suppliers to plan their resources, plants, and facilities more efficiently so that they can support us in busy times and look for other business in slow times.

The Competitive Advantage

Treating suppliers as partners is an evolutionary process that will take time. Suppliers have ups and downs—just as we do in our day-to-day business—but I've never met a supplier who didn't want to succeed and who didn't want its customers to succeed. We've gone through some tough times in the last eighteen months, and we have tough times ahead. But I believe that forging closer relationships with suppliers will accelerate fixes to our current problems and prevent future ones. Going forward and implementing suppliers as partners will also give us a comparative and competitive advantage in the future. I don't think our competitors will be working with suppliers the same way we will, and Boeing will be the preferred customer. ■

About the Author

Russell J. Bunio, serves as vice president and general manager of the Materiel Division of Boeing Commercial Airplanes Group. He is responsible for contracting with and managing the commercial Airplane Group's supplier network, as well as ensuring the quality and delivery of procured components for Boeing commercial jetliner programs. Prior to joining Boeing, Bunio held a similar position with Cummins Engine Company in Indiana, was the head of materials at New United Motors Manufacturing, Inc. (NUMM) in California, and held various positions with General Motors for fifteen years. Bunio holds a bachelor's degree in economics from West Virginia University and is a graduate of European Studies at the University of Basel, Switzerland.

Getting Lean: We Can't Do It Alone

Kathrine Beck
Manager magazine

■ *Boeing spreads the word upstream to suppliers*

Martha Stewart would be envious. You've got the garden beds perfectly weeded and carefully mulched. Any little weeds that pop up are whisked away before they have a chance to grow. You have everything under control except for the fact that your neighbor's yard is an untended jungle. Morning glory and crabgrass pay no attention to the property line, and you're downwind from a lawn full of bobbing dandelions gone to seed. If they'd just get their yard cleaned up, you'd have a much easier time maintaining yours. It works the same way when a company moves to a Lean Manufacturing system with a smoothly flowing value stream as its goal. Upstream suppliers can make the job that much tougher if their processes are wasteful and inefficient. Boeing and many of its suppliers are working hard to "get lean." But, ultimately, the success of everyone depends on smoothing out processes all along the way.

In several areas of Boeing, Lean thinking is now being expanded to suppliers, so that the entire flow—from an aluminum ingot to a finished airplane—runs smoothly. At the Wing Responsibility Center in Renton, for example, involving suppliers is crucial in order for the center to meet its aggressive goal of reducing the time it takes to get from raw materials to finished wing by 85 percent.

Jon Sutter is the Lean Manufacturing site leader for Boeing Commercial Airplane Group Materiel, and it's his job to work with suppliers and help them get lean. Sutter explains, "We want to cut down cycle time. We want to reduce inventory levels from raw materials to finished product. We want to cut down rework. We want all elements of the supply chain leaner."

Getting the Lean Message to Suppliers

Convincing suppliers that they should change the way they do things requires tact and skill. "They are sovereign companies," says Sutter, adding that some suppliers are more likely to view themselves as independent suppliers of products than as part of a value chain. "Sometimes the suppliers are shocked with the amount of waste in their operation," says Sutter, "but it's undeniable."

Spreading the gospel of Lean begins with making presentations and handing out educational materials, plus doing a diagnostic exercise to help suppliers uncover the waste in their processes. One of the best ways to make improvements is to do an Accelerated Improvement Workshop, an intensive five-day session in which employees, armed with stopwatches, change and improve the way they do their jobs.

Some suppliers are already thinking lean. Successes include a commitment from Alcoa, which is at the very beginning of the supply chain, to reduce its cycle time by 84 percent. Boeing Commercial Airplane Group Materiel is working with Alcoa to level the supply of and demand for its product throughout the Boeing supplier base.

Martin Lodge is director of Continuous Improvement at B. F. Goodrich Aerospace Aerostructures Group (formerly Rohr), designer and builder of nacelles and pylons for Boeing. He says his company first encountered Lean Manufacturing principles in l993. At that time, this manufacturer went through the AIW, or *kaizen*, process and had a positive experience, but didn't begin serious deployment of Lean until mid-1994. Up against the incredible competitive pressure facing everyone in the aerospace industry, the company was implementing Lean principles across all manufacturing sites by late 1995, learning from Toyota—considered by many to be the place where it all started.

By the time Boeing began its initiative to improve supplier processes in the spring of 1996, B. F. Goodrich was already on the same path. Just as Boeing is working with its suppliers to eliminate waste, B. F. Goodrich is working with its suppliers, another tier upstream. For the last three years, Lean has been the number one topic at the company's annual supplier conference. Currently, a core group of twenty-six suppliers is receiving on-site help and training from B. F. Goodrich. Lodge says the results of these efforts vary, depending on the individual

company. "There are some companies that recognize the opportunity, and they grab it and run. Others are willing to take a look. Some companies fall into the 'not-invented-here' camp."

Convincing suppliers that they should change the way they do things requires tact and skill.

Big Inventories Mean Big Costs

The importance of helping suppliers get lean is especially evident when it comes to parts inventories. One of the key principles of Lean Manufacturing is that parts should be available just in time—no sooner and no later. Chuck Kahler, Wing Responsibility Center vice president, says that the goals are a pull production system and single-part flow. That means ordering parts just when they're needed and avoiding big inventories. Large inventories of parts cost money in a whole slew of ways. Capital is tied up. Warehousing, transporting, and insuring the parts, as well as supporting a large infrastructure to handle them, adds more cost. Parts can sit around for so long that design changes render them obsolete.

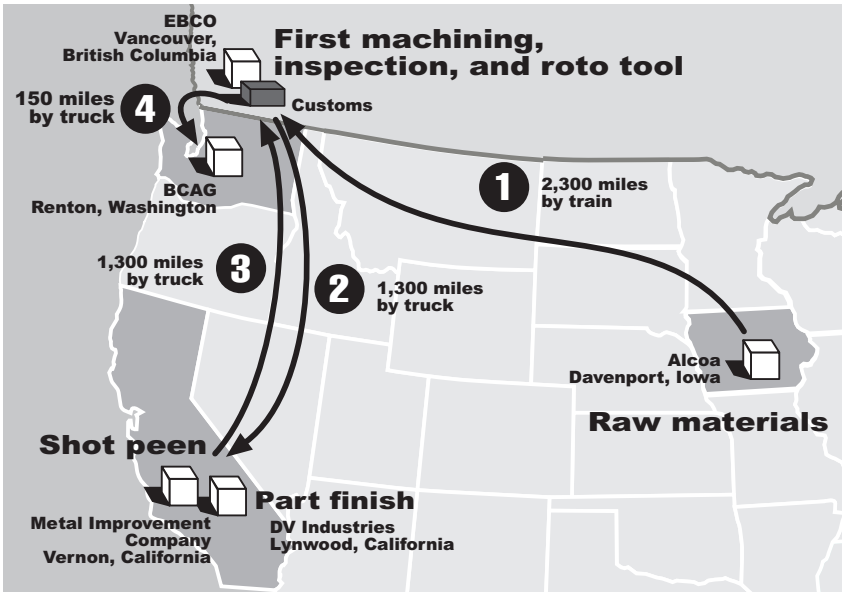
But we can't solve the problem of too much inventory by simply changing our ordering practices. For us to change our processes to receive parts just in time, suppliers must be able to supply parts on demand. Kahler explains that asking a supplier to provide just one part that takes an hour to make won't work if that supplier's operation is designed for production in batches, with cumbersome and lengthy setup procedures. Kahler says that an "archaic provisioning policy" encourages the manufacturing of parts in batches. Also, until recently, accounting practices didn't accurately reflect holding costs. This contributed to a climate in which production on an airplane would stop to wait for one part, while several years' worth of another part—in one case, seventeen years' worth—would sit in storage, with more on order.

With the advent of Lean thinking, things have changed at the Renton Wing Responsibility Center. Parts that are in excess are tagged in red, a clear visual sign that these parts should be used up and not reordered, and the ordering system has been revamped. In the Leading Edge area of the Wing Responsibility Center alone, inventory has dropped nearly 80 percent in just eighteen months. Shortages used to be commonplace; they've disappeared in the last six months.

Untangling the Supply Web

Understanding just how those suppliers work together to add value, and reducing the time it takes to add that value, is the goal of a Materiel pilot project that takes a unique approach. Ren Nanstad, senior manager for WRC Materiel Site Management, explains that his project will take one part of a wing, a 757-200 spar, and follow it through the value chain from purchase orders for raw materials to final wing assembly. His goal is to "understand supply and understand value," and he will thoroughly analyze the processes of the more than sixty suppliers—both inside and outside Boeing—who are responsible for the 900 or so separate parts incorporated in the spar. He'll conduct his analysis supplier by supplier, each one a thread in the 757-200 supply web, one thread at a time. "Our main emphasis will be reducing flow or cycle time. However, any number of value-added metrics and opportunities to reduce cost will likely be identified."

Once he's mapped out the flow, the next step is to determine what obstacles there are to the goal of a lean supply chain. Nanstad already knows some of the things he'll find. One spar component, for instance, is made in Canada, crosses the border to Los Angeles for more processing, returns to Canada, and comes back across the border to Washington State (see chart above). Why all this time-wasting, money-wasting moving around? Because no one in Canada is authorized by Boeing to perform the step that's done in Los Angeles. Maybe the processing can be accomplished in Canada or eliminated altogether.



Besides Boeing requirements, there are other constraints that must be identified and taken into account, such as government regulations or design philosophy. "You have to ask," says Nanstad, "whether we really need 900 parts to satisfy our design requirements."

Nanstad's variation on Lean analysis—thoroughly mapping every aspect of the value chain for one part—represents a new approach to Lean Manufacturing. "What we intend to do is use it as a model across the entire Wing enterprise," he says.

One of the key principles of Lean Manufacturing is that parts should be available just in time—no sooner and no later.

Value stream analysis for smart buying

The 757-200 wing pilot project follows on the demonstrated success of another pioneering method of value stream analysis. Soheila Khosravani, and the Extended Enterprise and Strategic Planning organization of the Boeing Commercial Airplane Group Materiel Division, analyzed value not in terms of one part, as Nanstad will be doing, but in terms of individual commodities. They began by analyzing aluminum and titanium. They put a process together that takes into account all value-added steps from mill to finished product, as well as cost drivers, flow, and leverage points.

Why is it helpful to have all this information? With a grasp of the entire stream, Boeing can make strategic decisions about buying, contracts, and planning. It can choose the right suppliers for the job and level demand to avoid shortages and price fluctuations. Khosravani explains that 5 percent of the titanium that goes into an airplane is bought by Boeing. The other 95 percent is bought by Boeing suppliers and their suppliers on up the line. Smoothing out the value stream and restructuring the supply chain reduces volatility in the availability and cost of raw materials. This initiative, launched in 1997, will save Boeing a significant amount in materials costs.

In the long run, says Chuck Kahler, "Supply chain management will save the company a lot of money. We're on the right track." To manage that supply chain, Boeing will have to reach out to suppliers to smooth out the flow all along the stream. When that happens, everyone along the way will benefit. ■

About the Author

Kathrine Beck is a freelance writer, covering many aspects of aviation and management. She also is the author of fifteen detective novels, writing under the name K.K. Beck.

Managing Customer Value

William B. Dodds, *Fort Lewis College*

Abstract

This paper builds the framework for linking the established work of competitive advantage with the emerging discipline of value marketing. The outcome of this linkage is the concept of strategic value management. Strategic value management focuses on the right combinations of product quality, customer service and fair prices as the key to selling to today's value conscious consumers. The core of the strategy stresses the firm's ability to combine and manage these dimensions of value in a way that a strategic value advantage is created and maintained. This advantage provides long-term profitability for the firm and satisfaction for the customer segment. Three companies that excel at strategic value management, Southwest Airlines, Hewlett-Packard, and Nordstrom, illustrate how this advantage provides long-term profitability for their firm and satisfaction for their customer segment. Value oriented actions have been developed to support a strategic value approach.

Introduction

Customers have come to expect a culture of value in the market place. Shoppers today want more of those things they value (Treacy and Wiersema 1995). If they value low prices, they want it lower. If they value convenience or speed when they buy, they want it easier and faster. If they look for state of the art design, they want to see the art pushed forward. If they need expert advice, they want companies to give them more depth, more time, and more of a feeling that they're the only customers. However, the way buyers define value is often split between price paid, product and service quality received, and the quality of customer service provided in the transaction. Customers expect a certain standard of quality, a suitable level of customer service and to pay within a specific range of prices.

Companies need to focus attention on the dimension of value that they are best able to provide and to target those [customers] who value that dimension.

An ideal position of value for the customer is where the product or service is the highest quality, supported by the best customer service, and offered at the lowest price. However, it allows very little, if any, profit margin for the seller. A generic position offers acceptable product quality with reasonable customer service at affordable prices. Unfortunately, there is always a competitor who is willing to offer a lower price, higher quality, or better customer service. Additionally, there are always consumer segments that are attracted to one value dimension at the expense of accepting lesser performance on the other dimensions. A key principle in this value culture is to understand that you can not be all things to all people. Companies need to focus attention on the dimension of value that they are best able to provide and to target those segments who value that dimension.

This paper builds a framework for strategic value management by integrating Michael Porter's generic strategy with the marketing issue of value. Porter's generic strategy concepts become the foundation for building the framework of strategic value management. Product quality, price and customer service decisions are the "lumber" while cost, competition and demand act as the "screws, nails and fasteners." Overall, a solid framework is presented in this paper for defining a successful and enduring value relationship between buyers and sellers.

Competitive Strategy for Value Decisions

Michael Porter, an authority on business level strategy proposed two "generic" competitive strategies for outperforming other businesses in a particular industry:

"Managing Customer Value" is an extension of an article, "A Framework for Strategic Value Management," published in Advances in Business Studies – An Irish Review. The original article, cited as best in track, was presented at the 1997 Academy of Marketing Annual Conference and the abstract appears in the conference proceedings.

lower costs and differentiation (Porter 1980). This section summarizes Michael Porter's work on generic competitive strategies that is described in his books (1980, 1985, 1990). Porter's business strategy raises the following questions:

- Should we compete on the basis of low cost, or should we differentiate our offerings on some basis other than price, such as product quality or customer service?
- Should we compete head to head with our major competitors for the biggest but most sought after share of the market, or should we focus on a niche in which we can satisfy a less sought after but also profitable segment of the market?

Lower cost is the ability of the firm to design, produce, and market a comparable product more efficiently than its competitors. Differentiation is the ability to provide unique and superior value to the buyer in terms of quality of the offering and customer service. Porter also proposed that a firm's competitive advantage in an industry would be determined by its competitive scope, that is, the breadth of the company's target market. Before using one of the two competitive strategies of lower cost or differentiation, the firm or unit must choose the range of product varieties it will produce, the distribution channels it will employ, the types of buyers it will serve, the geographic areas in which it will sell, and the array of related industries in which it will also compete. Simply put, a company can choose a broad target (mass market) or a narrow target (market niche). Combining these two types of target markets with the two competitive strategies results in four variations in the generic strategies depicted in Figure 1. When the lower cost and differentiation strategies have a broad mass market, they are simply called cost leadership and differentiation. When they are focused on a market niche, they are called cost focus and focused differentiation.

Figure 1
Porter's Generic Competitive Strategies

Competitive Scope \ *Competitive Advantage*	*Lower Cost*	*Differentiation*
Broad Target	Cost Leadership	Differentiation
Narrow Target	Cost Focus	Focused Differentiation

Cost leadership is a low-cost competitive strategy that aims at the broad mass market and requires "aggressive construction of efficient-scale facilities, vigorous pursuit of cost reductions from experience, tight cost and overhead control, avoidance of marginal customer accounts, and cost minimization in areas like R&D, service, sales force, advertising, and so on." (Porter 1980). Because of its lower costs, the cost leader is able to charge a lower price for its products than its competitors and still make a satisfactory profit. Having a low-cost position also gives a company a defense against rivals. Its lower costs allow it to continue to earn profits during times of heavy competition. Its low price will also serve as a barrier to entry, since few new entrants will be able to match the leader's cost advantage.

Differentiation is aimed at the broad mass market and involves the creation of a product or service that is perceived throughout its industry as unique. The company may then charge a premium for its product. Differentiation is a viable strategy for earning above-average returns in a specific business, because the resulting brand loyalty lowers customers' sensitivity to price. Increased costs can usually be passed on to the buyers. Buyer loyalty also serves as an entry barrier. New firms must develop their own distinctive competence to differentiate their products in some way in order to compete successfully.

Cost focus is a low-cost competitive strategy that focuses on a particular buyer group or geographic market and attempts to serve only this niche, to the exclusion of others. In using cost focus, the company seeks a cost advantage in its target segment. This strategy is praiseworthy because of a belief that a company that focuses its efforts is better able to serve its strategic target more efficiently than its competition can. A focus strategy does, however, necessitate that a trade-off between profitability and overall market share be made.

Focus on differentiation concentrates on a particular buyer group, product line segment, or geographic market. In using this strategy, the company seeks differentiation in its target segment. This strategy is valued because of a belief that a company that focuses its efforts is better able to serve its narrow strategic target more effectively than its competition can.

Sources of competitive advantage that determine consumer value satisfaction are quality, innovation, and company reputation. All three factors lead to a consistent behavior of purchasing one brand in a specific product or service category.

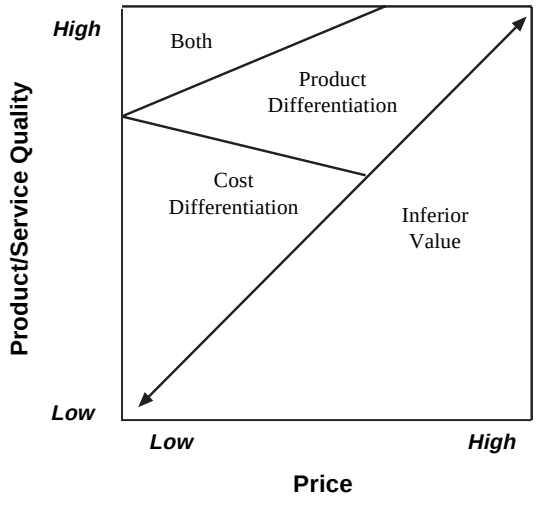
- The ability of quality to create a sustainable competitive advantage is dependent, in part, on the industry. Where product and customer service quality are more difficult to imitate in the short run, firms can achieve success by constantly staying one step ahead of competitors with continuous quality improvement. Quality that is characterized by constant innovations creates a loyal customer (Starr 1988).

- Innovation involves two issues. Process innovation is essential to maintaining a low cost position. Product innovation is critical to developing a basis for differentiation (Scarpello, Boulton, and Holer 1986). A firm that is successful with both will have ample opportunity to maintain a value advantage in the market place.
- A good organizational reputation may be linked with good quality and innovative products and services. Some have argued that a corporate reputation may be the only truly sustainable competitive advantage. It is the only component of competitive advantage that can't ever be duplicated in its entirety (Caminiti 1992).

Porter's proposition is that to be successful, a company's products must achieve one of the above "generic" competitive strategies. Otherwise, the products are stuck in the middle of an aggressive marketplace with no competitive advantage. Solid middle of the road names like Sears or Holiday Inn are struggling against a slew of new competitors that strike from one of the boxes in Figure 1. Emulated by rivals offering more luxurious goods or just plain cheaper prices, companies with products in "the middle of the road" are finding their market share dwindling and are seeking ways to break away from the image of just being average (Deveny 1990).

The idea of positioning value in terms of price and product/service quality is shown in Figure 2. While the boundary of expected value exists along the diagonal, a competitive advantage is consummated when a firm can attain cost and/or product differentiation. Firms that cannot cross this boundary with some form of differentiation are forced to compete as a "middle of the road" offering with inferior value.

Figure 2
Differentiation Strategies



The Competitive Advantage and Value Link

Some strategic management scholars have concluded that U.S. firms in the 1980s became so distracted with mergers and acquisitions and so burdened with debt that they neglected the key areas of competitive advantage (Hitt, Hosisson, and Harrison 1991). As the next century approaches, American industry reawakened to the new global competition and responded by refocusing on unique advantages. Competing for advantage in markets through superior customer value delivery is here to stay (Woodruff 1997). To survive in today's market place, companies need to create and maintain a competitive advantage over other competitors.

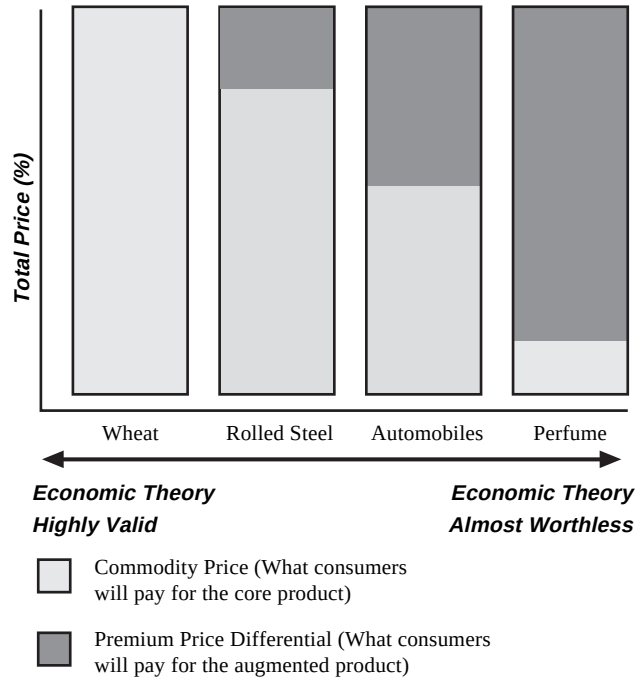
Competitive advantage in the marketplace can be profitably exploited if it can be converted to consumer value satisfaction (Cohen 1991). The key to competitive advantage is the consumer's satisfaction with "value" in the offering. Value means giving more: an improved product, with added features and enhanced service—all at a better price (Power 1991). Achieving a value advantage takes a commitment not just to meet, but to exceed consumer expectations for affordable quality (Artz 1993). To maintain this advantage, firms must ensure that they are not asking consumers to pay for unproductive costs - costs that do not add value (Artz 1993).

Creating and Maintaining a Value Advantage

Today's society is much more convoluted in terms of increased market size and product complexity. Figure 3 illustrates different products having different compositions of commodity and premium benefits. Products with a larger portion of premium price differential can provide a greater competitive advantage than a product with a smaller portion of premium price differential. Over time, a substantial number of products have migrated toward the right of the continuum where a premium price differential takes on added importance. The idea of competitive advantage is strongly rooted in the augmented product that justifies a premium price differential.

Despite the shortcomings of classical economic theory, elasticity emerges as a useful concept to link competitive advantage and value satisfaction. However, business people need to have a basic understanding of the slope of their product's demand curve. This information can be gathered from trade associations, market research experimentation, or experience. But, the slope and shape of the curve is unstable due to constant change in the marketing environment. Therefore, the actual existence of a demand curve is implausible. A common factor that will influence demand changes is the issue of substitutability. If there are close substitutes having similar levels of quality or customer service, there may be a large change in demand when a firm changes price. However, when there are no

Figure 3
Concept of Commodity and Premium Prices

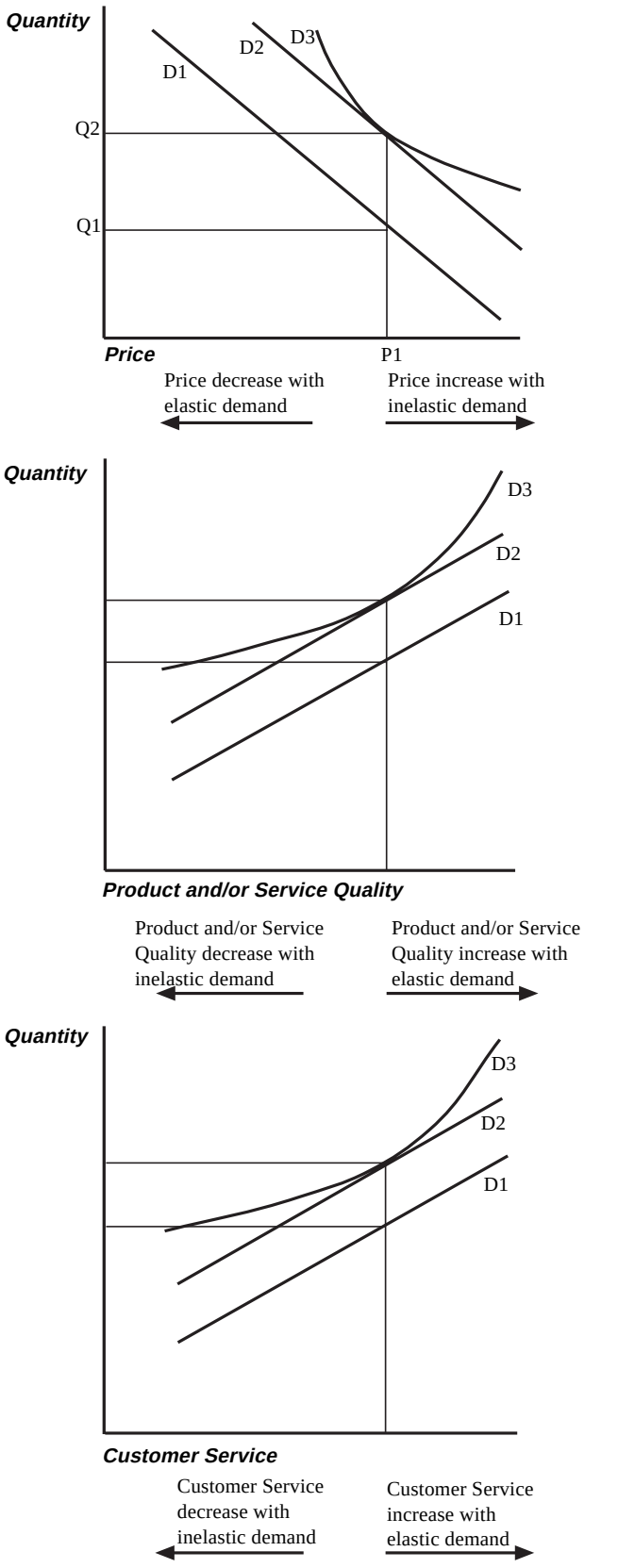


close substitutes, a price change will not have a great change in demand. The practical issue here is to understand and to apply the concept of demand elasticity.

Linear demand suggests that there is only one direction of change available. For example, demand curve D1 in Figure 4 is relatively steep in slope, suggesting an elastic demand condition. Therefore, a price increase might be accompanied by a significant decrease in demand. This situation might be viewed as disadvantageous. However, a price decrease is favorable, since demand will increase at a higher rate than the price change. If the curve was more inelastic (shallower slope), then the situation would be reversed. However, the outcome would still be one sided. Only a price increase would be effective. In addition, this one sided phenomenon would hold for changes in product quality and customer service. When demand is elastic, quality improvement would provide a favorable scenario, but any decrease in product quality would be met with substantial decreases in demand. The same scenarios would hold for changes in levels of customer service.

A firm creates and maintains a competitive advantage by utilizing the marketing mix to position the value of the product for a target market and keeps it focused on that target market. By carrying out a marketing program that will establish a strong value differentiation, the demand curve in Figure 4 shifts from D1 to D2 and eventually to D3. When consumers realize value satisfaction from a product, they tend to stay loyal to the product. There

Figure 4
A Successful Marketing Program to Create and Maintain Value Advantage



would be little attrition in demand with a price increase or product quality and customer service decrease. When price is decreased, a segment of price conscious consumers not currently buying will increase their consumption. A product quality or customer service increase would only bolster the value image that the product has attained. This phenomenon of "bending" the curve provides flexibility to maintain financial success by increasing or decreasing the value components as needed. This discretion is upheld by a firm's ability to create, enhance, and maintain a competitive advantage in the market place. A firm needs to understand demand sensitivities for each of the three components of value. If customers are most sensitive to customer service, then increases should have a substantial effect on increased demand. This would also hold for price and product quality changes when specific consumer segments respond favorably to these value components.

Critical Drivers for Creating and Maintaining a Value Advantage

In their book, The Discipline of Market Leaders (1995), Treacy and Wiersema write about old and new companies, redefining business competition in one market after another. By relentlessly driving themselves to deliver extraordinary levels of distinctive value to carefully selected customer groups, these market leaders have made it impossible for other companies to compete on the old terms (Treacy and Wiersema 1995). Companies that understand this new definition of competition manage four key drivers of value. They are:

- Price—the amount of money charged for their product or service.
- Cost—the amount of money it takes for the seller to provide the product or service for sale.
- Demand—the quantity of product or service that will be bought at different prices.
- Quality—the totality of features and characteristics of a product or service that bear on its ability to satisfy customers needs. Quality is used to describe the character of the product, service, and customer service.

These four drivers connect to provide six understandings for how value is created (see Figure 5).

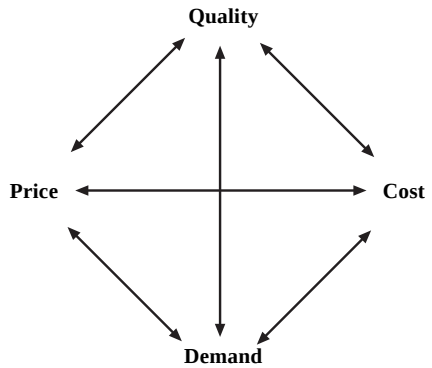
Price/Quality. Price and quality share a symmetric relationship. The obvious association is that better quality commands a higher price. However, some buyers use price as a perceptual cue of quality. Simply put, price says a lot about the expected quality of a product. Notwithstanding, buyers often report that they trust the market place to keep a positive relationship between price and quality. A significant point is that a seller can make a drastic mistake by pricing either too high or too low in reference to the quality provided. Pricing too low can scare away quality conscious buyers or simply obtain too small a margin to be profitable. Pricing too high may intimidate buyers who feel that the quality is sufficient but the asking price is too high. While the margin may be sufficient, there will not be enough demand to be profitable.

Price/Demand. Classic economic theory suggests an inverse relationship between price and demand. Price setters, relying heavily on the inverse price-demand function, often ignore psychological and other contextual factors that may lead to a different perception of price by buyers. However, as the complexity of the purchase mix grows, customers are evaluating the intrinsic quality of a product less and depending more on extrinsic cues of quality such as price as well as brand name and store image. Given a particular brand name and store name, there may be an inverted U relationship between price and demand. Consumers have a range of acceptable prices —upper and lower price limits—for each price segment. As a result, buyers will be apprehensive about purchasing when the price is too low as well as too high in substantially more situations.

A significant aspect of price is that it can be quickly adjusted to seize or hold a competitive advantage. A lower price can be a significant competitive advantage to gain and hold market share if there is a substantial cost advantage. Without any cost superiority, price reductions can be readily duplicated by competitors. Consequently, it will be better to use price changes with factors difficult to imitate such as cost reductions and quality enhancements to manage a competitive advantage. However, a more prudent use of changing only price is to fine-tune the advantage or to capitalize on the quality cost advantage.

Price/Cost. A revolution is under way in the manner by which consumers shop. The key is price. Consumers won't pay higher prices, retailers can't charge higher prices, and manufacturers have to cut costs to keep prices low. The "old-fashioned" notion that price is determined by a set markup does not work in the "new" way of doing business. The links of price and cost to quality will have a more substantial influence on profitability. When both links are considered simultaneously,

Figure 5
The Value Drivers



the most profitable situation is when the consumer's desired dimensions of quality are provided so a premium price can be asked but where costs are contained. This situation provides a healthy profit margin as well as a plentiful demand.

Cost/Quality. Simply stated, quality costs. However, firms that understand the needs of specific market segments can "engineer" costs out of products and services without noticeably reducing the quality. This approach can be used to control cost and maintain adequate profit margins. For example, Maytag, for years, has targeted that market that "likes things to work". Maytag products are viewed as dependable and, as a result, they are able to charge a premium price. In addition to making appliances that work, they include other features that make them work well. While other competitors may make appliances that have "other" superior advantages, no firm makes appliances that are more dependable. By focusing on the key quality attributes, a firm is able to develop a quality image without a heavy cost burden. The idea is to provide superior quality on dimensions preferred by the market along with reasonable quality on the less significant dimensions.

Quality/Demand. While customers are always interested in quality, the best is not always the answer. As discussed in the other linkages, a buyer will give up less meaningful quality attributes in an offering for a lower price. However, when a seller delivers exceptional quality on the determinant attributes and sets a fair price, then demand can be substantial.

Cost/Demand. The linkage between cost and demand is not direct. Nonetheless, it cannot be ignored. The link from cost to price and quality has been explained; the link from price and quality to demand has also been explained. Given these four linkages, the cost/demand link is important. A firm looking for competitive advantage through a low price–high demand strategy understands that the ability to influence demand will start with controlling costs.

These six linkages are vital to crafting a strategic plan for competing on the basis of a value advantage. The following section provides illustrative examples of three companies that manage the linkages effectively for gaining and maintaining a value advantage.

Companies with Highly Developed Value Cultures

Three companies are illustrated below that amplify one dimension of value by delivering exceptional performance on that dimension while providing acceptable performance on the other two. The market is flooded with companies that have been successful at offering good value to the customer. But the difference today is that many of the best companies offer an unbeatable lower price, exceptional quality and/or unassailable customer service (Cohen Mason 1994).

Southwest Airlines—The low price carrier

The airline industry is perhaps one of the least attractive industries in which to compete. Southwest Airlines thinks differently. By consistently combining low fares with friendly but bare bones service, it's the most successful carrier of its size. Naturally, you need to know that Southwest Airlines is the lowest-cost operator in the airline industry. Southwest has pursued a successful focus strategy by building a distinctive competence in serving short-haul routes, rather than fighting major airlines for long-haul business. Southwest Airlines practices low-cost policies in almost everything thing it does. Its planes are frugal, its offices are Spartan, and it does not serve fancy meals on its planes. Moreover, its procurement policies are also penurious; it buys one type of plane, the Boeing 737, to keep maintenance costs low. Its boarding procedures are geared to keep the plane at the gate for a minimum of time, thus maximizing revenue producing flight time. Bottom line for Southwest is that they manage to be profitable in an industry that is bogged down in red ink. They accomplish this by combining friendly but very frugal customer service and product quality that is only average by industry standards with outstanding prices. Ask satisfied Southwest customers what makes them loyal to Southwest, the reply is price.

Hewlett-Packard—The product quality specialist

Product quality leaders live by the fervent drive to make their current product line obsolete. Rather than to be beaten by their competitor, these companies have developed an internal culture of continuous improvement and innovation. Consider Hewlett-Packard. Their latest ink-jet-printer replaced a model introduced six months earlier. The old model was the world's best selling computer printer, but the new one offered color, not just black and white. Without the optimal color-printing kit, the new model costs $414 - just $49 more than the monochrome one (*Business Week* 1995). Hewlett-Packard moved away from a once standoffish position of charging a substantial premium for their product line. They are now a sizable player in the bigger market where the prices and customer service have to be competitive but still stand out in the market place with their superior quality.

Nordstrom —The customer service leader

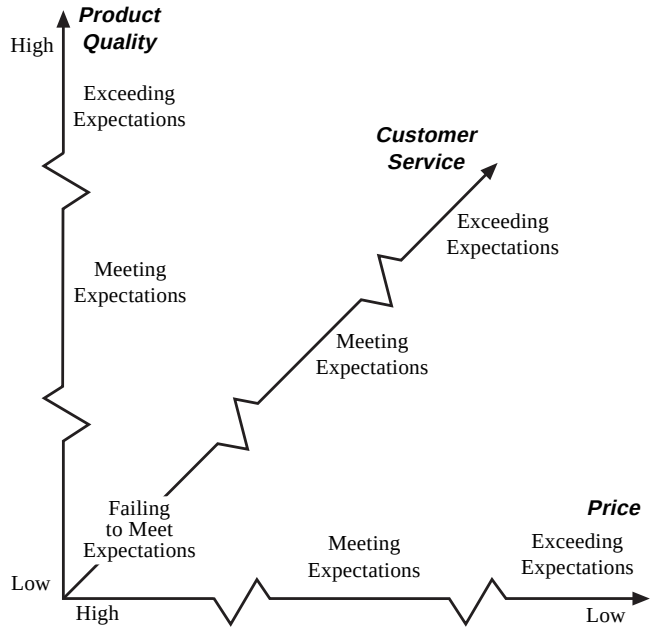
In the exacting low-margin, highly competitive world of department store sales, Nordstrom has turned exacting standards of customer service into a billion-dollar annual business. A major ingredient is the quality of the sales clerks. They are paid about 20 percent better than those of competitors, and they are well trained and encouraged to do almost anything within reason to satisfy customers. Nordstrom motivates its people, not just by paying them well but by congratulating them and encouraging them (*Time* 1987). Nordstrom put into practice the concept of

the "personal shopper." The first sales clerk that the customer encounters offers to serve as a dedicated resource, escorting the customer through the store, helping locate suitable accessories and ringing up all the transactions at once when the customer is finished shopping (*Planning Review* 1994). While the competition can easily duplicate Nordstrom's product quality assortment and their prices, the issue of superior customer service has not been approached. Nordstrom continues to reinvent the customer service concept to maintain its significant competitive advantage.

Marketing Strategies for Competitive Advantage

Product quality, customer service and price can be managed to deliver value to the consumer. Prior research has shown that consumers have a range of acceptable limits for prices. The results suggest that if the product's price is below the lower limit, the product is perceived to be "too cheap" and if the price is above the upper limit, the product is perceived to be "too expensive" (Dodds, Monroe, and Grewal 1991). These limits constitute thresholds. As with prices, it is plausible that buyers have ranges for product quality and customer service. Customers will often compare competitive offering to make these judgments. Product quality and customer service that is substantially below the competition will be judged unacceptable. Yet, when these attributes substantially exceed the competition, then product and customer service quality will be considered exceptional. Therefore, sellers have a region over which they can calibrate product quality, customer service and price where there is a range of acceptability with tails of unacceptable and exceptional zones. Consumers determine the thresholds by how they compare to the competition. Figure 6 shows this for the three dimensions of value: price, product quality, and customer service.

Figure 6
Value Dimensions



Exceeding Expectations – defined as noticeably above the competition; a superior situation

Meeting Expectations – defined to be about the same as the competition; a reasonable situation

Failing to Meet Expectations – defined as noticeably below the competition; an inferior situation

– a threshold where there becomes a noticeable difference

The idea of buyers being able to judge quality by the price has long been a part of understanding consumer behavior. Recently, the influence of brand quality and its effect on price perceptions as well as the overall evaluation of the product has been documented in research studies (Dodds, Monroe and Grewal 1991). A substantial finding is that when brand quality is judged to be high, the strength of the price information is diminished. Consequently, when product quality or customer service (whichever is judged by the buyer to be the significant dimension in the purchase decision) is well known through experience, then the value derived from price will fall as the price increases. There will be three notable price ranges: exceptional, exceeding expectations; acceptable, meeting expectations; and unacceptable, failing to meet expectations. Each range is typified by a relatively flat downward sloping value curve separated by a steep threshold that separates the three ranges. With a product of exceptional quality or supported by exceptional customer services, consumers will attribute real value to the product when the price is very low. As price increases, the offering will drop in value, but will maintain a reasonable value as it moves through the acceptable range. But, value drops considerably when the price is judged to be unacceptable.

Some buyers have considerable experience with a particular product and the customer service that supports that product. These buyers' sense of post purchase satisfaction allows them to sort product choices into categories of unacceptable, acceptable, and exceptional quality. Other buyers do not possess this experience and will have to make their evaluations from perceptions of price, brand, and store image. They gather information from sources such as personal experience, friends and family, impartial sources such as consumer reports, and marketer controlled sources such as advertising and sales personnel. Both types of consumers organize their information so as to place the product quality and the customer service into ranges of acceptance: exceptional, acceptable, or unacceptable.

In other situations, product quality and customer service are difficult to discern because of the complexity of the product, lack of experience with the product, or little knowledge about the brand name. In this situation, price information becomes much stronger in determining value. Prices that are too low or too high may signal respectively either a lack of quality or the product is intended for a higher price segment. Given the constraints of cost, demand, and competition, a business might choose to create an advantage by excelling on one of the dimensions and calibrating the other two dimensions to be similar to the competition. This was the case for Southwest Airlines, Nordstrom, and Hewlett-Packard.

Proactive Monitoring of the Marketplace

Firms that make successful value decisions take a proactive approach. The success of proactive value management is conditional on marketers' understanding of how value works and how consumers perceive value. Furthermore, this knowledge is critical for marketers to reach the markets they are targeting. Today's competitive business environment places a premium on the ability to make good, fast, and frequent marketing decisions. Management needs to (1) know what customers value, (2) expect and accept change in the market, and (3) control costs.

Know What Customers Value. Value oriented firms figure out who their customers are, what their needs and self-perceptions are and how they are changing. They conduct in-depth, substantial market research on current, potential, and lost customers and don't rely strictly on experience. Customers are the best gauge of how a company is faring against competitors. Involving them in the process of developing new products and services with superior value helps to guard against isolation and arrogance (*Business Week* 1995). At all costs, value-oriented firms maintain a continuous surveillance of the marketplace.

If product quality is most important, what attributes do consumers value the most? In comparison to the competitors, what level of quality will have to be provided to create and maintain an advantage? Given the cost of increased quality, can a firm charge a price where the combination of superior quality and reasonable price are need satisfying to the customer and profitable for the organization? What levels of customer service will be needed to support this value proposition? A value proposition is a promise to a specific segment that a firm is committed to fulfill. The firms with a strong value culture will determine the value their products offer to their target market, particularly compared to the competition. Value-oriented firms do not make the mistake of trying to be all things to all people. Porter's cost and differentiation strategies provide the ability to zero in on the select customers.

Expect and Accept Market Change. The market place is in constant flux. Companies that have excelled by providing superior customer service strive to make their current standard of excellence obsolete by "upping" the standard. Companies that compete on low prices endeavor to find ways to provide lower prices. If they do not, their rivals will (*Business Week* 1995). Understanding how customers "value" an offering is the key to maintaining an advantage as the value standards shift.

Control Costs. Cost is inherently connected to the three dimensions of value. Once the control of cost is lost, management has a very difficult time maintaining the value proposition of their offerings. By providing attributes most valued by consumers, businesses can "engineer" out the costs of attributes less valuable. Any cost expenditure that helps the company deliver value to customers deserves reinforcement and management support. Any other cost is non-value-adding overhead and needs to be eliminated (Levere 1992). Value culture companies do not wait for a downturn in business to search for these nonproductive costs; they search daily for cost break through. The idea of a "lean and mean" organization does not just involve product and customer service; rather it takes into account all cost centers.

These three points will lead a proactive manager to target marketing where the total product offering is consistent with consumers' perceptions of value. The challenge for accomplishing success with value management is to understand customer needs and to deliver the right set of attributes in the offering. The idea of the strategic triangle of value management in Figure 7 illustrates the relationship between the company's products, the competitors' products and how the customers see the comparative offerings.

Figure 7
The Strategic Triangle of Value

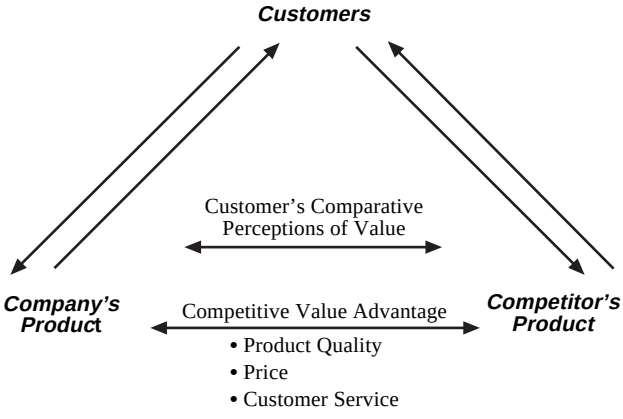


Figure 8
Questions to Monitor a Firm's Commitment to Value

Product Quality	*Customer Service*	*Develop Pricing Strategy*
• How important is product quality?	• How important is customer service?	• How important is price?
• What are the dimensions of product quality that buyers value?	• What are the dimensions of customer service that buyers value?	• What are the dimensions of price that buyers value?
• What are the buyers' knowledge and attitudes toward the company's and competitors' product quality?	• What are the buyers' knowledge and attitudes toward the company's and competitors' customer service?	• What are the buyers' knowledge and attitudes toward the company's and competitors' price?
• Do we set product quality standards that match or exceed customer's expectations?	• Do we set service quality standards that match or exceed customer's expectations?	• Do we set price levels to changes that match or exceed customer's expectations?
• How do buyers react to changes in product quality?	• How do buyers react to changes in customer service?	• How do buyers react to changes in price?
• What is the competitive reaction to changes in our product quality?	• What is the competitive reaction to changes in our customer service?	• What is the competitive reaction to price setting and price changes?
• What are the "points of difference" that makes our product or service quality unique relative to competitors?	• What is the "points of difference" that makes our customer service unique relative to competitors?	• What is the "points of difference" that makes our pricing strategy unique relative to competitors?
• Do we evaluate our product quality strategy on a periodic basis?	• Do we evaluate our customer service strategy on a periodic basis?	• Do we evaluate our pricing strategy on a periodic basis?
		• What is our ability to price at a premium when the product has substantial distinctiveness?

A firm committed to competing on value must monitor the strategic value triangle to assess the importance of the product quality, customer service and price. Responsiveness, assurance, empathy, reliability, communication, time , and convenience might define customer service. Price needs to be consistent with product quality of the offering as well as customer service. Value-oriented firms set price at a level that will appeal to potential customers and doesn't try to fool anybody.

The questions listed in Figure 8 are useful to address product quality customer service or pricing strategy.

Summary

In a normative sense, customers want to optimize satisfaction while sellers want to achieve satisfactory long-term profits. The six value linkages between price, cost, demand, and quality create opportunities as well as constraints as to how sellers can configure their product offerings. While the seller may strive to meet the needs of the buyer by offering exceptional levels of all three value dimensions, this will probably prove to be unprofitable. A more feasible approach may be to pick one, and possibly two dimensions to be exceptional while the other(s) is only acceptable. A key constraint is the cost factor. Cost needs to be balanced with the creation of value. There needs to be significant value to offer customers but adequate margins to contribute to the seller's profit. A realistic value strategy is to match the key competitor(s) on two dimensions and then grab competitive advantage by excelling on the third dimension.

This paper has presented a strong reason to continue exploring the product quality, price, and customer service relationship. Companies such as Southwest Airlines, Hewlett-Packard and Nordstrom have developed a strong value culture where they have distinct competitive advantages attributed to one of the three components of value. Other companies, struggling for distinction, need to understand and apply the concept of strategic value management as a way to achieve a "safe niche" in the marketplace that provides long-term profitability for the firm and satisfaction for the customer segment served.

To achieve and maintain a competitive value advantage, firms must internalize into their organizational culture a commitment to understand their markets and target markets. Additionally, firms need to translate consumer needs into superior performance in the mix of product/service quality, customer service and price. Providing the right combination of product quality, customer service and fair prices is the key to selling to value conscious consumers in today's marketplace. In doing this, firms gain the ability to lead their own destinies rather than to follow their competitors. ■

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His research interests have focused on the behavioral effects of market cues such as price, brand and store information on product evaluations. His research has been published in the *Journal of Marketing Research, Journal of the Academy of Marketing Science, Journal of Consumer Marketing, Journal of Business and Psychology, Journal of Marketing—Theory and Practice, Advances in Business Studies* and *Mid-American Journal of Business,* as well as numerous national proceedings. Dodds has developed a course that integrates the issues of product quality, price and customer service.

Resources and Capabilities for Sustainable Competitive Advantage: A Cross-Functional Perspective

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Mark Pagell, *Kansas State University*
Christian Bechtel, *Northwood University*

Abstract

This paper examines the sources of competitive advantage from a cross-functional perspective and presents a dynamic, general model of the tangible and intangible factors that lead to superior firm performance. We argue that superior performance results from the development of a complex, interrelated stock of organizational capabilities. We define capabilities as the result of managerial skill applied strategically to a firms' resources and processes in a manner that integrates and leverages these resources across functional areas. Furthermore, capabilities are not bought and sold, but built by skilled managers, who foster their growth by developing interconnected resource stocks. A process model is presented and implications for both managers and researchers are discussed.

Introduction

Performance differences between firms are obvious. Some firms, such as Merck and Coca-Cola, have enjoyed returns consistently greater than rivals for decades. Other companies, including General Motors and IBM, have developed—then lost—tremendous competitive advantages. Many more firms fail shortly after incorporation, in spite of solid financial and technical foundations. Notwithstanding the best efforts of researchers, the determinants of firm performance have yet to be clearly explained. Recently, researchers across a variety of business disciplines, including strategy (Aharoni 1993; Barney 1986; Hall 1992, 1993), operations management (Hayes and Pisano 1994), and marketing (Jacobson 1990) have suggested that the search for the roots of competitive advantage move away from the current emphasis on products and markets to an examination of inputs, including resources and capabilities. Some progress has been made in a variety of fields toward this end, with some encouraging preliminary results.

Many researchers point at the firm's competencies as important determinants of performance (Prahalad and Hamel 1990; Vickery, Droge and Markland 1993; Cleveland, Schroeder and Anderson 1989; Drucker 1994). Yet this approach has four basic flaws. First, most theories look at the development of competence within a single functional area, usually technology or operations (Stalk, Evans, and Schulman, 1992). Second, most research efforts lack a comprehensive theoretical foundation (Prahalad and Hamel 1990; Ferdows and Demeyer 1990). Third, much of the research on competence focuses on tangible products and processes, but gives short shrift to intangible or unobservable resources. Fourth, competence is not a new idea; in fact, competence may merely be a way of framing strategy on a "positioning" school philosophy based on internal firm factors as opposed to market or external variables (Mintzberg 1994; Eccles, Nohria and Berkley 1992).

…superior performance results from the development of a complex, interrelated stock of organizational capabilities.

This paper examines the sources of competitive advantage from a cross-functional perspective. Specifically, we argue that superior performance results from the development of not simply competence, but rather a more complex construct, capabilities. Capabilities are the result of managerial skill applied strategically to a firm's processes and resources in a variety of value chain areas going beyond just operations and technology. We will argue that capabilities are not bought and sold, but built by skilled managers who are able to foster the growth of the antecedents of capabilities throughout the firm. This paper attempts to integrate research on developing competitive advantage from several disciplines. A parable is offered as a tool to understand the diverse, somewhat conflicting theoretical approaches. A dynamic process model of competitive advantage, grounded in the resource-based view of the firm, is presented. Finally, implications and conclusions for managers and researchers are offered, revisiting the original parable as a tool for illustration and understanding.

A Parable

One starting point in an examination of firm performance is to analyze why firms fail to develop competitive advantage. The following parable illustrates the importance of taking a cross-functional approach to the development of the capabilities essential for high performance.

Containers for Candy (CFC) is a small manufacturer of heart shaped boxes for Valentine's Day candy. CFC is sensitive to the performance of the candy industry, which is prone to demand fluctuations driven by health trends and the macro-economy. The cyclical and seasonal nature of revenue streams, compounded by cost and price pressures from new competitors, have created significant challenges for CFC.

The nature of the product strains logistics. Cyclicality, seasonality, and customer demands for multiple runs of unique box designs mean that CFC carries no finished goods inventory. Limited space and tight working capital force managers to carry minimal raw materials or work-in-progress, prohibiting the use of inventory to smooth production. Consequently, the firm often runs two shifts from September to January, while employing a skeleton crew from January until March.

In recent years CFC's performance has suffered, due to both declining sales volume and intense price competition. Until recently, CFC competed only against two other small firms. All three firms enjoyed moderate growth and moderate margins. Today, CFC faces over thirty competitors, as larger packaging firms with strong finances have invaded CFC's niche. CFC needs help, and turns to a consulting firm that sends analysts to help with three major problems: operations, human resources, and business strategy.

The human resources consultant and CFC's human resource managers agree that turnover is the most urgent problem. Constant turnover, forced by cyclicality and seasonality, has resulted in employees who lack commitment to quality or efficiency. The HR consultant recommends three programs: First, employees should be trained in team building and quality control. Second, the compensation system should be overhauled by increasing base pay rates, awarding bonuses for completing training, and distributing team-level rewards based on productivity. Finally, turnover should be reduced by keeping workers on the payroll year-round, having them perform work process improvements and preventative maintenance in slow periods. The HR consultant predicts that productivity increases from the motivated, expert workforce will generate savings well in excess of the increased labor costs.

The operations consultant and the firm's production managers determine that CFC is over-dependent on direct labor, and cannot efficiently handle large volume fluctuations. The operations consultant suggests that the solution to both problems is to implement a Flexible Manufacturing System (FMS). The FMS is a set of computer controlled manufacturing tools that allows each individual unit to be produced with customized features but at speeds and costs resembling mass production. Currently, however, there are tradeoffs involved in using FMS. In this particular application, an FMS designed for volume flexibility will be unable to produce boxes in the wide variety of shapes, sizes and finishes currently available to CFC's customers. Nevertheless, managers believe that the vast majority of customer demands for variety can still be satisfied within the constraints of the FMS.

One starting point in an examination of firm performance is to analyze why firms fail to develop competitive advantage.

The business strategy consultant recommends diversification into new product lines for different U.S. holidays, and new products for the rapidly expanding Asian and South American markets. This will boost volume, alleviate pricing pressures, and reduce the impact of seasonal and cyclical fluctuations in the U.S. market. CFC's management and board of directors agree with the consultants' recommendations. The turnaround plan is approved, and funds are allocated for the required investments.

Later that year, the CFC workforce arrives on the first day back after the three-week changeover, all now fully instructed to work in self-managed teams. The employees are confronted with the newly installed FMS. Workers stand in quality circles, watching the machines run. It takes just a handful of workers to load materials, unload product, and clear the occasional jam.

Moments later, a marketing manager hands the operations manager a folder containing a large order for 3′ x 2′ American flag boxes. The operations manager is speechless—the FMS cannot make shapes that large, and the printing machine can only run one color at a time, so the flag box would take three passes, even if it did fit. Just then, CFC's founder and majority owner arrives to see the new line. The founder finds the two managers arguing in front of two hundred well trained but bored workers, whose wages and costs in this quarter alone have drained the payroll budget for the entire fiscal year. Meanwhile, the consultants are no place to be seen…

Response to the Parable: The Myth of Advantage Through Functional Sub-optimization

The parable above explains, in part, why many firms fail to achieve a long-term competitive advantage. The parable is a rough, but realistic reflection of some of the problems facing firms as they battle for competitive advantage in the current turbulent business environment. Traditional management strategy approaches—adherence to the philosophy of sub-optimizing functional depart-

ments in an effort to optimize total firm performance—are often no match for challenges including rapid globalization, immense cost pressures, and rapid technological advances.

The traditional bureaucratic approach has many shortcomings, including missed opportunities for developing synergies and a tendency to foster redundant, non-value added work. These shortcomings are the end result of reducing short-run costs, but at the expense of building sustainable competitive advantage. The following literature review outlines the treatment of competitive advantage from a variety of perspectives.

A Critique of Selected Functional Approaches to Competitive Advantage

The Operations Approach to Competitive Advantage

There are several distinct streams of OM literature that could be considered 'state of the art.' These include interest in competing on time, and competing by being flexible. Time Based Competition (TBC) is often lauded as the next competitive battlefield. Many would argue that costs and quality are now barriers to entry rather than areas of competition (Carter and Melnyk 1993). If cost and quality are givens, or order qualifiers (Hill 1994), then the operations function must improve response times.

Competing on time allows the fastest firms to be the first to both introduce new products and eliminate declining products. TBC can indeed improve customer satisfaction, if time is an order winner. However, the TBC philosophy can run counter to much of what is suggested by other fields, especially human resources. A firm can become faster by engineering products that are simpler to manufacture, by automating, and by standardizing products and processes. These approaches suggest that people should be replaced with machines, or that jobs should be simple and standardized. This contradicts the HR literature, which suggests that competitive advantage stems from a highly skilled, empowered workforce that participates in decision-making.

Other OM researchers and practitioners (DeMeyer, Nakane, Miller and Federows 1989; Gerwin 1993) see flexibility as the primary source of competitive advantage. There is no single recipe to become 'flexible,' but several concepts seem to be attracting attention, including flexible manufacturing systems (FMS) and outsourcing. FMS and other forms of flexible automation bridge a gap between dedicated machinery and general-purpose equipment. FMS remove much of the tradeoff between volume and variety, allowing mass producers to greatly increase variety, without sacrificing cost, while enabling job shops to increase efficiency without losing their flexibility. However, the claim that flexible automation will lead to long-term competitive advantage is flawed. Technology can indeed provide a short-term performance edge, but the mere purchase and installation of a piece of productivity-enhancing equipment can be quickly imitated by rivals.

Outsourcing has become a growing area of interest as many firms realize that supplier management is a fertile area for cost reduction. Many firms have enjoyed great success by outsourcing a high percentage of traditional 'in house' value chain activities. Is outsourcing the key to substantial long-term competitive advantage? Several authors (Monczka, Trent, and Callahan 1993; Venkatesan 1992) warn that, if outsourcing is to contribute to long-term competitive advantage, it must be linked to business strategy or competence. The impact of outsourcing without competence or strategy anchors is outlined in work on 'hollow corporations' (Markides and Berg 1988; Hayes and Wheelright 1984).

The Human Resource Management Approach to Competitive Advantage

The bulk of the human resource management literature suggests organizations seeking to develop a competitive advantage should train and empower their workers (Noe and Ford 1992), support continuous learning, and institute diversity programs (e.g. Noe, Hollenbeck, Gerhart and Wright 1994). Pfeffer (1994) argued that competitive advantage is obtained through people, rather than through any particular process, technology, or patent. Further, Pfeffer (1994) identified training and skill development as two key components that are essential to gaining competitive advantage.

Firms are working to increase the value of human resources in two ways. First, firms are increasing the value of the individual employee by increasing the skills and expertise of individual employees. Second, firms are increasing the productivity of individual employees by altering the coordinating structures among workers. These can include reporting relationships, communication networks, and culture. The end result is the development of skills and expertise that help workers become more efficient and effective and the creation of an organizational structure that can transmit and build expertise throughout the firm.

Competitive Advantage in the Management Strategy Literature

Traditional management strategy notions of competitive advantage have been based on the "Design" or "Structure" of a firm, as described by Mintzberg (1990). The "Design School" was followed by the formal planning approach, and the positioning approach. Several key problems exist with the "design," "planning," and "positioning" frameworks of strategy. All three approaches ignore the value of learning, which is critical in today's competitive environment. Also, strategy is treated as a controlled and formal process that should be known by all, but in fact, environmental complexity prohibits the existence of such a process. Finally, all three schools seek

to separate strategy formulation from implementation, but in fact decentralization and empowerment of employees force strategy formulation and implementation to be bound together (Mintzberg 1994).

A popular framework, developed by Porter (1980), underscored the criticality of selecting an appropriate generic business strategy–cost leadership, differentiation, or cost and differentiation focus. Porter (1980) stated that firms should select one of the three generic strategies, or become destined for poor performance. Porter's framework may have been useful in a fairly stable economic environment, but the current business climate may be rendering Porter's (1980) prescriptions less relevant (Miller 1988; Miller and Friesen 1986). Perhaps this is because Porter's framework hinges on a tradeoff between cost and differentiation. Recent theory development focuses on reducing the need for making tradeoffs such as cost versus differentiation. New emphasis on flexibility and flexible management systems is breaking down the cost versus differentiation tradeoff. Porter's framework may be too simplistic. Firms today are competing on time, design, innovation, and customization. In response to these changes, managers are now using tools that are beginning to break down functional barriers.

Implications of Single Function Approaches

As the parable and the proceeding sections indicate, optimization of one function often comes at the expense of another. Perhaps the most obvious examples are between operations and human resources. Simplification and standardization tend to produce higher quality products, at lower costs, and in less time. These achievements can often be accomplished by automating. The jobs that result from these activities are likely to be simple and not very challenging. These jobs will also be excruciatingly boring for the "knowledge workers" that the human resource people are creating. Unfortunately for the firm, bored employees actually reduce the performance of the facility (Karuppan and Schniederjans 1995).

Research on the linkages between operations and marketing (e.g. Hill 1994) is becoming more common, but most functional linkages are not well developed. The end result is a disparate collection of policies that can optimize one part of an organization but which may harm another part.

Perhaps partially in response to these shortcomings some new methodologies have been created that take a more holistic view of the firm. These more systematic methods of achieving competitive advantage are discussed next.

Benchmarking, TQM, and Process Reengineering—Toward a Cross-Functional Approach

Optimization of various processes or functions has led to the recent surge in benchmarking. However, benchmarking will not lead to a sustainable competitive advantage for several reasons. The implementation of benchmarking often creates problems. Benchmarking targets a world class or state of the art company in an attempt to learn how to make a single functional area successful. The problem is that the benchmarked firm has other functions, all of which relate to that being benchmarked. Observable processes are the end result of many unrecorded, inimitable events. The company that benchmarks gets only the end product—no map as to how the benchmarked company got to this point, and importantly, no accumulated learning will develop. Firms using benchmarking as a means to gain competitive advantage may not succeed.

Benchmarking targets a world class… company…to learn how to make a single functional area successful. The problem is that the benchmarked firm has other functions, which relate to that being benchmarked.

Firms benchmark for a specific reason, often to implement TQM, or to reengineer processes. TQM is arguably one of the few cross-functional methodologies for attaining a competitive advantage. Customer satisfaction is increased through continuous improvement and enhanced quality. But TQM may have limitations (Schneiderman, 1998). The focus on quality may be misplaced. A quality initiative may be appropriate for firms where quality is an order winner. But, when quality becomes an order qualifier, a company's needs may go beyond TQM to include TCM (total cost management) or TLTM (total lead time management) to gain competitive advantage.

Finally, the increased need for internal process information has led to the recent clamoring over business process reengineering. Reengineering has a more internal focus than benchmarking and TQM, but has the same problems. That is, reengineering can often be applied to areas of the firm that are not in critical need of it, or, even worse, can have unintended negative effects on related functions within the firm.

It is apparent that numerous conceptualizations of competencies, the sources of competitive advantage, exist across disciplinary boundaries. Table 1 summarizes selected functional approaches to defining the competency construct. Firms indeed appear to be moving toward a more cross-functional approach with TQM, reengineering, and benchmarking.

However, this movement may be driven more by consultants and practitioners. As a result, these approaches tend to be relatively atheoretical. Following is an attempt to systematically incorporate many of the strengths of various functional approaches into a single cross-functional theoretical framework.

Theory Development

An Alternative Approach

By viewing the firm as a system or chain of self-contained functional centers, each contributing some discrete value, there is a tendency to think that any single link or functional unit can be independently strengthened, improved, or replaced. An alternative approach suggests that the firm is a collection of interdependent resources (e.g. Barney 1986; Dierickx and Cool 1989). Such a framework implies that any individual functional area cannot be considered independent of the entire system. Changing a policy or process in a single functional area will impact a myriad of other resources across a variety of functional areas. Therefore, a main premise of this work is that the call for cross-functional teams to solve problems in the business world must be accompanied by cross-functional research to give practitioners direction.

The impact of this resource-based view is that it forces managers to look beyond the traditional value chain. The value chain and its associated optimization of functions as individual fiefdoms not only has the potential to mislead a firm, it can have a negative effect on the competitiveness the firm is trying so hard to achieve. What is needed is an alternative way of looking at the firm that takes into account both tangible and intangible contributions to value, and also recognizes that almost everything that the firm does has an effect on everything else the firm does. Rather than a chain that almost forces single function thinking, the new view takes into account the way various areas relate to each other.

For instance, a firm planning to install an FMS using the value chain model might focus attention and resources on the operations area. If the technology would make operations more efficient and effective, then the technology must be a good choice because the operations link has been 'strengthened.' New technology is not only the domain of operations. According to Pavitt (1990), firms need to develop a comprehensive technological strategy that looks at the impact of a given technology on all aspects of the firm. Pavitt argues that such a strategy is essential for successful implementation of advanced technology.

Table 1
A Summary of Competence Terms

Term	*Cite*	*Definition*
Competence	Selznick (1957)	A skill or activity a firm excels at compared with other firms.
Core Competence	Prahalad and Hamel (1990)	1. Provides potential access to a wide variety of markets, 2. Offers significant contribution to perceived customer benefits and end product, 3. Is difficult to imitate.
Distinctive Competence	Hayes and Wheelright (1984)	Notion that a firm should identify and exploit resources, skills and organizational characteristics that give it a comparative advantage.
Capabilities	Stalk, Evans, and Schulman (1992)	Application of strategic thinking to business processes in areas beyond just operations and technology.
Resources	Wernerfelt (1984)	Companies should look internally at tangible and intangible resources for sources of competitive advantage as opposed to looking externally at products.
Competitive Advantage	Porter (1985)	Delivering the product at lower cost or offering unique benefits to the buyer to justify a premium price. How a firm puts generic strategies into practice.
Core Capabilities	Bowen, Clark, Holloway, and Wheelright (1994)	Attributes of a company that enable it to serve customers in a unique way distinguishing it from competitors including: 1. knowledge and skills, 2. managerial systems, 3. physical systems, 4. values.
Asset Stock Accumulation	Dierickx and Cool (1989)	Inimitability is the key to sustaining competitive advantage and can be achieved by applying the following five areas to assets: 1. time compression diseconomies, 2. interconnectedness, 3. asset mass efficiencies (success breeds success) 4. asset erosion, 5. causal ambiguity.

A technology strategy would look not only at how the FMS changed operations but at issues such as the impact of the technology on its users, the effect on marketing (i.e. "will our product range increase?") and any other areas of the firm that are affected by the change. Managers must realize ahead of time that the installation of a new technology in one area can affect the way the rest of the firm does business. Although this seems straightforward, current functional-specific approaches to strategy often under-emphasize these cross-functional relationships. Such a narrow approach can degrade decision-making.

A firm viewed as an interrelated structure can not be arbitrarily strengthened, weakened, or changed. Instead, any major change in any functional area must be examined within the larger context of how that change will impact the entire firm. When the value chain view is broadened, perspective is shifted from a single function view of optimization to a firm wide view of optimization. The value chain might drive optimization of single functional areas or process with little regard for the entire firm. A broader view forces one to look at how each functional area or process impacts on others, and how firm wide performance will be changed when we make changes to specific areas.

The Nature of Intangible Resources—Toward a Process Model of Capability Development

New developments in the management strategy literature discuss intangible resources as sources of competitive advantage. These resources include the ability to innovate new products, the people in an organization (Barney 1986; Pfeffer 1994) and the informal culture or communication within an organization. Intangible sources of competitive advantage are more difficult to copy than organizational structures or strategies (Aharoni 1993; Dierickx and Cool 1989; Lippman and Rumelt 1982), thus providing a basis for developing long-term competitive advantage.

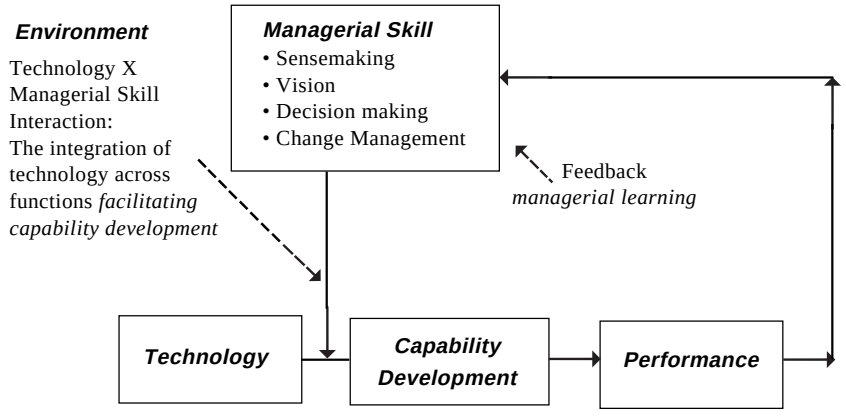
The key to competitive advantage, according to Dierickx and Cool (1989) lies in creating an asset stock that best leverages the interconnected nature of firm resources over long periods of time. This allows the firm to build competencies that are difficult for rivals to imitate, as the causal nature of the competencies is ambiguous. One particular type of intangible resource, managerial skill, is highlighted in the process of building capabilities that support competitive advantage.

To date, researchers have yet to develop a dynamic model explaining the impact of capability development on firm performance. Lack of theory has stunted the ability of both practitioners and researchers to understand the nature of capabilities and their impact on performance. The cross-functional approach to the present research question has resulted in the generic model of capability development presented below. This model considers capability development both across and within functional areas, providing a general explanation of firm and industry performance.

This model also allows for better prediction of the relationship between technology and firm performance, which will in turn lead to improved prescriptions for practitioners for their goal of leveraging technology to maximize performance. The model is presented graphically in Figure 1. The two underlying relationships summarized by the model are:

1. performance = *f* (capabilities, environment)
2. capability = *f* (technology, managerial skill)

Figure 1
A Dynamic Process Model of Capability Development



Performance is defined as return on assets (ROA). ROA is a useful variable because managers understand it and see it as a yardstick of managerial effectiveness (Keats & Hitt, 1988). It is seen by some as a better measure of performance than other market related variables because assets are much more under the control of managers, and it has been shown to be closely related to market value. ROA is considered better than other accounting measures because it is not as vulnerable to variability as a result of changes in leverage (Ramaswamy, 1997).

Technology is defined as discrete tools acquired or developed with the intent of increasing the value added by a process, e.g. equipment, materials, hardware, software, training program, expertise, 'process reengineering' programs. Technologies have several specific properties. They are generally easy to imitate by rivals, acquired via market, and exist within a functional area.

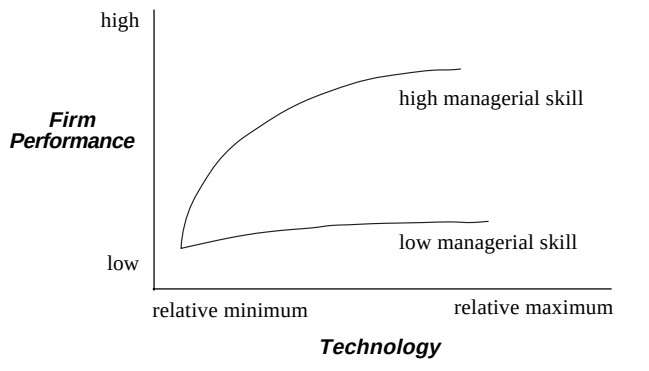
Capabilities are defined as the result of the interaction between technology and managerial skill, which result in increased performance. For this paper, only those capabilities that result in improved performance are considered. The characteristics of capabilities are such that they are difficult to imitate, are not available on market, diffused across functions, and exist as a combination of physical asset and shared cognitions.

Managerial skill is defined as the ability to create processes by which technologies are infused throughout the organization so as to maximize the value (either through enhancing output or reducing costs) added by the technology. Characteristics of managerial skill include accurate environmental scanning, the ability to manage change, creativity, vision, and motivational ability.

The model suggests that technologies are developed into interconnected, cross-functional, assets called capabilities by managerial skill. Technologies that are developed into these systemic capabilities are those that we expect to lead to long term extra-normal firm performance. Traditional systems-approach models look at the feedback link between performance and the nature of technologies brought into the firm–a link that is important but fails to capture essential feedback benefits. Every firm reinvests some profit into research and capital expenditures. However, firms that develop managerial skills to transform technologies into capabilities add to the existing stocks of expertise. This investment, in turn, increases the likelihood of developing additional technologies into capabilities and earning extra-normal profits over time.

The predicted relationship between the level of technology utilized by the firm, relative to industry rivals, and relative firm performance is mediated by managerial skill in implementing the technology across functional boundaries. This relationship is illustrated in Figure 2. The implications of this model are discussed below.

Figure 2
Predicted Mediated Relationship between Technology, Managerial Skill, and Performance



Discussion (A Return to the Parable)

In the opening parable a company followed a fairly typical (if exaggerated) path to try and achieve competitive advantage and failed. Let us return to CFC, but this time using our dynamic process model of capability development. Using this model the firm would not divide along functional lines in an attempt to improve performance. Instead they would do the following from a cross-functional perspective:

1. Identify key technologies, as well as technological gaps with competitors
2. Identify managerial skill sets as well as shortcomings in managerial skill sets
3. Identify present capabilities and sources of competitive advantage
4. Compare sources of competitive advantage to today's market as well as future markets
5. Determine ways to leverage existing capabilities, develop new capabilities, and to stop performing tasks where the company does not and will not in the future have the required capabilities.

The first step will focus on actual processes and technologies. CFC's equipment is generally old and very labor intensive. Cardboard cutting and pasting are done manually, with high costs to get quality levels comparable with more automated competitors. However, CFC has developed a proprietary system for applying finishes to boxes, which is more efficient and of higher quality than the competition.

CFC managers realize that they are exceptionally good at three things. First is the design and building of the aforementioned finishing equipment. Second is the ability to manage logistics and inventory. Strategy implementation requires coordination across, purchasing, operations, and logistics. The firm has been effectively using JIT in a very cyclical market for many years. Finally, they are very good

at predicting trends in candy box finishes. One of the reasons they have remained in business is the ability to be the first to market with a new candy box concept.

Skills that are lacking fall into two broad categories. First is cost control. Labor costs (hiring, firing, wages, training, etc.) are all higher than industry averages, as are production costs and the costs associated with R&D. Second, the company does not know much about industries using similar containers (e.g., flowers, jewelry) and cannot reap economies of scale and scope from serving potential customers in other markets.

Management identified three core capabilities that span functions. One is the development of new and novel container finishes. They remain in business because they are able to correctly predict trends in container finishes, as well as to secure the required supplies for these finishes. The second capability links to the first in that CFC managers have the capability to develop the technology to apply these finishes at the quality levels their customers require. The final capability is the management of the supply chain for on time delivery and high quality, although not at low costs.

CFC's sources of competitive advantage come from making innovative boxes using proprietary technologies. In addition they are able to ensure that these boxes are delivered on time and at the correct quality level. Innovation as well as being able to compete on time should be valuable in the market for many years.

The final step is actually two-fold. First, CFC managers must determine how to use present capabilities. Second, CFC managers must identify and plan to develop future capabilities. The company's present capabilities are actually quite strong but they have been overshadowed by attempts to control costs and to compete in the entire market, especially the low cost portion of the market. Problems with labor turnover and other cost problems come from trying to provide a complete line of candy containers, including those sold on cost. The first strategic change will be to focus solely on high-end boxes that have unique and/or innovative finishes. This will lower volume, but should increase margins. In addition the company will be able to decrease the size of the workforce while maintaining their core of skilled employees.

As part of the same strategy, the company will leverage its process research and development skills (in equipment design and manufacturing) to create a unit that not only makes equipment for internal use but also sells to competitors. Not only does CFC have this capability, but at the present time this market has almost no competition. In addition, the business cycles, while somewhat severe, are much longer than the overall box market which should also help to level off employment needs. The company's capability in supply chain management, especially working in a JIT environment, will be very useful in this business.

Finally the company will develop a new skill. They have been very successful at creating products for their very narrow niche, but they need to learn about other markets for high-end cardboard containers. Developing this capability will help create new markets, thereby reducing seasonal variability and improving related problems with hiring and cash flow.

This thrust may actually be aided by the move into equipment sales. It is likely that they will have customers for their equipment who make other types of containers. In designing and building equipment for these customers they will also be learning about these markets.

By reexamining CFC as an entire enterprise and focusing on capabilities that they have or will build the outcomes are much different. First, the company will address turnover and quality problems. Second, dependence on a single market and the related volume fluctuations will be mitigated. And finally, CFC will have diversified into new markets with fewer competitors and higher margins. The end result should be competitive advantage for many years.

Conclusions

This paper has defined a capability as the result of the accumulation of interconnected tangible (technologies) and intangible (managerial skill) resources, which result in the diffusion of technology across functional boundaries. A process model was introduced that suggests how the development of capabilities impacts firm performance. The model has implications for both managers and researchers.

From a research standpoint the model's most important implication is the need to see how the managerial programs suggested by single function research truly impact capability development and firm performance. Research that looks at how a major functional change impacts functional performance may be very misleading. For instance, the institution of TQM may indeed reduce defects and lower cost, but if it also limits the ability to innovate and bring new products to market has it been truly successful? The same types of questions can be asked about major changes in human resource policies or marketing plans. Therefore, researchers need to be aware of the effect of innovations not only within the function of interest, but across the firm and the entire-supply chain.

Researchers need to also be aware of the capability building process. Often new ideas are disseminated through case studies of leading firms. While these exemplars are interesting, the cases can be of limited value to others who cannot possibly determine the wide range of interconnected resources were brought to bear in order to make the innovation work. Case studies generally just describe directly related resources and processes. The cross-functional approach suggested here places equal importance on indirect capabilities and processes that are

often difficult to see. This point is especially important when dealing with intangible resources. We suggest that one of the reasons that competitive advantage research at both the firm and functional level has disappointed is due to a focus on technologies and tangible resources as opposed to managerial skills and intangible resources that are used to create unique capabilities.

Managerial implications are similar. The first implication is that firms need to be aware of what they are good at. What capabilities do they have? Many functional areas have worked at identifying their individual competencies, without considering how these competencies impact the overall firm's capability(s). In order for the entire firm to add value it must be viewed as a whole when making plans for the whole. Managers must therefore be aware of how what they do impacts the rest of the firm. And in a similar view managers should be aware that their activities may have implications for other parts of the supply chain.

By examining and implementing strategy from the standpoint of developing and leveraging capabilities over time firms may be able to achieve true competitive advantage. An achievement that is far less likely when the firm is treated as a number of separate functional fiefdoms. ■

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Quality Management Practices in Manufacturing and Service Corporations: How are they Different?

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Abstract

This study examines the relative perceptions of manufacturing and service quality executives about the use and benefits of quality management programs. In particular, survey responses from 358 of the largest U.S. manufacturing and service corporations were used to assess the impact of quality program practices, training, support, and results. This exploratory research suggests that quality management systems have been more thoroughly developed by manufacturing firms relative to service companies. Many quality management practices have resulted in greater perceived competitive results in the manufacturing environment. The greater success of those quality practices in manufacturing firms may be related to the increased training in these programs and higher levels of management and employee support. The greater success of some quality management practices may also provide important insights to manufacturing and service organizations on gaining competitive advantage, especially in terms of customer relationships.

Introduction

This study of U.S. manufacturing and service quality executives examines the practices, training, support, and results of their corporate quality management practices. Most leading American corporations have championed quality management practices for the past few decades, but implementation difficulties have translated into questionable results for some programs. Several CEOs have recently announced vastly revitalized Six Sigma programs (including quality practices such as process mapping, quality function deployment, statistical process/ quality control, design of experiments, quality action teams, etc.), especially at General Electric, Allied Signal, and Motorola (Byrne 1998; Charan 1998; Hoerl 1998). It was estimated that the lack of a Six Sigma program before 1995 had cost GE between $8 billion and $12 billion annually in inefficiencies and lost productivity (Byrne 1998). The reported Six Sigma program cost savings for 1997 were about $600 million at GE and more than $800 million at Allied Signal (Hoerl 1998). Past research for quality programs has reported similarly dramatic results for a select sample of corporations in certain manufacturing industries (Flynn, Schroeder, and Sakakibara 1995). The purpose of the present research includes the examination of the success rates of quality management practices for manufacturing versus service industries. Furthermore, the present study addresses current academic criticism of the lack of knowledge regarding an appropriate human resource management environment to support the implementation of a quality program, for example employee training. Such "tacit resources" have been suggested as the real source of competitive advantage (Powell 1995).

> ***…the study addresses the lack of knowledge regarding an appropriate human resource management environment to support the implementation of a quality program…***

Although there has been considerable research on quality in the past few years, this study is one of the few multi-industry surveys of quality management programs at some of the largest 500 U.S. manufacturing and 500 U.S. service corporations. This study examines certain problems that have been created by the recent implementation of American quality programs (Adam 1994; Powell 1995). Recent research has pointed to differences between manufacturing and service sector industries in terms of the relationship between quality and productivity (Huff, Fornell, and Anderson 1996). Specifically, the study concluded that quality and productivity are positively correlated for manufacturing companies but are inversely related for service companies. Quality system performance for manufacturing firms has also been reported to result from successful implementation of several key practices such as concurrent engineering, new-product quality, employee involvement, feedback, maintenance, labor skill level, selection for teamwork potential, process control, and supplier relationships (Flynn, et al. 1995; Forker 1997). However, successful

implementation of less "tangible" human resource quality practices has been more elusive for American companies (Dobyns and Crawford-Mason 1991; Powell 1995).

This research examines current concerns about the effectiveness of manufacturing and service sector corporate quality management programs. From a recent survey by the Delta Group, eighty-five percent of company presidents believe that quality programs will remain the top initiative for the near future, but seventy percent of the chief quality officers are troubled by the disappointing quality program results (Powell 1995). This study assesses the amount of current use, the number of years of use, and the competitive results of each quality practice. The survey also examines the effects of employee training, as well as management and employee support, as suggested for further investigation in past studies (Flynn, et al. 1995; Grandzol and Gershon 1997; Powell 1995).

Competitive Advantage and Quality Management Systems

Sustainable competitive advantage is an emerging managerial paradigm proposed as the real efficacy of a corporate quality management system (Powell 1995). Recent research has championed internal dimensions of competitive advantage, building on a resource-based theory of the corporation (Barney 1991, 1995, 1997). The VRIO model proposes four key attributes of competitive advantage, i.e., value added, rareness, initiation cost, and organization. The VRIO concept implementation focuses on four key questions. For value added, do your firm's resources and capabilities enable your firm to respond to environmental threats and/or opportunities? For rareness, do competing firms not possess your firm's particular valuable resources and capabilities? For initation cost, do firms without a resource or capability face a cost disadvantage in obtaining it compared to your firm that already possesses it? Finally, for the organization factor, is your firm organized to exploit the full competitive potential of its resources and capabilities? See Barney, 1997.

External dimensions of competitive advantage have been emphasized by previous models. In one approach the characteristics of sustainable competitive advantage focus on the identifiable, strategic, defensible, and sustainable factors. The identifiability factor could be a critical success factor or core competency that provides customers with quality, value, service, or timeliness (Bemowski 1995; Rowe, Mason, Dickel, Mann, and Mockler 1994). The strategic nature of a competitive advantage refers to market success relative to competitors due to the implementation of an effective business strategy, for example cost/price leadership, cost focus, differentiation, and focused differentiation of a product or service (Porter 1990; Reed, Lemak and Montgomery 1996). The defensible nature refers to protecting the uniqueness of the product, service, or process advantage as much as practically possible against duplication by competitors for maximum investment recovery (Rowe, et al. 1994). Finally, the sustainable dimension results from customers consistently perceiving a positive difference between a firm's products or services and those of its competitors for a reasonable period of time (Rowe, et al. 1994). Another model combines external and internal dimensions to formulate competitive advantage as (1) driven by customer needs, wants and value, (2) makes a significant contribution to the success for the business, (3) matches the organization's unique resources with opportunities in the environment, (4) is durable, lasting, and difficult for competitors to copy, (5) provides a basis for further improvement, and (6) provides direction and motivation to the entire organization (Wheelwright 1989). Therefore, overall competitive advantage of a corporation could be conceptualized as a combination of internal and external factors.

The examination of the sustainable competitive advantage of quality management systems has been proposed from literature reviews as one of the most promising areas requiring future research (Dean and Bowen 1994; Godfrey 1993; Spitzer 1993). Sustainable competitive advantage has been reported to result from "tacit" quality management dimensions such as employee commitment but generally not from "tangible" quality dimensions such as benchmarking (Powell 1995). Manufacturing corporations have recently embarked on a dramatic shift from an operational quality philosophy toward a quality management paradigm that emphasizes strategic and human resource competitiveness (Blaine 1993; Byrne 1998; Charan 1998; Hoerl 1998; Powell 1995; Tsurumi 1982; Yahagi 1992).

Manufacturing and Service Quality Differences

Previous research has identified differences between manufacturing and service companies based on several factors. One model has proposed three dimensions: intangibility in the lack of a physical presence in the delivery of a service, heterogeneity in the differentiation of the service for each customer, and simultaneity in the usage of a service at the time it is delivered as opposed to saving it for later use (Parasuraman, Ziethaml and Berry 1985). Relative to the manufacturing environment, service sector employees have more direct contact with the customer, and employee contact is often reported as the most critical element in the success of a service relative to competitors (Bitner and Hubbert 1994; George and Jones 1991). The importance of the employee service encounter is demonstrated by the use of several employee-related items in national survey instruments, for example the SERVQUAL questionnaire (Parasuraman, Ziethaml, and Berry 1988). Therefore, the customer relationship developed by the organization and its

employees has been perceived as more critical for success in the service rather than the manufacturing sector.

Even after accounting for the lead time advantage of manufacturing sector quality programs, there are several proposed natural differences in quality systems between manufacturing and service firms. Manufacturing outputs are more tangible and visible, in contrast to services that are more directly customer oriented, more delivery time sensitive, more customized, more labor intensive, and less easily automated (Evans and Lindsay 1996, 44-46).

…there are several… natural differences in quality systems between manufacturing and service firms.

This study addresses the relative competitive results of quality management systems for the manufacturing sector versus the service sector corporations. The diffusion of knowledge of quality program experience among industries has been primarily from manufacturing sector to service sector organizations, promoted through various channels such as conferences, consortiums, and consulting firms (Cortada and Woods 1995; Godfrey 1993). The superior quality system experience could partially result from the greater age and sophistication of the manufacturing sector quality programs, as reported by Powell (1995). The superiority of manufacturing firms has been reported for certain traditional quality practices by one study (Powell 1995). Specifically, manufacturing firms excelled in "tangible" factors such as closeness to suppliers, zero defects mentality, process improvement, and "measurement" (e.g., quality goals and data analysis). However, the overall results concluded that other "tacit," behavioral, imperfectly imitable features, such as open culture, employee empowerment, and executive commitment, were the real sources of competitive advantage. These "tacit resources" and other human resource dimensions of quality management were only partially examined in previous research and should be investigated further.

Methodology

This exploratory study captures the efficacy of several key quality program practices that have been implemented by major American corporations to address some aspect of product or service quality improvement. A review of previous research suggests the assessment of the following fifteen quality practices: quality action/improvement teams, self-managing work teams, just-in-time production, cost-of-quality monitoring, self-inspection by employees, work/manufacturing cells, supplier quality evaluation, statistical quality control, statistical process control, customer satisfaction evaluation, supplier partnerships, delivery time-based competitiveness, ISO 9000 implementation process, concurrent engineering, and design of experiments (Evans and Lindsay 1996; Flynn et al. 1995; Powell 1995). Each practice is evaluated for each of four attributes: the amount of current use, internal benefits, external (competitive) benefits, and the number of years in use (which was reported by Powell (1995) to have a significant effect on program success).

The success of each quality system practice may depend on the level of three potential moderator variables. Some practices may have been used longer for the manufacturing sector, than for the service sector. The second variable includes the extent to which the firm's workforce is trained in the following six areas: group decision-making or problem-solving, quality system or statistical-analysis skills, leadership skills, skills in understanding the business, team-building skills, and job skills training (Bowles and Hammond 1991; Greene 1993). Finally, management and employee support will be assessed, as reported by Powell (1995).

The quality practice attributes, training, and support were measured by a questionnaire survey sent to the chief quality officer of the 500 largest manufacturing and 500 largest service companies in the U.S. An initial questionnaire was tested in a pilot survey sent to approximately 90 corporate quality program directors. The revised questionnaire consisted of 109 items. Most items were rated on a five-point Likert scale, but the age of each quality practice item was rated in number of years and the seven training items were rated as a percentage of corporate employees. Respondents were asked to evaluate their perception of each of the training and support items, as well as the four attribute items for each of the quality practices. The Likert scale used 1 as "no extent," 2 as "low extent," 3 as "moderate extent," 4 as "high extent," and 5 as "great extent." The fifteen quality practices were described briefly. The "internal benefits" item was defined in terms of overall results of greater product/service value, productivity, morale, cost-reduction, etc. The "external (competitive) benefits" item was delineated in terms of greater customer satisfaction, delivery performance, and ability to adapt to future environmental changes.

The survey consisted of four separate mailings to the top quality officer of each corporation, including a cover letter, the questionnaire, and a postage-paid return envelope. The cover letter included a "box" containing a few response options, such as "there is no corporate-wide quality program" and "our program is less than a year old." Those response conditions were measured if the cover letter was returned. The respondents were guaranteed confidentiality and were sent the overall averaged results of the survey and the averaged results for their industry. There were 220 questionnaire responses from manufacturing

Table 1
ANOVA between Manufacturing and Service Firms for Amount of Use for Each Practice

	Total Mean	*MFG. Mean*	*SERV. Mean*	*F Ratio*	*F Prob.*
Quality Action/Improvement Teams	3.53	3.67	3.32	9.69	.0020
Customer Satisfaction Evaluation	3.49	3.26	3.86	20.41	.0000
Supplier Quality Evaluation	3.29	3.51	2.91	21.47	.0000
Self-Inspection By Employees	3.18	3.43	2.72	28.04	.0000
Supplier Partnerships	2.99	3.18	2.64	16.86	.0001
Statistical Quality Control	2.87	3.19	2.29	47.75	.0000
Statistical Process Control	2.82	3.22	2.15	76.90	.0000
ISO 9000 Implementation Process	2.61	3.20	1.60	105.48	.0000
Cost of Quality Monitoring	2.43	2.64	2.07	16.69	.0001
Just-In-Time Operations	2.42	2.74	1.83	41.76	.0000
Self-Managing Work Teams	2.35	2.51	2.08	12.21	.0005
Delivery Time-Based Competitiveness	2.26	2.45	1.92	12.13	.0006
Work Cells/Manufacturing Cells	2.19	2.59	1.45	56.51	.0000
Concurrent Engineering	2.10	2.40	1.61	32.21	.0000
Design of Experiments	2.07	2.40	1.49	60.16	.0000

firms, for a response rate of 63.4 percent from companies with a corporate quality program more than a year old. Likewise, 138 service companies responded for a 68 percent response rate. The final sample consisted of some representation from all of the twenty-seven manufacturing and ten service industries in the 1996 *Fortune* list.

The analysis of the survey data was initiated by reporting the overall mean value of the amount of current use of each quality practice, simply to establish the overall order of the variables. Secondly, the reliability of the competitive result scale was assessed by a Cronbach Alpha test for each of the quality practices. Thirdly, analysis of variance (ANOVA) tests were conducted for differences between the manufacturing and service samples for the amount of current use, competitive results, and number of years in use for each practice. Finally, the impact of the training and support variables was examined by ANOVA tests for differences between the manufacturing and service sectors.

Results

The statistical analysis of values for the manufacturing sector versus the service sector revealed significant differences at least at the .05 level for the amount of current use for all of the quality practices, as highlighted in Table 1. The manufacturing firms' mean exceeded the service companies' mean for quality action/improvement teams, supplier quality evaluation, self-inspection by employees, supplier partnerships, statistical quality control, statistical process control, ISO 9000 process, cost-of-quality monitoring, just-in-time operations, self-managing work teams, delivery time-based competitiveness, work/manufacturing cells, concurrent engineering, and design of experiments. Service corporations surpassed manufacturing firms only in the amount of current use of customer satisfaction evaluation.

The Cronbach alpha values for the reliability of the "competitive results" scale are reported in Table 2. The competitive results scale combines the internal benefits (e.g., value, productivity, morale, cost reduction, etc.) and the external benefits (e.g., customer satisfaction, delivery performance, etc.) items for each quality practice. The literature has suggested that the operationalization of competitive advantage should include some internal and external dimensions (Barney 1991, 1995, 1997; Powell 1995; Wheelwright 1989). The Cronbach alpha values in Table 2 are all well above the acceptable 0.6 level.

For the perceived competitive results of each quality practice, there was a statistically significant difference at

Table 2
Cronbach Alpha for the Competitive Results Scale

Quality Action/Improvement Teams	.725
Customer Satisfaction Evaluation	.766
Supplier Quality Evaluation	.761
Self-Inspection by Employees	.762
Supplier Partnerships	.765
Statistical Quality Control	.766
Statistical Process Control	.789
ISO 9000 Implementation Process	.767
Cost-of-Quality Monitoring	.821
Just-In-Time Operations	.780
Self-Managing Work Teams	.726
Delivery Time-Based Competitiveness	.854
Work Cells/Manufacturing Cells	.810
Concurrent Engineering	.849
Design of Experiments	.794

Table 3
ANOVA between Manufacturing and Service Firms for Competitive Results of Each Practice

	Total Mean	*MFG. Mean*	*SERV. Mean*	*F Ratio*	*F Prob.*
Quality Action/Improvement Teams	3.30	3.41	3.13	6.69	.0101
Customer Satisfaction Evaluation	3.48	3.34	3.71	10.21	.0016
Supplier Quality Evaluation	3.16	3.23	3.02	2.74	.0991
Self-Inspection By Employees	3.06	3.17	2.81	7.84	.0055
Supplier Partnerships	3.25	3.30	3.13	1.77	.1884
Statistical Quality Control	2.99	3.15	2.61	16.52	.0001
Statistical Process Control	2.98	3.12	2.57	15.39	.0001
ISO 9000 Implementation Process	3.00	3.08	2.58	5.65	.0194
Cost of Quality Monitoring	2.60	2.57	2.67	.045	.5008
Just-In-Time Operations	3.00	3.10	2.70	5.10	.0250
Self-Managing Work Teams	2.84	2.93	2.64	3.93	.0486
Delivery Time-Based Competitiveness	3.04	3.13	2.82	2.99	.0854
Work Cells/Manufacturing Cells	3.18	3.24	2.83	2.90	.0908
Concurrent Engineering	3.01	3.07	2.81	1.74	.1894
Design of Experiments	2.79	2.83	2.61	1.39	.2396

Table 4
ANOVA between Manufacturing and Service Firms for Number of Years in Use of Each Practice

	Total Mean	*MFG. Mean*	*SERV. Mean*	*F Ratio*	*F Prob.*
Quality Action/Improvement Teams	4.92	5.61	3.76	22.40	.0000
Customer Satisfaction Evaluation	5.14	4.46	6.24	10.72	.0012
Supplier Quality Evaluation	5.31	5.51	4.89	1.15	.2842
Self-Inspection By Employees	5.25	5.60	4.44	3.00	.0844
Supplier Partnerships	4.70	4.96	4.09	0.87	.3518
Statistical Quality Control	6.01	6.67	4.26	12.33	.0005
Statistical Process Control	5.21	5.82	3.41	16.69	.0001
ISO 9000 Implementation Process	2.19	2.17	2.29	0.23	.6288
Cost of Quality Monitoring	4.72	5.34	3.11	10.76	.0012
Just-In-Time Operations	4.67	5.22	2.72	8.07	.0051
Self-Managing Work Teams	3.06	3.26	2.61	2.66	.1043
Delivery Time-Based Competitiveness	4.46	3.96	5.68	1.33	.2509
Work Cells/Manufacturing Cells	4.35	4.24	4.99	0.53	.4677
Concurrent Engineering	3.91	4.18	2.96	1.86	.1748
Design of Experiments	4.46	4.41	4.74	0.20	.6570

Table 5
Percent of Employees Given Training in the Last Five Years

	Total Mean	*MFG. Mean*	*SERV. Mean*	*F Ratio*	*F Prob.*
Job skills training	58.3	56.3	62.1	2.43	.1199
Group decision-making/prob-solving skills	43.3	48.5	34.3	14.36	.0002
Team-building skills	39.1	42.0	34.0	4.84	.0284
Quality System or statistical analysis skills	36.6	43.8	24.0	27.69	.0000
Skills in understanding the business	28.9	24.9	35.6	8.67	.0035
Leadership skills	27.8	28.1	27.1	0.12	.7320

least at the .05 level between the means of the manufacturing and service sectors for eight of the quality practices, as highlighted in Table 3. The manufacturing company mean surpassed the service sector average for quality action/improvement teams, self-inspection by employees, statistical quality control, statistical process control, ISO 9000 implementation process, just-in-time operations, and self-managing work teams. Again, service corporations surpassed the manufacturing companies only for customer satisfaction evaluation.

The difference between means of the number of years in use for the manufacturing sector versus the service sector was statistically significant at least at the .05 level for only six of the quality practices, as highlighted in Table 4. The manufacturing sector exceeded the service sector for quality action/improvement teams, statistical quality control, statistical process control, cost-of-quality monitoring, and just-in-time operations. However, the service firms surpassed the manufacturing companies only for customer satisfaction evaluation.

Table 6
Amount of Support/Enthusiasm for the Quality System

	Total Mean	*MFG Mean*	*SERV. Mean*	*F Ratio*	*F Prob.*
From top management	3.71	3.85	3.48	13.56	.0003
From employees	3.40	3.50	3.23	11.25	.0009

Analysis of variance revealed differences between the manufacturing and the service sectors that were statistically significant at least at the .05 level for two types of variables. As highlighted in Table 5 for the training variables, the manufacturing companies excelled in group decision-making/problem-solving skills, team-building skills, and quality system or statistical analysis skills, but service firms were rated higher for skills in understanding the business. Likewise as highlighted in Table 6, the manufacturing sector exceeded the service sector for both top management and employee support and enthusiasm for the quality system.

Limitations

The present exploratory study focuses only on selected quality management practices, training, support, and results that were reported in previous research and refined by a pilot study. Potential drawbacks common to survey research include the usage of a single respondent per firm, the use of perceptual data, and self-selection of responses. This study reports observations at one point in time and lacks trends or changes. Finally, manufacturing and service sectors are broad categories that contain many different corporations. It might be interesting to examine differences among industries within each sector. Therefore the conclusions are tentative and further research could enhance the generalizability of the present results, for example for external benefits other than competitive advantage.

Conclusions

The results of this study of quality management executives demonstrate the relatively greater training, use, and implementation of quality management systems generally by manufacturing firms, as compared to service organizations. Manufacturing organizations indicate greater use of quality practices and perceive greater benefits from such efforts. Also, manufacturing firms are more likely to perceive that quality practices will lead to competitive advantage, particularly those activities related to quality and self-managing work teams, self-inspection by employees, quality and process control, just-in-time operations, and ISO 9000 implementation. Manufacturing organizations have used some quality management practices significantly longer than service firms. Also, manufacturing firms receive greater support for quality management systems from their management and employees as well as providing more training in quality management concepts and principles. The relatively greater maturity of manufacturing organizations in quality management can provide important insights to service organizations as they continue to develop and use quality system practices to improve competitive advantage.

For specific quality management practices, there were several dramatic trends. Service sector corporations clearly excelled in the amount of use, competitive results, and years in use of customer satisfaction evaluation, consistent with other "intangibles" reported previously (Powell 1995). Accordingly, manufacturing sector companies could benefit from learning how service firms have achieved greater perceived closeness to their customers. Overall, quality action/improvement teams were rated highest in current use and second highest in competitive results, but more so for manufacturing than service firms. Service sector corporations could benefit from emulating the manufacturing sector or simply implement more effective quality teams as they gain experience over time.

Other quality practices that are rated more highly for manufacturing companies may be due to the natural advantage that seems to persist for "tangible" factors (Powell 1995) such as for statistical quality/process control, and just-in-time operations. Service sector firms could also improve their effectiveness by learning from the reasons for the success of manufacturing companies especially for self-inspection by employees, quality action teams, and ISO 9000 implementation.

Finally, for some recent practices, such as self-managing work teams, it may be too soon realize the full benefits. For many older practices, for example supplier quality evaluation and cost-of-quality monitoring, service corporations seem to have learned well from prior experience by manufacturing firms. Therefore manufacturing and service sector companies have gained comparably significant competitive advantages for most of the quality management practices evaluated by the present survey.

Managerial Implications

This paper studied the perceptions of upper-level quality executives regarding the relative use and benefits of quality management programs. The perceptions of the executives were found to differentiate according to whether the organization represented was a manufacturing or service enterprise. In general, the quality executives of manufacturing organizations indicated relatively greater use and perceived benefits of quality practices which tended to be more "tangible" and quantitative in nature, such as inspection and statistical process control. By contrast, superior use and competitive results for customer satisfaction evaluation could have been due to the greater subjective, "tacit," and behavioral nature of customer programs for service organizations. These conclusions address the proposal that quality in organizations is contingent upon the environment in which a manager operates.

…quality in organizations is contingent upon the environment in which a manager operates.

Our findings support the purpose of this study which is to examine differences in the perceptions of quality managers in manufacturing versus service corporations. Existing perceptions of quality aspects are shown to be restrictive and limited to the type of product (good or service) delivered. "Tangible" quality practices are perceived by manufacturing firms as more effective in terms of competitive results. However, manufacturing firms could expand the effectiveness of "tacit" quality practices, for example better integration of customer satisfaction and customer partnerships into existing "tangible" practice programs. Likewise, service firms should champion greater success for their "tangible" quality practices.

A recent highly-publicized example is the promotion of General Electric's "Six Sigma" quality program by CEO, Jack Welch (Byrne 1998; Charan 1998; Hoerl 1998). The program was initiated by Welch in late 1995 with 200 projects and training programs. Six Sigma was expanded to 3,000 projects and programs in 1996, and then 6,000 projects and training programs in 1997. The overall benefits have been estimated to yield $320 million in productivity gains and profits in 1997. The Six Sigma efforts were expected to provide $750 million in net benefits in 1998.

General Electric, Allied Signal, Motorola, and Polaroid have been innovative by training quality teams as well as individuals usually known as "black belts" for Six Sigma projects (Hoerl 1998). Each black belt recruit begins with an assigned quality improvement project during the four-month training program and project completion leads to full-time supervision of a quality team (Dusharme and Larson 1997). GE trained 1800 black belts in 1996 at a cost of about $200 million and GE expects to have 10,000 black belts by the year 2000 with annual savings of about $400 million to $500 million. A lesson to be learned by all managers is that both quantitative and qualitative issues must be addressed in the design and implementation of effective quality management programs. It is incumbent upon today's quality executives to simultaneously champion both "tangible" and "tacit" dimensions of quality activity to achieve the world-class competitive advantage from quality management programs. ■

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The Dow Jones Industrial Average:

Issues of Downward Bias and Increased Volatility

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Abstract

Does the method of divisor adjustment used for stock splits in the Dow Jones Industrial Average (DJIA) cause a downward bias in the average's level and does this method of adjustment cause increased volatility in the average? To investigate these issues, two averages are created using DJIA stocks. One average is adjusted for stock splits through adjustment in the divisor. This method is identical to the DJIA method of adjustment. The other average makes adjustment for stock splits by adjusting the stock value in the numerator. Relative to these two methods of adjustment for stock splits, the results of the study demonstrate that there is no downward bias of the DJIA. Additionally, it is found that the method of divisor adjustment for stock splits does not increase the volatility of the average. When compared to the Standard and Poor's Industrial Index, the DJIA does show downward bias.

Introduction

The Dow Jones Industrial Average (DJIA) closed on December 31, 1997 at 7908.25. This was its highest calendar year close until that time. It had hit new highs throughout 1997 and records continue to be broken. This measure of stock performance is the most widely known stock market indicator. Each night on the major network evening news, all three networks present the DJIA closing level and the change from the previous day's close. The Cable News Network flashes the DJIA on the screen throughout the day.

While the DJIA is certainly known to the public, it is severely criticized by practitioners as well as by academicians. The four primary criticisms are sample size, representativeness, weighting, and the method of divisor adjustment. The sample size criticism is directed at the fact that there are only thirty stocks used in the calculation of the average. Is this a sufficient sample size to represent a much broader market? The representativeness criticism is directed at the fact that the thirty stocks are all considered to be "blue chip" stocks. Blue chip stocks are stocks of firms that have a well established and proven record of performance but do not represent all sections of the broader market. The weighting criticism is directed at the fact that the average is price weighted. The average is calculated by summing the price per share of the thirty stocks and dividing this total by a divisor. Is the use of price per share representative of investment opportunities in a company's shares? These three criticisms (sample size, representativeness, and weighting) are certainly matters of concern when one evaluates the DJIA, but it is the fourth criticism that is the focus of this paper.

The four primary criticisms [of the Dow Jones Industrial Average] are sample size, representativeness, weighting, and the method of divisor adjustment.

The DJIA divisor is adjusted every time there is a stock split or a stock dividend greater than ten percent. The after-split or after-stock dividend price is used as the price in the numerator with adjustment made in the divisor. Some contend that this causes a downward bias in the level of the average. It is argued that stocks of successful companies increase in price and as the stock price increases, the company declares a stock split or stock dividend to keep the nominal price in a more favorable "trading range." Note that when a split or stock dividend occurs, a company's stock which previously had a high value in the numerator for the calculation of the DJIA, now has a reduced value. To keep the average's level unchanged following this value reduction, the divisor is adjusted downward. Consequently, over the years, stocks of very

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successful firms have had their proportional contribution to the average reduced through this method of divisor adjustment. Thus, it is pointed out that the DJIA is understated relative to what it would be without this adjustment technique. A related issue to the divisor adjustment method used for calculating the DJIA pertains to the average's volatility. Some contend that as the divisor is reduced, the volatility of the average increases. They argue that the sum of the stock prices (which constitutes the numerator) is a large positive number and division by a decreasing divisor (as the divisor is reduced by stock splits and stock dividends) will cause increased volatility in the value of the DJIA. This may be illustrated using this study's data. At the beginning of the study period, the DJIA divisor stood at 1.443. At the closing period of the study, the divisor had dropped to .25089315. In other words, the DJIA moved up or down by a mere .69 points for each dollar change in its numerator value when the divisor was 1.443. However, it was magnified to 3.99 points at the end of the study period when the divisor was much smaller at .25089315. Thus, the supporters of the volatility argument contend that it is the decreasing divisor that contributes to the increased volatility of the DJIA. The present study addresses both these issues, the possible downward bias and the increased volatility attributable to the DJIA's method of divisor adjustment.

Previous Research

The effect on the level of the DJIA due to its method of divisor adjustment for stock splits and stock dividends has long been debated. Milne (1966) argues that the DJIA is not at the level it should be because of its method of divisor adjustment. He concludes that, "the DJIA as reported has a longer-term downward bias as a result of its treatment of stock splits…when compared with an index using market value weights such as the S&P indexes." In referring to the effect of stock splits on the DJIA, Tewels and Bradley (1987) state that "this has given the industrial average a distinct downward bias. Over time, therefore, the average may not have risen as rapidly or as far as it might have otherwise." Reilly (1994) argues that the weighting scheme causes a downward bias in the DJIA because the stocks that have higher growth rates will have higher prices, and since such stocks tend to split, they will consistently lose weight within the index. Butler and Allen (1979) recommend that the present method of divisor adjustment for splits be stopped for it causes a downward bias. Lorie, Dodd, and Kimpton (1985) state that "the adjustment process and the method of weighting can produce a bias…weighting and adjustment process for the DJIA would produce a downward bias." The Appendix presents a simple numerical example that supports the above authors' positions that there is a downward bias in the level of the DJIA caused by the method of divisor adjustment. However, this view

When a stock splits, the DJIA adjusts the divisor downward and as the divisor is reduced, subsequent changes in the numerator are magnified due to division by a smaller divisor.

is not universally shared. Carter and Cohen (1967) assert that there is no evidence to suggest that the DJIA has any downward or upward bias. They argue that the issue can only be settled by empirical results.

Discussion in the literature of the impact on the volatility of the DJIA as a result of its method of divisor adjustment for stock splits and stock dividends is more recent than the issue of downward bias. The primary argument relates to changes in the divisor. When a stock splits, the DJIA adjusts the divisor downward and as the divisor is reduced, subsequent changes in the numerator are magnified due to division by a smaller divisor. Zigas (1989) points out that with five DJIA stocks splitting in 1989, the chance for large swings in the average is greater than usual. He argues that for stock price changes the average is magnified by the increased value of the reciprocal resulting from the stock splits. Sease and Steiner (1992) also support this argument by concluding that the DJIA's four stock splits in May 1992, would cause the average to become slightly more volatile. They reasoned that the splits would shrink the divisor further and the effect of price changes on the average would be magnified. Kerwin (1985) argues that the high level of the DJIA and the corresponding shrinking divisor tend to exaggerate the impact of stock price changes on the average. Kichen (1984) also pointed out that the small divisor in the DJIA means larger moves in the average for a small price change in its stocks. A secondary argument pertains to the impact on the numerator of the DJIA as a result of stock splits. Rudd (1979) holds that the changes in the proportional weightings of stocks in the DJIA, brought on by stock splits, is a source of instability over time. He contends that this problem makes the DJIA a poor indicator of long-term market movements. Lorie, Dodd, and Kimpton (1985) echo Rudd on weightings and contend that the DJIA is likely to become more volatile.

Though past research discusses extensively the issues of downward bias and increased volatility of the DJIA due to its method of divisor adjustment for stock splits and stock dividends, there has been no empirical testing done of these two issues. This study fills the void. More specifically, it is directed at testing for the suggested existence of downward bias of and increased volatility in the DJIA. In other words, this is the first empirical research study that addresses these two frequently debated issues of downward bias and increased volatility due to the divisor adjustment method used by the DJIA.

Methodology

The divisor for the calculation of the DJIA is adjusted such that the level of the average is not affected by stock splits or stock dividends. The Appendix illustrates this method of adjustment with an example of one stock having three stock splits at three different times. Average A uses the after-split stock price in the numerator and more importantly, adjusts the divisor in such a way that the level of the average is left unchanged immediately after the split. The major drawback of this treatment is that the proportional contribution of each of the non-splitting stocks in the average is increased while the split stock's contribution is reduced. The DJIA follows this technique and uses the closing price of the stock the day before it trades ex-split to arrive at an after-split price which is then used to calculate the new but smaller divisor. The net effect of this adjustment is that the level of the DJIA remains the same immediately after the split as it was prior to the split. An alternative method of adjustment for stock splits is not to alter the divisor, but to adjust the stock price in the numerator to effect the split. Average B in the Appendix illustrates this method. Average B adjusts the numerator for stock splits by multiplying the after-split price of the split stock by the split factor. This results in the level of Average B being unaffected by the split. It should be noted here that a significant contrasting feature between these two averages is that adjusting the divisor in Average A affects the proportional contribution of all stocks in the average, while adjusting the split stock by the split factor in Average B does not affect the proportional contribution of any stocks in the average. These two alternative methods of calculation for the DJIA stocks are employed in the study.

Period of Study

The study was conducted using price data over the period December 29, 1978 through the close of the market on December 31, 1997. Monthly closing price data over this period for each of the stocks in the DJIA were collected from the Wall Street Journal (WSJ). Because the WSJ reports the composite closing prices of stocks, these closing prices may not exactly match the New York Stock Exchange (NYSE) closing prices which are used for the calculation of the DJIA. Stocks may continue to trade on the Pacific Exchange and thus the closing price for the reported composite close would be the Pacific Exchange closing price. In order to ensure that the levels of the averages determined by the divisor and the numerator adjustment methods were not affected by the use of different stock price closes, the averages were calculated using identical data. This meant that rather than just use monthly DJIA closes from the WSJ, the composite closing prices for its thirty stocks were used to develop monthly calculated DJIAs (CDJIA).

Calculation and Comparability of Averages

The divisor used for the calculation of the DJIA, as reported in the WSJ, was followed over the period of the study. Every time there was a change in the divisor, the cause of the event was researched and identified. The four events causing changes were stock splits, stock replacements, subsidiary spin-offs, and large cash dividend distributions. For all four of these events, the DJIA makes an adjustment to the divisor to keep the level of the average unchanged.

…the composite closing prices for its thirty stocks were used to develop monthly calculated DJIAs.

To ensure that all of these events were accounted for in both the averages, the CDJIA and the DJIA were compared monthly. Over the study period of nineteen years, it was clear that there was very little deviation between the levels of these averages. The largest of the insignificant deviations occurred in the April close of 1997. Specifically, the DJIA close was 7008.99 and the CDJIA close was 6993.13. This represented a difference between the two averages of 15.86 points but only a percentage variation of less than one-fourth of one percent. By the end of the study, December 31, 1997, the DJIA closed at 7908.25 and the CDJIA at 7894.47. Likewise, there was not much deviation noticed between the divisors. For example, at the close on December 31, 1997, the DJIA's divisor stood at .25089315 and the calculated divisor at .25125190. The closeness of the two averages and their divisors assured us that all the events requiring adjustments of the divisor were identified. In addition, the adjustment for the CDJIA was done similarly to that for the DJIA.

An alternative average is constructed to provide a basis for comparison with the CDJIA. This average makes adjustments in the numerator for a stock split by multiplying the after-split stock price by the split factor for the stock which splits. In other words, the total contribution of the stock that splits is unchanged in the numerator with the divisor remaining unmodified. This adjustment method is identical to that used in the Appendix for Average B. Note however, that for events such as stock replacements, subsidiary spin-offs, and large cash dividends, the divisor adjustment method used is identical to that used in the DJIA. This is done for two reasons: 1) that the alternative average (hereafter referred to as the Modified Industrial Average (MIA)) is constructed primarily for comparison purposes and should therefore, closely follow the DJIA with minimal deviations, and 2) tracking and incorporating prices of those companies that left the MIA becomes extremely complex and probably less meaningful for the intended task. In fact, the DJIA

does not utilize these companies' prices in the calculation of its average levels after they leave the DJIA.

While the primary focus of the study is to compare the level and volatility of the CDJIA with that of the MIA, it would be of interest to study how these two averages compare with the Standard and Poor's Industrial Index (SPII) over the same period of the study. It should be noted here that the method of stock split adjustment used in the MIA is more closely related to that used by the SPII. While the MIA uses a modified price weighting versus the SPII's value weighting, both make adjustments for stock splits in their numerators. The MIA multiplies the after-split price per share by the split factor and the SPII makes a similar adjustment by multiplying the after-split stock price per share by an increased after-split number of shares outstanding. Under either of these adjustment methods, the respective contribution of a firm's stock to the level of the average/index is not affected by the split. Monthly closing levels of the SPII were collected from the WSJ over the entire period of the study for comparison purposes.

Results

The DJIA saw tremendous growth in its level over the nineteen-year period of the study. On December 29, 1978, it closed at 804.12. It rose to a calculated close of 7894.47 on December 31, 1997. The period saw many stock splits and other changes for the DJIA stocks. Tables 1A and 1B show the evolution of the DJIA over the period of the study. There were a total of sixty-three

Table 1A
1978-88 Evolution of the Dow Jones Industrial Average

December 31, 1978											*December 31, 1988*
Components	***1979***	***1980***	***1981***	***1982***	***1983***	***1984***	***1985***	***1986***	***1987***	***1988***	***Components***
Allied Chemical	–	–	Renamed Allied Corp	–	–	3.2	Allied Signal	–	–	–	Allied Signal
Alcoa	–	–	2:1	–	–	–	–	–	–	–	Alcoa
American Brands	–	–	2:1	–	–	–	McDonalds	3:2	3:2	–	McDonalds
American Can	–	–	–	–	–	–	–	–	Renamed Primerica 2:1	–	Primerica
AT&T	–	–	–	–	–	New AT&T	–	–	–	–	AT&T
Bethlehem Steel	–	–	–	–	–	–	–	–	–	–	Bethlehem Steel
Chrysler	IBM	–	–	–	–	–	–	–	–	–	IBM
DuPont	3:1	–	–	–	–	–	–	–	–	–	DuPont
Eastman Kodak	–	–	–	–	–	–	3:2	–	3:2	–	Eastman Kodak
Esmark	Merck	–	–	–	–	–	–	2:1	–	3:1	Merck
Exxon	–	–	2:1	–	–	–	–	–	2:1	–	Exxon
General Electric	–	–	–	–	2:1	–	–	–	2:1	–	General Electric
General Foods	–	–	–	–	–	–	Philip Morris	2:1	–	–	Philip Morris
General Motors	–	–	–	–	–	–	–	–	–	–	General Motors
Goodyear	–	–	–	–	–	–	–	–	–	–	Goodyear
Inco Limited	–	–	–	–	–	–	–	–	Coca Cola	–	Coca Cola
Inter. Harvester	–	–	–	–	–	–	–	Renamed Navistar	–	–	Navistar
Inter. Paper	–	–	–	–	–	–	–	–	2:1	–	Inter. Paper
Johns Manville	–	–	–	Amer. Exp.	4:3, 3:2	–	–	–	2:1	–	Amer. Exp.
Minnesota Mining	–	–	–	–	–	–	–	–	2:1	–	Minnesota Mining
Owens Illinois	–	–	–	–	–	–	–	2:1	Boeing	–	Boeing
Procter & Gamble	–	–	–	–	2:1	–	–	–	–	–	Procter & Gamble
Sears	–	–	–	–	–	–	–	–	–	–	Sears
Std. Oil California	–	–	2:1	–	–	Renamed Chevron	–	–	–	–	Chevron
Texaco	–	–	–	–	–	–	–	–	–	–	Texaco
Union Carbide	–	–	–	–	–	–	–	3:1	–	–	Union Carbide
U.S. Steel	–	–	–	–	–	–	–	Renamed USX	–	–	USX
United Technology	–	–	–	–	–	2:1	–	–	–	–	United Technology
Westinghouse	–	–	–	–	–	2:1	–	–	–	–	Westinghouse
F. W. Woolworth	–	–	–	–	–	–	–	2:1	–	–	F. W. Woolworth

stock splits. Fourteen stocks were replaced. Five stocks were renamed. AT&T underwent the breakup of the Bell System, and Allied and Signal merged. Not shown in Tables 1A and 1B are the two special cash dividends of Texaco and one of Union Carbide. Also not shown are the spin-offs of Henley by Allied Signal; of Praxair by Union Carbide; of Dean Witter, Discover, and Allstate by Sears; of Eastman Chemical Company by Eastman Kodak; of Lehman Brothers Holdings by American Express; of Imation by Minnesota Mining and Manufacturing; of Lucent Technologies, and NCR by AT&T; and of Hughes defense systems by General Motors. The DJIA and the CDJIA divisors on December 29, 1978 stood at 1.443. By the end of the study period, the calculated divisor had dropped to .25125190 as a result of the above changes. In May 1992, the divisor for calculating the DJIA was extended to eight decimal places. Similar adjustments were made on this date to the divisors used in the study to determine the CDJIA and the MIA.

The Issue of Bias

As stated earlier, some contend that the method of divisor adjustment used for stock splits in the calculation of the DJIA may result in a bias. Their view is that it causes the DJIA to be understated relative to what it would be if instead, the level of the numerator were to be appropriately adjusted for the split. But Bierman (1988), Dorfman (1992), Laderman (1993), Livingston (1993), and Sease and Steiner (1992), believe that the DJIA outperforms, not underperforms, the broader market. Here we look at the validity of both these arguments through empirical investigation.

The issue of bias caused by the divisor adjustment method was addressed by comparing the results of the CDJIA, the MIA, and the SPII over the entire nineteen-year period of the study. Rather than compare the absolute levels of these averages/index, they were compared on a relative basis. Each was taken relative to its level as of December 31, 1978. Consequently, all three began

Table 1B
1988-97 Evolution of the Dow Jones Industrial Average

December 31, 1988										*December 31, 1997*
Components	***1989***	***1990***	***1991***	***1992***	***1993***	***1994***	***1995***	***1996***	***1997***	***Components***
Allied Signal	–	–	–	–	–	2:1	–	–	2:1	Allied Signal
Alcoa	–	–	–	–	–	–	2:1	–	–	Alcoa
McDonalds	2:1	–	–	–	–	2:1	–	–	–	McDonalds
Primerica	–	–	Morgan J.P.	–	–	–	–	–	–	Morgan J.P.
AT&T	–	–	–	–	–	–	–	–	–	AT&T
Bethlehem Steel	–	–	–	–	–	–	–	–	Hewlett Packard	Hewlett Packard
IBM	–	–	–	–	–	–	–	–	2:1	IBM
DuPont	–	3:1	–	–	–	–	–	–	2:1	DuPont
Eastman Kodak	–	–	–	–	–	–	–	–	–	Eastman Kodak
Merck	–	–	–	3:1	–	–	–	–	–	Merck
Exxon	–	–	–	–	–	–	–	–	2:1	Exxon
General Electric	–	–	–	–	–	2:1	–	–	2:1	General Electric
Philip Morris	4:1	–	–	–	–	–	–	–	3:1	Philip Morris
General Motors	2:1	–	–	–	–	–	–	–	–	General Motors
Goodyear	–	–	–	–	2:1	–	–	–	–	Goodyear
Coca Cola	–	2:1	–	2:1	–	–	–	2:1	–	Coca Cola
Navistar	–	–	Caterpillar	–	–	2:1	–	–	2:1	Caterpillar
Inter. Paper	–	–	–	–	–	–	2:1	–	–	Inter. Paper
Amer. Exp.	–	–	–	–	–	–	–	–	–	Amer. Exp.
Minnesota Mining	–	–	–	–	–	2:1	–	–	–	Minnesota Mining
Boeing	3:2	3:2	–	–	–	–	–	–	2:1	Boeing
Procter & Gamble	2:1	–	–	2:1	–	–	–	–	2:1	Procter & Gamble
Sears	–	–	–	–	–	–	–	–	–	Sears
Chevron	–	–	–	–	–	2:1	–	–	–	Chevron
Texaco	–	–	–	–	–	–	–	–	Johnson & Johnson	Johnson & Johnson
Union Carbide	–	–	–	–	–	–	–	–	–	Union Carbide
USX	–	–	Disney	4:1	–	–	–	–	–	Disney
United Technology	–	–	–	–	–	–	–	2:1	–	United Technology
Westinghouse	–	2:1	–	–	–	–	–	–	Travelers Group, 3:2	Travelers Group
F. W. Woolworth	–	2:1	–	–	–	–	–	–	Wal-Mart	Wal-Mart

with a relative value equal to one. This was done so that direct comparisons could be made. Figures 1A and 1B show the CDJIA relative (DJIAR) minus the MIA relative (MIAR); the DJIAR minus the SPII relative (SPIIR); and the MIAR minus the SPIIR. The legend identifies each of the respective graphs. Figure 1A ranges from January 1979 through June 1988, and Figure 1B from July 1988 through December 1997. This was done merely to add clarity to the graphs.

In looking at the graph in Figure 1A representing the DJIAR minus the MIAR, it is clear that there is very little difference between these two averages. Figure 1B shows the continuation of this relationship until late 1989 or early 1990. After this time, there is a sharp move down in the graph, then a somewhat lateral move with minor variation. The graph then makes a sharp rise with a subsequent lateral movement and then a sudden turn down in late 1993. The downward trend continues through 1997, with considerable variation. Using Box Jenkins analysis to find points of intervention, the first intervention point was approximated at about April 1990 or month 136. For months 1 through 135, or January 1979 through March 1990, the relationship of the DJIAR minus the MIAR was found not to be significantly different from zero, with a t-statistic of 1.23. After this point, a model could not be fitted to the graph.

Figure 1A
Differences in Relatives
January 1979 through June 1988

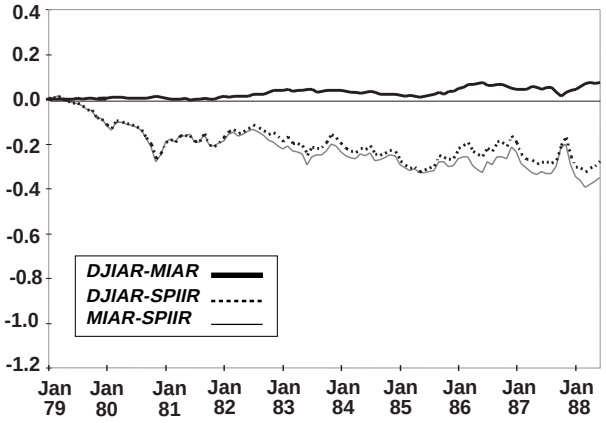
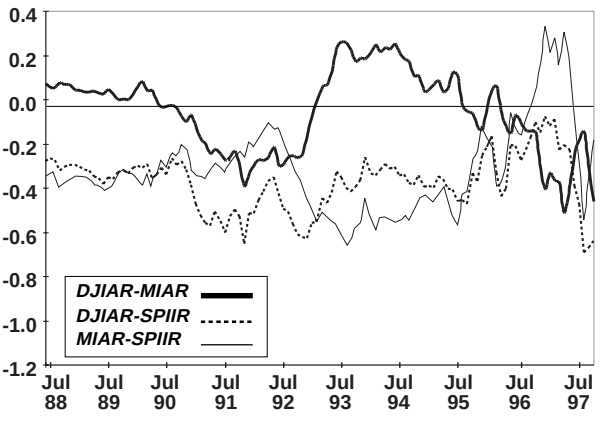


Figure 1B
Differences in Relatives
July 1988 through December 1997



The fact that the DJIAR and the MIAR were so close to one another for a period of eleven and one-fourth years was an interesting finding. It certainly does not support the view that the method of divisor adjustment used for the DJIA, versus a numerator adjustment method, causes a downward bias in the average. However, the substantial deviation found in the CDJIA and MIA relationship after March 1990 was a concern. Table 2 sheds some insight into why this deviation has occurred. This table shows the prices/values of the stocks in the CDJIA and the MIA on three selected dates. These dates are the end of month closes for March 1990, December 1991, and August 1993. These dates were selected because the first date represents approximately the end of the period of consistency between the DJIAR and the MIAR. The second date shows the trough of negative differences between these two relatives. The last date shows the peak of positive differences between these two relative values. Table 2 also shows the percentage contribution of each stock's price/value to the CDJIA and the MIA. Also shown are the top five stocks and their percentage contributions to the averages. Of particular interest in the Table is the date of December 1991. The total percentage contribution of the top five stocks to the MIA on March 1990 stood at 41.89 percent. On this date, Merck and Philip Morris combined contributed 19.13 percent to the total value of the MIA. On December 1991, the same top five stocks' contribution was 52.67 percent, and Merck and Philip Morris' combined percentage was 31.52 percent. Thus, while the top five's share of the total increased by 10.78 percent, the share of Merck and Philip Morris combined went up by 12.39 percent. By the end of 1993 the top five stocks' share of the MIA had declined to 42.93 percent, and that of Merck and Philip Morris combined stood at 18.97 percent.

To investigate the impact of Merck and Philip Morris on the differences in the DJIAR minus the MIAR, Figure 1C was created. The Figure shows the DJIAR minus the MIAR over the second half of the study period but with Merck and Philip Morris removed from the CDJIA and the MIA averages starting in April 1990. This period includes the time over which there were substantial differences in the levels of the CDJIA and the MIA. To correct for the removal of these two stocks from the averages the divisors for both were readjusted so that the levels of the averages remained unchanged. These averages were then recalculated over the same period using the remaining

twenty-eight stocks, with adjustments made for splits, spin-offs, etc., if any. It is clear from Figure 1C that the differences between the DJIAR and the MIAR are reduced with the removal of Merck and Philip Morris. To statistically test the impact on the DJIAR minus the MIAR with Merck and Philip Morris removed, the Box Jenkins analysis was repeated. The first intervention point was approximated at about June, 1993 or month 174. As previously shown, when all stocks were included in the averages, the initial intervention point occurred at month 136. The removal of these two stocks extends this intervention point by over three years. The t-statistic of 2.15 supports the conclusion that the relationship of the DJIAR minus the MIAR, when Merck and Philip Morris are removed, is not significantly different from zero for the above identified period.

Figures 1A and 1B also present the relationship between the DJIAR minus the SPIIR. This relationship shows a descending pattern, with increasing variability. The variability becomes intense starting in 1990. The pattern during this late period, though at a more negative level, almost parallels that of the DJIAR minus the MIAR. The increased variability may be explained by the value weighting of stocks such as Merck and Philip

Table 2
Prices/Values and Percentages for Selected Dates

Company	*March 1990*				*December 1991*				*August 1993*			
	DJIA		*MIA*		*DJIA*		*MIA*		*DJIA*		*MIA*	
	Price	*%*	*Price*	*%*	*Price*	*%*	*Price*	*%*	*Price*	*%*	*Price*	*%*
Allied Signal	37.000	2.46	55.500	1.45	43.875	2.48	65.812	1.26	74.750	4.58	112.125	2.21
Alcoa	64.750	4.31	129.500	3.38	64.375	3.63	128.750	2.47	75.125	4.60	150.250	2.96
American Express	25.750	1.71	103.000	2.68	20.500	1.16	82.000	1.57	32.500	1.99	130.000	2.56
AT&T	42.000	2.80	42.000	1.09	39.125	2.21	39.125	.75	62.875	3.85	62.875	1.24
Bethlehem Steel	19.625	1.31	19.625	.51	14.000	.79	14.000	.27	13.500	.83	13.500	.27
Boeing	71.750	4.78	107.625	2.80	47.750	2.69	107.437	2.06	39.625	2.43	89.156	1.75
Caterpillar					43.875	2.48	43.875	.84	82.250	5.04	82.250	1.62
Chevron	67.500	4.49	135.000	3.52	69.000	3.89	138.000	2.65	93.125	5.70	186.250	3.67
Coca Cola	74.750	4.98	74.750	1.95	80.250	4.53	160.500	3.08	43.375	2.66	173.500	3.41
Disney					114.500	6.46	114.500	2.20	39.250	2.40	157.000	3.09
Dupont	38.375	2.55	345.375	9.00	46.625	2.63	419.625	8.06	48.625	2.90	437.625	8.61
Eastman Kodak	39.125	2.60	88.031	2.29	48.250	2.72	108.562	2.09	61.000	3.74	137.250	2.70
Exxon	46.125	3.07	184.500	4.81	60.875	3.43	243.500	4.68	65.375	4.00	261.500	5.15
General Electric	64.250	4.28	257.000	6.70	76.500	4.32	306.000	5.88	98.250	6.02	393.000	7.73
General Motors	45.875	3.05	91.750	2.39	28.875	1.63	57.750	1.11	46.875	2.87	93.750	1.85
Goodyear	35.750	2.38	35.750	.93	53.500	3.02	53.500	1.03	42.500	2.60	85.000	1.67
IBM	106.125	7.06	106.125	2.77	89.000	5.02	89.000	1.71	45.750	2.80	45.750	.90
International Paper	50.500	3.36	101.000	2.63	70.750	3.99	141.500	2.72	65.125	3.99	130.250	2.56
McDonalds	31.750	2.11	142.875	3.72	38.000	2.14	171.000	3.28	53.750	3.29	241.875	4.76
Merck	69.500	4.63	417.000	10.87	166.500	9.39	999.000	19.19	31.875	1.95	573.750	11.29
Minnesota Mining	81.375	5.42	162.750	4.24	95.250	5.37	190.500	3.66	109.625	6.71	219.250	4.32
Morgan JP					68.625	3.87	68.625	1.32	75.000	4.59	75.000	1.48
Philip Morris	39.625	2.64	317.000	8.26	80.250	4.53	642.000	12.33	48.750	2.99	390.000	7.68
Proctor & Gamble	67.750	4.51	271.000	7.06	93.875	5.30	375.500	7.21	48.375	2.96	387.000	7.62
Sears	39.250	2.61	39.250	1.02	37.875	2.14	37.875	.73	54.500	3.34	54.500	1.07
Texaco	58.750	3.91	58.750	1.53	61.250	3.46	61.250	1.18	64.875	3.97	64.875	1.28
Union Carbide	21.750	1.45	65.250	1.70	20.250	1.14	60.750	1.17	18.500	1.13	55.500	1.09
United Technology	57.250	3.81	114.500	2.98	54.250	3.06	108.500	2.08	56.875	3.48	113.750	2.24
Westinghouse	75.500	5.03	151.000	3.94	18.000	1.02	72.000	1.38	15.375	.94	61.500	1.21
Woolworth	63.125	4.20	126.250	3.29	26.500	1.50	106.000	2.04	25.750	1.58	103.000	2.03
Navistar	4.125	.27	4.125	.11								
Primerica	27.500	1.83	55.000	1.43								
USX	35.625	2.37	35.625	.93								
TOTAL	1437.500	100.0	3836.906	100.0	1772.250	100.0	5206.437	100.0	1633.125	100.0	5081.031	100.0

Top Five Percentage Firms

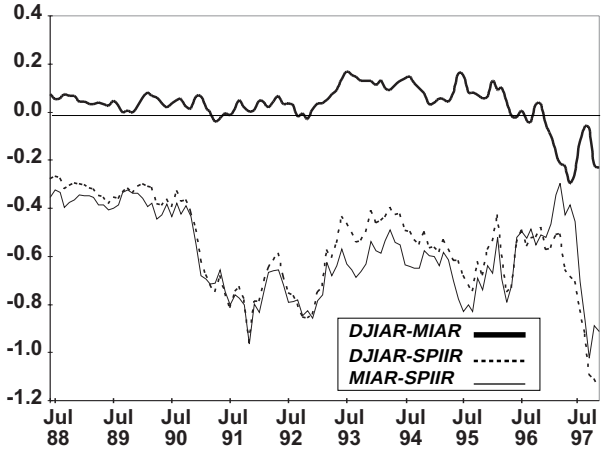
Coca Cola	4.98	Dupon	9.00	Disney	6.46	Dupont	8.06	Alcoa	4.60	DuPont	8.61
IBM	7.06	Gen Ele	6.70	IBM	5.02	Gen Ele	5.88	Caterpillar	5.04	Gen Ele	7.73
Merck	4.63	Merck	10.87	Merck	9.39	Merck	19.19	Chevron	5.70	Merck	11.29
Minn Mng	5.42	PMorris	8.26	Minn Mng	5.37	PMorris	12.33	Gen Ele	6.02	PMorris	7.68
Westing.	5.03	P & G	7.06	P & G	5.30	P & G	7.21	Minn Mng	6.71	P & G	7.62
Totals	27.12%		41.89%		31.54%		52.67%		38.07%		42.93%

Morris in the SPII, and, in the case of the CDJIA, their price weighting. Whatever the cause, it is clear from Figures 1A and 1B that the SPII has outperformed the CDJIA over the period of the study. This shows that there may be a downward bias in the DJIA relative to the SPII. However, because these two measures of stock performance are calculated differently and use different stock samples, it does not directly place the cause on the method of divisor adjustment used for the DJIA.

The last relationship shown in Figures 1A and 1B is between the MIAR and the SPIIR. This relationship also shows a descending pattern. It tends to parallel the relationship of the DJIAR minus the SPIIR. This is as expected in that the DJIAR and the MIAR are so close until early 1990. From late 1990 until the end of the study period, the graphs for the DJIAR minus the SPIIR and the MIAR minus the SPIIR are quite different. The DJIAR minus the SPIIR is substantially more negative and stays this way until late 1992. At this point there is a change in the relationship. Very early in 1993 these graphs cross and the DJIAR minus the SPIIR graph moves above the MIAR minus the SPIIR graph. In 1994, the gap between these two indicators narrows. From late 1994 until mid-1996 the difference between these two is rather small. In late 1996, the MIAR minus the SPIIR indicator breaks out and moves upward becoming positive very late in 1996 and early 1997. It then becomes negative once again although less negative compared with the DJIAR minus the SPIIR indicator.

Figure 1C also shows the relationships of the DJIAR minus the SPIIR and the MIAR minus the SPIIR. However, in this case, Merck and Philip Morris were removed from the CDJIA and the MIA beginning in April 1990. As would be expected, given that the DJIAR and the MIAR are much closer, the relationship of each of these to the SPIIR is more similar than in Figure 1B.

Figure 1C
Differences in Relatives
(Merck and Phillip Morris removed from DJIAR and MIAR)
July 1988 through December 1997



What can be said with respect to bias? Over a major part of the nineteen-year period of the study there is no indication that the method of adjusting the divisor for stock splits in the DJIA causes a downward bias relative to a method which adjusts the numerator. In fact, for eleven and one-fourth years, there was very little difference. Beginning in 1990, the differences became acute, but these differences were not consistently negative or positive. When Merck and Philip Morris were removed from both the CDJIA and the MIA beginning April 1990, the differences were reduced. However, once again no consistent pattern of bias was found. Relative to the SPII, the CDJIA did not move to as high a level. This is counter to those who stated that the DJIA would outperform the broader market. Over the period of January 1979 through late 1992 early 1993, there was no sustained period in which the descending trend between the DJIAR minus the SPIIR indicator was reversed. Then in early 1993, this indicator shows a general upward trend, though never showing a positive relationship. Then in early 1997 the relationship trends down sharply. The overall relationship is one where the SPII is outperforming the CDJIA.

The Issue of Volatility

The DJIA divisor saw a substantial reduction over the nineteen-year study period. Specifically, the divisor which stood at the beginning of the study period on December 28, 1978, at 1.443 declined to .25089315 by the end of the study period, December 31, 1997. This is a reduction to less than eighteen percent of its initial value. As noted earlier, some have argued that such a reduction in the divisor would cause increased volatility in the DJIA. To test this, it is hypothesized that the slope coefficient between the DJIA divisor and the volatility of the CDJIA will not be significantly different from zero.

To measure the volatility of the CDJIA and the MIA, standard deviations of returns were calculated. Returns were narrowly defined as the monthly percentage change in the level of the averages. Cash dividends on stocks in the averages were not included. This was done so that the focus was not on total returns of the averages, but rather on the volatility of the averages themselves. The standard deviations for the CDJIA and the MIA were determined using monthly percentage changes for a twelve-month period. The calculated divisor at the beginning of the twelve-month period was associated with that twelve-month period standard deviation. This was done moving forward monthly from December 1978 through December 1996. For example, the monthly changes for the year 1997 were used to calculate the standard deviation which was then associated with the December 1996 CDJIA divisor. The divisors were then ordered, by time for that divisor value, from the lowest to the highest value along with their associated standard deviations. Because of using twelve

months of percentage changes and moving forward one month at a time there is always an eleven month overlap between adjacent standard deviation calculations. The CDJIA's sharp negative change for the month of October 1987 caused a grouping of standard deviations which was substantially higher than for all other divisor values.

If the reduction in the divisor causes an increase in the volatility of the average, then when divisors are ordered from the lowest to the highest, one would expect the slope coefficient for the relationship between divisors and standard deviations of the CDJIA returns to be negative. However, the analysis showed a positive slope with a value of .0052. The corresponding t-statistic had a value of 2.1210. Thus, the hypothesis that the slope coefficient would not be significantly different from zero is rejected. The above analysis was repeated with the removal of those high standard deviations caused by the October 1987 change in the CDJIA. The slope coefficient became slightly higher at .0062 with a t-statistic value of 3.8960. Once again, the hypothesis that the slope coefficient would not be significantly different from zero is rejected. The positive signs for the above slope coefficients is contrary to what some would expect. However, because the slope coefficients are not negative there is no indication that there is increased volatility in the CDJIA as a result of divisor reduction.

The analyses were repeated using the relationship between divisors and standard deviations for the MIA. Note that the MIA divisors, unlike the CDJIA's, experienced a much narrower range, from 1.443 to 1.611 during the study period. This is because stock splits have had no effect on MIA's divisor values. The reason that the upper value exceeds the initial divisor value of 1.443 is because replacement stocks caused the divisor to increase. The slope coefficient and the t-statistic are -.0304 and -1.7412, respectively. Thus, while there is a negative relationship between increasing divisors and standard deviations, it is not significantly different from zero. Note that the MIA's standard deviations have also experienced high values as a result of the 1987 stock market crash. When high standard deviations from October 1987 were removed, the slope coefficient became .0050 and the t-statistic, .4087. Under both data sets for the MIA, the hypothesis is accepted that the slope coefficient is not significantly different from zero.

Conclusions

The study set out to answer two questions, 1) does the method of divisor adjustment used for the calculation of the DJIA cause a downward bias in the average, and 2) does the volatility of the DJIA increase as the divisor is reduced? This study answers both of these questions definitively, based upon analyses of data for a nineteen-year period. The study period, covering 1979 through 1997, saw the actual DJIA move from 804.12 to 7908.25, nearly a tenfold increase. During this period, stocks that comprise the DJIA experienced a total of sixty-three stock splits, an average of over three splits per year. These stock splits were the main cause for the DJIA divisor, which stood at 1.443 at the beginning of the study period, to drop to a low of .25089315 at the end of 1997, a mere 17 percent of its original value. Given these dramatic changes in the DJIA during the past nineteen years, the study period clearly reflects an excellent time frame for addressing these above questions.

The DJIA is not found to be biased downward, nor is its volatility increased, as a result of using its method of divisor adjustment for stock splits.

To answer the first question, two averages were calculated holding all factors constant except for the method of adjusting for stock splits. In one average, the denominator (the divisor) was adjusted, as does the actual DJIA, and in the other, adjustment was made in the numerator. The study's findings were that the method of adjustment does not cause a downward bias in the level of the DJIA. In fact, it was found that for the first eleven years of the study period there was no distinguishable difference between the levels of these two averages. During the remaining study period, while the differences in the levels increased, there was no consistent positive or negative relationship between these two averages. Box-Jenkins analysis was used to statistically test for the downward bias. The results showed that there was no clear evidence that the relationship between the levels of these two averages was significantly different from zero. Furthermore, the performance in the level of the CDJIA was consistently below that of the broader SPII.

The question of volatility was addressed by analyzing the relationship between divisors for the CDJIA and standard deviations of succeeding twelve monthly returns for the average. The divisors were ordered from the lowest to the highest with their associated standard deviations. Given this ordering of the divisors, the relationship between divisors and volatility (as measured by standard deviations of returns) was expected to have a negative slope. The results were not as expected. In fact, the relationship was found to be positive and significantly different from zero. To conclude, as the DJIA's divisor was reduced, the volatility of the DJIA did not increase.

The findings of the study run counter to the established beliefs held by many as evidenced from the published literature on the DJIA. The DJIA was not found to be biased downward, nor was its volatility increased, as a result of using its method of divisor adjustment for stock splits. Holding all factors constant, except for the method of divisor adjustment versus numerator adjustment for stock

splits, the study found no evidence of a downward bias. Additionally, volatility in the DJIA does not relate positively to reductions in its divisor. Both of these findings add credence to the use of the DJIA as a popular measure of stock market performance over the long-term. Notwithstanding its popularity, the DJIA may still suffer from the limitations of sample size, representativeness, and weighting, but it is clear that there is no systemic downward bias or increased volatility caused by its current method of adjustment for stock splits. ■

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Appendix

The method of divisor and numerator adjustment for stock splits and their impact on the levels of price weighted averages are illustrated below.

There are two averages, A and B and both use the same three stocks for their split calculations. Stocks 1 and 2 show no price change over the period. However, stock 3 doubles in price three times during this period and has 3 splits–2 for 1–each time. Initially each average is equal to 10 with each stock priced at $10.00 and the initial divisor for both is equal to 3.

Average A adjusts the denominator when a stock split occurs to ensure that the level of the average is not changed as a result of the split. The method of adjustment is identical to that used for the DJIA. Average B, which is the same as the MIA in the paper, adjusts for stock splits, but does so in the numerator. In this case, the stock which has split has its ex-split price multiplied by the split factor.

	Average A		Average B	
Initial Level	$\frac{10 + 10 + 10}{3.0000}$	=10.00	$\frac{10 + 10 + 10}{3.0000}$	=10.00
(Stock 3's price increases to $20) Day Before 2:1 Split	$\frac{10 + 10 + 20}{3.0000}$	=13.33	$\frac{10 + 10 + 20}{3.0000}$	=13.33
Adjustment for Split	$\frac{10 + 10 + 10}{2.2506}$	=13.33	$\frac{10 + 10 + (10x2)}{3.0000}$	=13.33
(Stock 3's price increases to $20) Day Before 2:1 Split	$\frac{10 + 10 + 20}{2.2506}$	=17.77	$\frac{10 + 10 + (20x2)}{3.0000}$	=20.00
Adjustment for Split	$\frac{10 + 10 + 10}{1.6882}$	=17.77	$\frac{10 + 10 + (10x2x2)}{3.0000}$	=20.00
(Stock 3's price increases to $20) Day Before 2:1 Split	$\frac{10 + 10 + 20}{1.6882}$	=23.69	$\frac{10 + 10 + (20x2x2)}{3.0000}$	=33.33
Adjustment for Split	$\frac{10 + 10 + 10}{1.2664}$	=23.69	$\frac{10 + 10 + (10x2x2x2)}{3.0000}$	=33.33

Note: It is clear that the method used to adjust the averages for stock lags has an influence on the level of the average. After three splits using identical stocks, Average A, with divisor adjustment clearly lags behind Average B, which adjusts its numerator for stock splits. More specifically, after 3 identical splits, Average A's level is at 23.69 compared with Average B's level of 33.33. It is clear that the method used for adjustment of the averages for stock splits has an influence on the level of the averages.

The Relationship of Net Income to Comprehensive Income: An Analysis of Fortune 500 Companies

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Abstract

The Financial Accounting Standards Board (FASB) has recently issued Statement of Financial Accounting Standards, (SFAS) No. 130, *Reporting Comprehensive Income*. That Statement requires companies to report a comprehensive income measure, which includes net income and net-of-tax adjustments for changes in unrealized gains/losses on securities, foreign currency gain/loss adjustments, and minimum pension liability adjustments. These latter adjustments were previously reported directly in the stockholders' equity section of the statement of financial position. This paper analyzes the effects of comprehensive income disclosures for 100 randomly selected Fortune 500 companies. Comprehensive income was computed for these companies and compared with reported net income to determine the number and significance of these other comprehensive income adjustments. The results indicate that a large number of firms may report a comprehensive income amount different from reported net income. Although these differences may be significant for some firms, the majority of these adjustments will not cause comprehensive income to be materially different from reported net income for most firms.

Introduction

Accountants, as well as financial statement users, have long debated the placement of certain irregular gains and losses in the financial statements. These arguments have frequently placed individuals in one of two camps. Proponents of the current operating performance concept advocate selective income reporting by excluding extraordinary and nonrecurring gains and losses from income. Income, in their viewpoint, should only consist of usual and recurring items and that the exclusion of nonrecurring items from income would enable users to make better inferences. They believe that management is in a better position to determine unusual items than financial statement users. Proponents of the all-inclusive income concept, on the other hand, argue that all revenue and expense items comprise a company's total earnings history. Consequently, all revenues, expenses, gains, and losses recognized during the period should be included in income, regardless of whether or not they are the result of the period's activities.

Accountants, as well as financial statement users, have long debated the placement of certain irregular gains and losses in the financial statements.

APB Opinion No. 9, *Reporting the Results of Operations*, effective in 1966, required a modified all-inclusive approach mandating that items be included in net income, except for prior period adjustments. However, since that time, the Financial Accounting Standards Board (FASB) has provided for several other exceptions to the all-inclusive requirement by allowing certain items to initially bypass the income statement and be reported directly as adjustments to equity. Statement of Financial Accounting Standards (SFAS) No. 130, *Reporting Comprehensive Income*, now requires these items to be reported as a component of comprehensive income and not as an adjustment to stockholders' equity on the statement of financial position.

The reporting of comprehensive income satisfies the FASB's earlier conclusions reached in its conceptual framework project. That is, in Statement of Financial Accounting Concepts (SFAC) No. 5, *Recognition and Measurement in Financial Statements of Business Enterprises*, the FASB stated that "a full set of financial statements for a period should show: financial position at the end of the period, earnings for the period, comprehensive income for the period, cash flows during the period, and investments by and distributions to owners during the period." Comprehensive income was defined in SFAC No. 6, *Elements of Financial Statements*, as "the change in equity of a business enterprise during a period from transactions and other events and circumstances from nonowner sources. It includes all changes in equity during a period except those resulting from investments by owners and distributions to owners." Comprehensive

It is believed that SFAS No. 130 will have widespread impact on many companies.

income is to represent a measure of overall enterprise performance for the period. The FASB believes that, when used with the information in the other financial statements and related disclosures, the reporting of comprehensive income may help investors, creditors, and others in assessing the enterprise's financial performance and the amount, timing and uncertainty of its future cash flows. Presently, information on other comprehensive income is not consistently presented among companies, and is often aggregated in such a way that the amounts of individual components are difficult to determine (Smith and Reither 1996).

This paper will discuss the basic provisions of SFAS No. 130 and present the results of a study comparing net income to comprehensive income for Fortune 500 companies.

Comprehensive Income: The New Standard

The FASB, in June 1997, issued SFAS No. 130. Effective for fiscal years beginning after December 15, 1997, this Statement requires business enterprises to report all components of comprehensive income in a financial statement, along with its full set of financial statements that report financial position, results of operations, and cash flows. Comprehensive income is defined in SFAC No. 6, *Elements of Financial Statements*, as the change in equity (net assets) of a business enterprise during a period from transactions and other events and circumstances from nonowner sources. Comprehensive income is broader than net income in that it includes *all* changes in equity during a period except those resulting from investments by owners and distributions to owners. Components of comprehensive income include net income as presently reported and other items traditionally bypassing the income statement, including foreign currency translation adjustments, changes in the market value of securities available for sale, and minimum pension liability adjustments. Comprehensive income tends to view a company's performance as a continuum, with transactions and events occurring both regularly and irregularly throughout the company's existence (Robinson 1991).

It is believed that SFAS No. 130 will have widespread impact on many companies. Both publicly held and privately owned companies experience events that cause comprehensive income to differ from net income. Since the recognition and measurement of items comprising comprehensive income was not addressed, SFAS No. 130 impacts only financial reporting. However, the impact on individual companies can be significant. For example, General Electric's profits grew 10 percent in 1994, 39 percent in 1995, and 11 percent in 1996. Comprehensive income, on the other hand, would have revealed a profit decline of 33 percent in 1994, a 162 percent profit increase in 1995, and a 20 percent profit decrease in 1996. "This has the potential to be a major statement with broad application," said Stewart Sandman, technical services partner with the New York City accounting firm of Goldstein Golub Kessler & Company. And according to a study by Bear, Stearns & Co., the new profit figure will likely expose more volatility in the earnings of many of the thirty companies in the Dow Jones Industrial Average (McDonald 1997).

SFAS No. 130 requires a specific presentation for items that typically have bypassed the income statement. The new disclosures must have equal prominence as the other financial statements, and must report an amount representing total comprehensive income. A specific format for the financial statement was not prescribed, however, the reporting of earnings per share for comprehensive income is not allowed. Items comprising comprehensive income are to be classified by their nature in a statement of financial performance and the accumulated balances of items of comprehensive income must be displayed separately from retained earnings and additional paid-in capital in the equity section of the statement of financial position. A descriptive title such as "accumulated other comprehensive income" should be used for that component of equity. Figure 1 illustrates the two statement approach to reporting comprehensive income, using the 1995 and 1996 financial information of the Lear Corporation. That reporting alternative is one of three reporting options available. Other reporting alternatives include (a) a combined statement of income and comprehensive income, and (b) inclusion of other comprehensive income in a statement of changes in equity. The latter alternative, while acceptable, is not preferred by the FASB.

SFAS No. 130 requires that *all* items that meet the definition of comprehensive income be reported in a comprehensive income statement, on a net-of-tax basis. Therefore, this Statement amends Statements 52 (foreign currency translation adjustments), 80 (accounting for futures contracts), 87 (minimum pension liability adjustments), and 115 (changes in market value of securities available for sale) to require those comprehensive income items to be presented in the statement of financial performance, rather than directly in a statement of financial position. Adjustments, termed reclassification adjustments, however, may be required in order to avoid double counting in comprehensive income those items presently included in net income which were previously considered in comprehensive income. Those items would be deducted through other comprehensive income in the period of sale to avoid including them in comprehensive income twice.

Figure 1
Comprehensive Income Reporting:
A Two-Statement Approach
Lear Corporation (amounts in millions)

Consolidated Statement of Income:

	1996	1995
Net sales	$6,249.1	$4,714.4
Cost of sales	5,629.4	4,311.3
Selling, general and administrative expenses	210.3	139.0
Amortization of goodwill	33.6	19.3
Operating income	375.8	244.8
Interest expense	102.8	75.5
Foreign currency exchange (gain) loss	.5	8.6
Other expense, net	19.1	7.8
Income before provision for national income taxes, minority interests in consolidated subsidiaries, equity in net income of affiliates and extraordinary items	253.4	152.9
Provision for national income taxes	101.5	63.1
Minority interests in consolidated subsidiaries	4.0	(1.7)
Equity in net income of affiliates	(4.0)	(2.7)
Income before extraordinary item	151.9	94.2
Extraordinary loss on early retirement of debt	–	(2.6)
Net income	$ 151.9	$ 91.6

Consolidated Statement of Comprehensive Income:

Net Income	$ 151.9	$ 91.6
Other comprehensive income, net of tax:		
Foreign currency translation adjustments	5.1	(7.3)
Unrealized gains/losses on securities	–	–
Minimum pension liability adjustment	1.5	1.4
Other comprehensive income	6.6	(5.9)
Comprehensive income	$ 158.5	$ 85.7

Comprehensive Income: Impact on Fortune 500 Companies

The 1995 and 1996 financial statements of 100 randomly selected Fortune 500 companies were analyzed. Specifically, comprehensive income for those respective years was computed and compared to reported net incomes. The type, dollar amount, and overall significance of the other comprehensive income adjustments were determined. The other comprehensive income adjustments identified included changes in unrealized gains/losses on securities, foreign currency gain/loss adjustments, and minimum pension liability adjustments. These amounts were then computed net of tax, as required by SFAS No. 130. The overall effect and significance of the other comprehensive income adjustments, individually and collectively, on an individual firm and for the entire sample of 100 firms was calculated and are presented in Table 1.

Changes in Unrealized Gains/Losses on Securities

Sixty firms in 1995 reported no unrealized gains/losses on securities, thirty-three firms reported unrealized gains, and the remaining seven firms reported unrealized losses. For 1996, fifty-seven firms reported no unrealized gains/losses, sixteen reported unrealized gains while twenty-seven reported an unrealized loss.

The majority of the unrealized gains/losses reported for the forty and forty-three firms in 1995 and 1996, respectively, were less than 5 percent of net income. Including those firms not reporting unrealized gains/losses, the adjustment to net income for unrealized gains/losses was 5 percent or less for 79 percent and 86 percent of the sample firms in 1995 and 1996, respectively. Some firms, however, had unrealized gains/losses on securities in amounts exceeding 10 percent of net income. Eighteen firms in 1995 and nine firms in 1996 reported unrealized gains/losses in excess of 10 percent of reported income. Five percent and 10 percent were chosen as the threshold for determining significance since "common percentages (about materiality). . . are 5 to 10 percent of income . . ." (Guy, Carmichael, and Whittington 1994).

Foreign Currency Gains/Losses

Most firms did not have significant foreign currency gain/loss adjustments, as compared to net income. Foreign currency gain/loss adjustments were 5 percent or less of net income for ninety-one firms in 1995 and for eighty-six firms in 1996. Only five firms in 1995 and seven firms in 1996 had foreign currency gain/loss adjustments in excess of 10 percent of its net income.

Minimum Pension Liability Adjustment

There were relatively few minimum pension liability adjustments. In both 1995 and 1996, only twelve firms reported a minimum pension liability adjustment and most were not large, as compared to net income. In 1995, only two firms reported an adjustment in excess of 10 percent of net income, and only one firm reported an adjustment in excess of 10 percent of net income in 1996.

Composite Effect of Other Comprehensive Income Adjustments

Composite adjustments for comprehensive income affected 73 percent of the firms in 1995 and 76 percent of the firms in 1996. In 1995, twenty-six firms' net income

Table 1
Effect of Other Comprehensive Income Adjustments on Net Income

1995

(number of firms = 100)

Percentage Adjustment To Net Income	Unrealized Gains/Losses or Investments	Foreign Currency Gains/Losses	Minimum Pension Liability	Comprehensive Income
+26%+	9	1	-	14
+21-25%	-	-	-	-
+16-20%	2	-	-	3
+11-15%	6	3	-	9
+6-10%	3	2	1	6
+1-5%	13	21	4	17
0%	60	56	88	27
-1-5%	6	14	5	18
-6-10%	-	2	-	2
-11-15%	-	-	1	1
-16-20%	-	-	-	-
-21-25%	-	-	-	-
-26%+	1	1	1	3

1996

(number of firms = 100)

Percentage Adjustment Income To Net	Unrealized Gains/Losses or Investments	Foreign Currency Gains/Losses	Minimum Pension Liability	Comprehensive Income
+26%+	-	-	1	1
+21-25%	-	-	-	-
+16-20%	-	-	-	-
+11-15%	1	2	-	3
+6-10%	2	4	-	4
+1-5%	13	13	9	26
0%	57	54	88	24
-1-5%	16	19	1	21
-6-10%	3	3	1	8
-11-15%	-	4	-	4
-16-20%	1	1	-	2
-21-25%	-	-	-	1
-26%+	7	-	-	6

was increased by more than 10 percent and four firms' net income decreased by more than 10 percent. In 1996, four firms' net income increased by more than 10 percent, while thirteen firms' net income decreased by more than 10 percent. Table 2 illustrates the significant comprehensive income adjustments reported by three selected firms. For Aetna, in 1995, those adjustments actually caused $252 million of net income to become a comprehensive loss of $867 million.

The majority of the firms (62 firms in 1995 and 71 firms in 1996), however, had other comprehensive income adjustments of 5 percent or less of reported net income. In fact, comprehensive income compared to net income for all 100 firms was 101.9 percent and 99.5 percent for 1995 and 1996, respectively.

Comprehensive Income: Further Evolution

SFAS No. 130 only addressed the presentation of comprehensive income by modifying prior pronouncements that relate to presentation of items directly as a component of stockholders' equity. The next step in the reporting of comprehensive income, according to the FASB, is to address issues of when components of comprehensive income should be recognized, how those components should be measured, and whether those components should be included in net income or in other comprehensive income.

These future issues, in our opinion, pose significant concerns for both the FASB and corporate reporting. There is a growing awareness that the FASB is moving away from historical cost accounting to a more fair value measurement, in an effort to make the balance sheet "fairer." SFAS No. 133, *Accounting for Derivative Instruments and Hedging Activities*, for example, requires that all derivatives be reported on the balance sheet at fair value. SFAS No. 115 resulted (prior to SFAS No. 130) primarily in a balance sheet market valuation for certain investments in debt and equity securities. Now those valuation adjustments are to be included as a component of comprehensive income, requiring articulation between the balance sheet and the statement of comprehensive income. Consequently, all future pronouncements that affect balance sheet valuations (with the exception of owner transactions) will be presented in the statement of comprehensive income. Therefore, most (if not all) future FASB pronouncements will have comprehensive income reporting effects. The battle lines now will be to determine whether or not those income items should be included as a component of net income or other comprehensive income.

Implications for Corporate Reporting

The results indicate that a large number of firms will report a difference between net income and comprehensive net income. These differences for some firms will be significant. For 1995, 30 percent of the firms reported comprehensive income amounts higher or lower than 10 percent of their reported income. The differences between comprehensive income and reported net income in 1996 were not as profound, but 17 percent of the firms did report a greater than 10 percent difference between the two income measures.

Table 2
Significant Other Comprehensive Income Adjustments: Selected Firms

	AETNA		Lincoln National As.		LTV Corp.	
	1995	**1996**	**1995**	**1996**	**1995**	**1996**
Net Income	$251,700,000	$651,000,000	$482,186,000	$513,558,000	$184,800,000	$109,200,000
Unrealized Gains/Losses	(1,118,327,800)	(182,466,600)	777,127,800	(197,089,02)	1,869,000	(568,800)
Foreign Currency Gains/Loses		5,0227,710	39,674,668			
Minimum Pension Liability Adj.					(111,517,000)	111,168,800
Comprehensive Income	($866,627,800)	$468,533,400	$1,264,336,600	$356,143,644	$75,152,000	$219,800,000

Although slightly more firms reported adjustments for foreign currency gains/losses than for unrealized gains/losses on securities, their impact was not as significant. That is, forty-four firms in 1995 and forty-six in 1996 reported an adjustment for foreign currency gains/losses. That gain/loss adjustment was greater than 10 percent of net income for only five firms in 1995 and seven firms in 1996. Unrealized gains/losses on securities were reported by forty firms in 1995 and forty-three in 1996, but the impact was greater than 10 percent of net income for eighteen firms in 1995 and nine firms in 1996. Few disclosures of minimum pension liability adjustments were reported and those reported were generally not material. Of the twelve firms reporting minimum pension liability adjustments in 1995 and 1996, only two in 1995 and one in 1996 reported amounts in excess of 10 percent of reported net income.

For the 100 firms studied, the combined effect of other comprehensive income adjustments on total net income was limited. For 1995, the combined net income for all 100 firms was $298,799,977,809, while the adjusted comprehensive income was $304,344,549,899, for an increase of 1.9 percent. Similarly in 1996, combined net income was $300,178,724,221, adjusted comprehensive income was $298,825,664,496, for a decrease of 0.5 percent. Sixty-two firms and seventy-one firms in 1995 and 1996, respectively, reported comprehensive income within 5 percent of its net income. The results were based on a sample of *Fortune 500* companies, therefore, generalizability of the results to smaller companies should be done with caution.

Firms experiencing significant other comprehensive income adjustments may want to "manage" those items to reduce the volatility of reported comprehensive income. For the majority of firms, however, the difference between comprehensive income and net income may not be significant. ■

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Teaching Computer Software Skills: Matching Teaching and Learning Styles

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Abstract

This study investigates whether matching teaching approach with student preferred learning style is important at the undergraduate level. The results suggest that there is a significant association between three areas (1) traditional in-class and self-paced teaching approaches, (2) individuals' preferred learning styles defined as instructor-dependent and independent study, and (3) computer skills proficiency. It appears that students who worked independently developed tools necessary to achieve the same level of skill mastery as students who relied on in-class instruction and instructor assistance, and there was no significant difference between the two groups in the amount of time spent in completing assignments. The results support the idea that students are likely to learn best, in terms of effectiveness and efficiency, when the teaching method most compatible with each student's choice of learning style is used.

KEYWORDS: Learning Styles, Teaching Methods, Computer Skills, Software, Spreadsheet

Introduction

Whether young people gain exposure to computers formally through school, informally at home, or recreationally by "surfing" the Internet, there is little doubt that they continue to be exposed to computers at earlier ages. To be sure, computer technology impacts our lives in many ways. Employees in businesses of all sizes use microcomputers daily, and studies suggest that this trend will continue (Nazem and Price 1989). For example, the Olsten Corporation conducted a nationwide survey of 1,481 MIS executives and found that since 1991, requirements for computer literacy in businesses have become increasingly critical in almost every job category (Olsten Corporation 1993). Over 70 percent of the companies surveyed require computer competency in their middle and senior managers, and over 90 percent require their secretarial and support personnel to have these skills.

Young people today, …often grow up surrounded by technology…. The spoon-feeding days are clearly past.

Because of the widespread use of computers in firms, business school faculty generally agree that a well-rounded business school graduate must have basic computer skills (Bowman, Grupe, and Simkin 1995; Dyrud 1993; Scudder and Kucic 1989). Therefore, two issues that affect business school educators, students, and organizations are (1) how students are educated on the use of computers, and (2) how well they learn to use computers.

As computer technology evolves at a "dizzying speed" (Dyrud 1993), society's approach to new computer technology has changed significantly over the years. In the beginning of the "computer age," people unfamiliar with computers were understandably slow to grasp the concept behind these "thinking" machines, and even slower to learn how to use them and to integrate them into their daily routines. At the time, it made sense that computer educators spoon-fed computer knowledge to students in small, easily digestible components. Young people today, however, often grow up surrounded by technology–Nintendo, computer games, educational teaching aids, and the Internet. The spoon-feeding days are clearly past.

Because people are introduced to computers at younger ages and accessibility to computer technology has increased, educators may need to change the way they teach students about computers and software packages. Researchers such as Anderson and Skwarecki, whose studies focus on teaching computer programming skills, believe that "even in ideal circumstances, most of the [undergraduate] student's learning occurs through hands-on programming experience outside of class and not during lectures" (1986, 842). Dyrud (1993) suggests

that one thing educators should not do is yield to the temptation of teaching software in our business courses due to the valuable class time this activity consumes. Bowman, Grupe, and Simkin (1995) found that when given the opportunity, students were more satisfied and the costs of their computer education were lower when they were able to learn at their own pace versus during structured lessons or computer sessions.

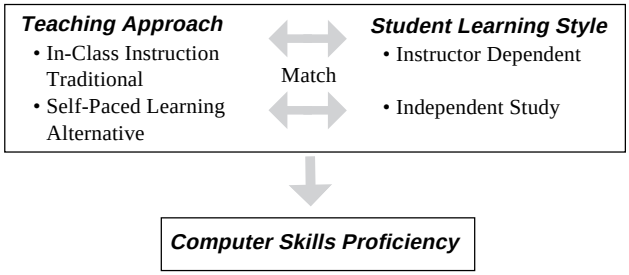
Computer-based approaches to instruction have been studied for over two decades. Several studies (Baker, Simon, and Baseli 1986; Izard and Reeve 1986; Kachelmeier, Jones, and Keller 1992; Kolb 1976; Scudder and Kucic 1989) have examined in-class versus out-of-class, or self-managed, learning of software skills at the graduate level. These studies strongly support the assumption that MBA and other masters-level students not only learned computer spreadsheet packages through self-managed instruction, but students also seemed satisfied with the mode of software instruction they received. Also suggested is that graduate students are indifferent to learning a software package on their own as opposed to learning it as a formal part of a class.

However, the above mentioned studies purposefully focused on graduate students. The primary reason given for the graduate-level focus of the studies was based on the belief that when compared to undergraduates, the learning styles of graduate students "are more highly concentrated on the abstract conceptualization and active experimentation than on the lower levels of the learning process" (Baker et al. 1986, 10), particularly when a practical application of ideas is used as a method of learning. In other words, these authors consider graduate students to have more highly developed critical thinking skills and to be more highly motivated than undergraduate students and, therefore, better able to apply abstract concepts in their studies. Thus, the results and conclusions of those studies cannot be generalized to undergraduate students. An underlying assumption is that when left on their own, undergraduate students will spend insufficient time learning a software package or will require a great deal of assistance to learn and understand its command structure and properly apply the software (Scudder and Kucic 1989). Thus, researchers of software education appear to concur with the belief that undergraduates require more than an introductory-level of in-class computer software instruction, particularly for spreadsheet software such as Lotus 1-2-3.

However, Dyrud (1993) reports that undergraduate students in her department are required to learn a variety of software programs on their own, freeing in-class time to concentrate on advanced document design and application issues, leading to very high quality student output. Based on reports such as Dyrud's, combined with students' earlier introduction to computers, the increasingly popular use of the World Wide Web, and the extensive integration of computers in high schools and colleges, teaching approaches for computer software packages should be reevaluated at the college undergraduate level. In sum, a variety of research and theory as well as the increasing availability of computers all suggest a critical question: Are present computer teaching methods the most effective to enhance learning at the undergraduate level? This study was designed to test this question.

This research evaluates teaching approaches by considering students' preferred learning style in a collegiate environment for the portion of an undergraduate introductory computer class devoted to spreadsheet software. The purpose of this study is to determine the effectiveness of matching instructor dependent versus independent study learning style and in-class versus self-paced teaching approaches in an undergraduate computer and software applications course. The above relationships are shown in Model 1.

Model 1
Acquiring Computer Skill Proficiency by Matching Teaching and Learning Styles



Because people's learning styles differ (Biberman and Buchanan 1986; Schneider and Angelmar 1992; Simon 1991), it seems logical to assume that different teaching methods would tend to be more (or less) effective for different individuals in the classroom. In this study, individual learning style preference is defined as being either instructor-dependent (dependent) or independent-study (independent). The choice of these two styles was based on the premise that some students at this stage or level of their education process are likely to learn better when course work is formatted in a logical sequence and administered under close supervision. On the other hand, others will learn better when course work is briefly introduced and administered under more flexible supervision. An issue likely to be of great concern to educators is that effective learning may significantly depend on the amount of supervision and guidance undergraduate students require in the classroom.

In this study, "dependent learners" are defined as those who prefer extensive supervision and continual guidance when learning something new. Students in this group would generally avoid experimenting on their own and

feel that they learn best by having someone show them how to perform tasks, help identify errors, and make corrections (Simon 1991). Dependent learners, then, are likely to feel that extensive in-class demonstration and close supervision are required for them to learn. In contrast, "independent learners" are defined as those who feel that they learn best by experimenting on their own, making mistakes, and learning from their mistakes (Simon 1991). Independent learners are likely to feel that classes with less explanation and more time to experiment with software provide a more efficient and effective way to learn. It is easy to understand how these two learning styles might easily clash in the classroom, particularly one in which software applications education is the focus.

With the above ideas in mind, a research study was designed. The following sections describe the research design and hypotheses development, the measures used to test the hypotheses, and how the data were analyzed. The final section discusses results of the analyses and conclusions.

Methodology and Hypothesis Development

Research Design

This study examined whether in-class or self-paced teaching techniques resulted in effective and efficient learning for undergraduate students enrolled in four sections of the course, "Introduction to Business Information Systems." The course was offered in the College of Business at a mid-size Midwestern university. To minimize potential confounding effects of differing grading practices or supervisory styles, all students involved in the study were taught by the same instructor for the entire course. In addition, the substance of the course–the textbook, handout materials, initial introduction, and assignments–were identical for all students.

A total of 139 undergraduate students participated in the study. The participants included 111 (80 percent) business majors and 28 (20 percent) majors from non-business disciplines. The class distribution was 37 (26.6 percent) freshmen, 76 (54.7 percent) sophomores, 24 (17.3 percent) juniors, and two (1.4 percent) seniors. With regard to age distribution, 131 (94.2 percent) were 18 to 24 years old, six (4.3 percent) were between 25 to 30, and two (1.4 percent) were over 30.

All students attended four 50-minute classroom sessions devoted to a basic introduction and discussion of the principles and functions of *Lotus 1-2-3 (1-2-3)*, version 5 for Windows. Students were then given four assignments designed to help them learn and apply the software package (see Table 1). At this time, students had an opportunity to ask questions to clarify lecture sessions and the course work assignments. Handouts that summarized the development of *1-2-3* and listed the commands and functions necessary to operate the *1-2-3* spreadsheet software were distributed in class to all students. The computer labs contained *1-2-3* tutorials and lab manuals that were available to all students for their discretionary use.

Table 1
A Brief Description
of the Four *Lotus 1-2-3* Assignments

Assignment #1	Basics of creating, editing, saving, and printing a simple spreadsheet and performing simple mathematical calculations.
Assignment #2	Creating and formatting more complex spread sheets using *1-2-3* functions and mathematical formulas such as calculating number of employees and numbers with two decimal places, inserting columns and rows, using absolute identifiers, etc.
Assignment #3	Creating and formatting spreadsheets using complex *1-2-3* functions and mathematical formulas such as IF, MAX, MIN, ROUND statements, copying cell contents to a range, etc.
Assignment #4	Combining lessons from the first three assignments to assess individual skill development. A "problem statement" is given which includes basic numerical and other pertinent information. Answers must be correctly calculated and formatted.

Students were informed that the portion of the course devoted to *1-2-3* would be taught using two different methods, which were described in detail before students chose which method they preferred. Based on their individual decisions as to which learning method they preferred, students were placed into one of two groups. Group I students were considered to be dependent learners because they chose to learn the software and do the assignments in class with supervision and help from the instructor and lab assistants. Those who chose in-class help were given five instructional lab sessions and were provided hands-on exercises similar to the *1-2-3* assignments required from all students. In addition, this group could request help from the instructor via the telephone and e-mail. Group II students were considered to be independent learners because they chose to learn and apply the software and do the assignments at their own pace out-of-class without additional assistance from the professor or lab assistants. It is important to note here that while students in Group II were told the professor would only answer questions to clarify the assignments, she would have provided *limited* guidance if approached. None of the Group II students requested her help during this portion of the course, either in person or via telephone or e-mail.

While materials concerning the mechanics of *1-2-3* were made available to all students should they wish to consult and use them, no attempt was made to control access to other aides such as workbooks or use of private

tutors that students may have obtained on their own. Students in both groups could work in any university computer lab outside of the scheduled class time; however, lab assistants in the university's labs were given a list of names of the Group II, independent-study students and were advised to offer no assistance to those individuals on their *1-2-3* assignments. Since each computer lab is regularly staffed by only one lab assistant and contains approximately forty computers for student use, there was very little formal help available if a student was not a member of Group I.

Students' self-selection of one of the two learning methods resulted in 40 percent…as dependent learners…and 60 percent as independent learners…

Students' self-selection of one of the two learning methods resulted in 52 (40 percent) of the class in Group I–dependent learners who chose in-class assistance and supervision in completing assignments in the computer lab. Group II consisted of 87 (60 percent) students as independent learners who chose to do assignments out-of-class on their own. At the end of the spreadsheet portion of the course, all students were given an objective test to measure their understanding of the basic concepts and command structure of *1-2-3* as well as a performance exam that required them to create a complex spreadsheet with certain features and formatting to demonstrate their working or applied knowledge of the software. An addendum to the performance exam was a self-response survey used to ensure that students in both groups were equivalent on important demographic and background characteristics. (Each of these is described more fully in the Measures section.)

Hypothesis Development

It was expected that students in both groups would perform equally well on both the objective test and the performance test. Because independent learners chose to work on exercises on their own out of class, an argument could be made that independent learners would perform better than dependent learners because the former would make a greater effort to work with, figure out, and apply the *1-2-3* software when completing the four assigned exercises. Conversely, it could be argued that dependent learners would outperform independent learners because the latter would spend insufficient time on their own to learn the software and how to apply it (Baker et al. 1986). However, due to (1) the results of previous studies of graduate students, combined with (2) the effects of matching teaching approaches with individual choice of learning styles, and (3) students' increased exposure to electronic games and computers in general, it was assumed that undergraduate students would learn best if permitted to utilize their own chosen style of learning. (The effects of prior computer knowledge were not considered at this stage of the study due to the elementary nature of the course. However, data on students' prior computer experience was gathered on the addendum survey and is discussed in the Data Analysis section.)

Consistent with the above logic, the researchers also believed that after the four assigned exercises had been completed and returned to the instructor, both groups of students would be equally competent in their ability to identify spreadsheet errors as well as correct those errors when tested on these variables during the performance exam. The above rationale, then, suggests the following hypotheses:

Hypothesis 1: Students who choose to work independently without in-class assistance will perform as well on the objective exam as students who choose to receive in-class assistance.

Hypothesis 2: Students who choose to work independently without in-class assistance will be able to create a spreadsheet as adeptly as students who choose to receive in-class assistance.

Hypothesis 3: Students who choose to work independently without in-class assistance will be as proficient in the identification of spreadsheet errors as students who choose to receive in-class assistance.

Hypothesis 4: Students who choose to work independently without in-class assistance will be able to correct spreadsheet errors as well as students who choose to receive in-class assistance.

While it was assumed that independent learners would perform as well as dependent learners on the objective and performance exams, it seemed probable that the two groups would differ significantly on the amount of time spent to complete the four assigned exercises. Since dependent learners had formal help available at their request, it was expected that this group would not remain "stuck" on a problem area for long before asking for help from the instructor or lab assistants. On the other hand, the researchers theorized that independent learners would take longer to complete the exercise assignments because they were more likely to search out their own sources and go through more lengthy "trial and error" sequences until problems which they encountered were solved. This logic suggested the final hypothesis:

Hypothesis 5: Students who choose to work independently without in-class assistance will complete exercise assignments less quickly than students who choose to receive in-class assistance.

Measures

Demographic and situational data. To ensure that the students in both groups were equivalent, the authors compared important demographic and background characteristics such as age and level of prior computer experience. The characteristics were based on predictive performance criteria used in earlier studies (Bowman et al. 1995; Evans and Simkin 1979; Harrison and Rainer 1992). Because "level of satisfaction" is a widely used subjective measure of performance (Yellen 1989), students were also asked to indicate their level of satisfaction regarding: whether a sufficient amount of in-class instruction was provided; their level of confidence in developing a spreadsheet by various operations; and whether the amount of instructor and lab assistance was adequate. Students were also asked to indicate the approximate length of time taken to complete the four assigned exercises, which was used to test the fifth hypothesis. This data was gathered from all students on the self-report survey administered as an addendum to the performance exam.

Objective exam. After completing the four increasingly complex *1-2-3* spreadsheet assignments, all students were given an objective written test on the use of *1-2-3* software in class. This exam was used to measure students' levels of knowledge and understanding of the *1-2-3* software, including its command structure. The exam consisted of twenty multiple choice and true/false problems designed to measure each student's knowledge of how to: (1) create a spreadsheet using mathematical formulas and *1-2-3* functions, and (2) edit, (3) format, and (4) print the spreadsheet. The objective test had a maximum possible score of 20 and was graded by the same instructor who taught the introductory sessions on *1-2-3*. Results of this exam were used to test the first hypothesis.

Performance exam. In addition to understanding the basic concepts and essential features and options of *1-2-3* that were assessed on the objective exam, the performance exam required students to actively apply their knowledge and create a spreadsheet in class using *1-2-3* software. This test was similar to the spreadsheets developed in the earlier four assigned exercises. Students were tested on several operations which were categorized as: (1) data entry, (2) using formulas and functions for calculations, (3) formatting the worksheet, (4) insertion of columns and rows, (5) copying the cell content to a range, (6) using absolute identifiers, (7) saving the spreadsheet file, (8) printing the spreadsheet, and (9) retrieving and editing the previously stored file.

All students in each section completed the performance exam in the classroom lab at the same time with no assistance from either the instructor or lab assistant. The project was reviewed and graded by both the course instructor and graduate assistant for reasonableness of format, correctness of formulas, appropriate use of functions, and ability to identify errors and make corrections in the spreadsheet. Results of the performance exam were used to test Hypotheses Two, Three, and Four.[1]

Data Analysis

The principal statistics used were Pearson's chi-square test and the t-test. The level of statistical significance for all tests was at a *p* value equal to .05. In addition to the chi-square and t-tests, frequency analyses were also applied to the demographic and situational variables described above.

Demographic and Situational Data Tests

As shown on Table 2, a chi-square of 1.60 ($p > .05$) suggests the two groups did not significantly differ in age. A chi-square of 4.42 ($p > .05$) suggests there was no difference in the reported level of computer experience among the two groups. Computer experience was considered an inclusive term to include spreadsheet experience. Group I students identified themselves as belonging about equally to one of three experience levels: 33 percent (17) inexperienced, 33 percent (17) moderately experienced, and 34 percent (18) experienced. Group II students identified themselves similarly: 28 percent (24) inexperienced, 37 percent (32) moderately experienced, and 36 percent (31) experienced. In sum, the composition of each group ranged from inexperienced to experienced computer users and in approximately equal distribution percentages for each level.

Recall that subjects were asked to rate: whether a sufficient amount of in-class instruction was provided; their level of confidence in developing spreadsheets; and whether the assistance received from the instructor or lab assistants was adequate. Responses to these questions were evaluated to determine whether or not the amounts of in-class instruction and assistance were significant factors in student performance. A chi-square of 5.08 ($p > .05$) suggests that there was no significant difference in

Table 2
Results of Tests for Demographic and Situational Data

	Chi-Square	*df*	*p-value*
Age	1.6078	4	0.4613
Prior computer experience	4.4206	4	0.3521
Adequate in-class instruction	5.0777	4	0.2795
Adequate assistance provided	2.6329	4	0.6210
Level of confidence by function:			
Data entry	0.3202	4	0.9562
Using formulas/functions	0.4048	4	0.9821
Formatting columns/rows	0.6614	4	0.8823
Inserting columns/rows	1.8899	4	0.5956
Copying cell contents	2.5786	4	0.6306
Using absolute identifiers	3.2745	4	0.5130
Saving the spreadsheet	5.1652	4	0.0756
Printing the spreadsheet	3.9876	4	0.4077

the way either group felt about the amount of in-class instruction. Forty-six percent (24) of those in Group I versus 59 percent (51) of Group II students suggested less instruction was needed than was provided, while 21 percent (11) in Group I versus 19 percent (16) in Group II thought more instruction was needed.

Regarding students' perceptions of their confidence in developing a spreadsheet using various *1-2-3* operations, such as entering data, using formulas and functions, and using absolute identifiers, chi-squares ranging from 0.32 to 5.17 ($p > .05$ for each) suggest that there was no significant difference between the two groups on these factors. Both groups demonstrated similar levels of confidence in working with the various functions necessary to create a complex spreadsheet.

Finally, a chi-square of 2.63 ($p > .05$) suggests that there was also no difference in the way students felt about the level of other assistance that was provided. Sixty-seven percent (35) of Group I students versus 60 percent (52) in Group II thought the amount of assistance provided was adequate, and only 10 percent (5) Group I versus 15 percent (13) of Group II students thought it inadequate. In sum, neither group was more or less satisfied than the other on the in-class versus self-paced approaches; however almost half of the students thought less instruction was needed than what was provided and more than half thought there was an adequate amount of assistance provided to them.

Hypothesis Testing

The test statistic used to determine significance in hypothesis testing is the t distribution. All statistics reported for the five hypotheses are shown in Table 3.

Hypothesis One states that Group I dependent learners and Group II independent learners will perform equally well on the objective test of students' knowledge and understanding of *1-2-3*. The statistic used to test the hypothesis was not significant ($t = -.39$, $p > .05$) in a two-tailed test. The result suggests that there is no significant difference between the test scores of Group I dependent learners and Group II independent learners in the sample. Thus, Hypothesis One is supported.

The results of the analysis also show support for Hypothesis Two, which states that there will be no difference in the abilities of Group II independent learners and Group I dependent learners to create a spreadsheet. The test statistic ($t = .34$, $p > .05$) is not significant in a two-tailed test. As hypothesized, Group I students were as proficient at developing a complex spreadsheet using *1-2-3* as were Group II students.

Hypothesis Three states that Group II independent learners and Group I dependent learners will be equally proficient in identifying spreadsheet errors. Again, the test statistic ($t = .01$, $p > .05$) is not significant in a two-tailed test. Therefore, Hypothesis Three is supported; there was no significant difference in the abilities of the two groups to identify spreadsheet errors.

Hypothesis Four states that Group II independent learners and Group I dependent learners will be equally adept at correcting spreadsheet errors. The test statistic ($t = .08$, $p > .05$) used to test this hypothesis was not significant in a two-tailed test. Hypothesis Four was therefore supported and suggests that, similar to the results of the first three hypotheses, independent and dependent learners were equally capable of correcting the errors they identified.

Finally, Hypothesis Five states that Group I dependent learners will complete spreadsheet homework assignments more quickly than will Group II independent learners. The test statistic ($t = -.76$, $p > .05$) is not significant. Therefore, Hypothesis Five is not supported. Apparently both groups of students took approximately the same amount of time to complete their assignments.

Discussion

The statistical analysis indicates the two groups of students in the study—Group I dependent learners who chose to have supervision and assistance from the instructor and lab assistants, and Group II independent learners who chose to learn the software package and do their course assignments outside of class and without help from the instructor or lab assistants—are not significantly different from each other on age. Neither do they differ

Table 3
Results of Tests for Hypotheses 1-5

	Group I (n = 52)		*Group II (n = 87)*				
	Mean	*St.D*	*Mean*	*St.D*	*t-test*	*df*	*p-value*
Performance on objective exam	14.79	2.61	14.97	2.59	-0.39	137	0.70
Proficiency in creating spreadsheet	2.81	1.09	2.75	0.97	0.34	137	0.73
Identifying spreadsheet errors	2.58	1.11	2.57	0.92	0.01	137	0.99
Correcting spreadsheet errors	5.08	2.21	5.05	2.09	0.08	137	0.93
Time spent on assignments	2.00	0.77	2.11	0.92	-0.76	137	0.45

significantly on their level of prior computer experience or in proficiency in learning concepts or applying the *1-2-3* program. The results strongly suggest that both groups performed equally well on the objective test as well as on the practical exam of student knowledge and understanding of *1-2-3*. Thus, using objective measures of performance, it appears that the two groups generally learned and understood the software equally well—students who worked independently developed tools to achieve the same level of skill mastery as students who relied on instructor assistance.

It is interesting to note that while there was not a statistically significant difference between the two groups, a review of summary data indicates that 91 percent (79) of the independent learners achieved average or above average scores on the two tests, but only 81 percent (42) of dependent learners achieved the same levels. It may be that students who worked independently outside of the structured lab sessions and without instructor assistance developed the same level of skill mastery as students who depended on instructor assistance. Perhaps the fact that Group I students received help from the instructor or lab assistants when they encountered problems learning the *1-2-3* command structure and the application of those commands somewhat inhibited their learning process.

While independent-study students were expected to require a greater amount of time to learn and apply the software package on their own and complete their assigned work, dependent and independent learners showed no significant difference in the amount of time reported in completing their assignments. This finding is important because, contrary to the beliefs of researchers and theorititians who imply that there is "one best approach or method" for computer education (Scudder and Kucic 1989), these results support the idea that students are likely to learn best, in terms of effectiveness and efficiency, when the teaching method most compatible with each student's choice of learning style is used, even at the undergraduate level.

Because 63 percent (87) of the students (i.e., those in Group II) either used their own personal computers or used university lab computers at differing times when they were available, computer labs and equipment were presumably more readily available to all university students during the *1-2-3* portion of this course. The professor and lab assistants were available to provide quality assistance to students who determined they did require more help. Considering the high costs of setting up, maintaining, and staffing computer labs on university campuses, this finding is particularly important, and supports conclusions of Bowman et al. (1995) cited earlier: that when given the opportunity, students were more satisfied and the costs of their computer education were lower when they were able to learn at their own pace. In this study, students in both groups were able to learn at their own pace during the *1-2-3* portion of the course, and there was no significant difference between the groups in their reported levels of satisfaction and content mastery. It may benefit computer educators and their institutions to shift some degree of their teaching focus away from laboratory exercises and more toward teaching advanced topics, concepts, or applications of computers in general.

One limitation of the study is that there was no independent test to confirm students' self-selected classification. Students may have chosen to be in one of the two groups for reasons other than their preferred learning style. For example, a particular group may have been chosen because a friend was in that group, the group sounded like it would entail less work than the other, the student had previous spreadsheet software experience, or because a particular "teacher" (i.e., the professor versus another resource person) was associated with the choice.

…there was no significant difference between the groups in their reported levels of satisfaction and content mastery.

Computer and software availability could also have been a major factor in the self-selection process that could bias the results. For example, students may have chosen to be in Group II if they had access to privately owned equipment and did not require the use of a university computer lab. Conversely, students may have chosen to be in Group I as a means of having better access to a computer at a regularly scheduled time. It is unlikely, however, that this is the case. The University has twenty-five computer labs placed in academic buildings throughout campus, four of which are located in the College of Business, and ten additional computer labs are located in student dormatories (Tunc 1997). There is an average of forty computers per lab and all computers are equipped with the *1-2-3* software. In addition, the labs are open to students seven days a week, ranging from 8:00 a.m. to 2:00 a.m., for a total of ninety-nine hours per week.

The study is also subject to common method variance from self-report data. The fact that there was no significant difference found between the two groups on the variables of age and previous computer experience or in student performance on the exams suggests a lack of substantial method variance to confound the interpretation of results. While the above analysis does not totally rule out the possibility of same-source, self-report biases, it is probably not an adequate explanation for the findings obtained in this study.

Another potential limitation is that the research design used a post-testing arrangement without pre-

testing students on computer proficiency or individual learning style. A pre/post test design is likely to provide stronger results and comparisons, as well as reinforce issues of reliability and validity, particularly for self-report biases. While a pre-test would be useful in assigning students to the test groups, it was considered desirable to have students self-select their own preferred learning style rather than require time consuming and possibly misleading assignment of students to a particular group. In other words, the research may be more important as a study on students' self-identified preferred learning method or mode in a collegiate environment and objective measures of performance rather than a study on learning styles per se.

Conclusions

Many computer software education faculty have long believed that MBA students are capable of learning and applying requisite software skills on their own. However, these same faculty have not considered undergraduate students to have the same abilities. The belief that undergraduate students' critical thinking skills are not yet developed enough to permit them to adequately learn and correctly apply software applications on their own (versus simply learning key strokes) is apparently not a valid assumption. Educators want students to do far more than just restate facts they have been taught or to repeat steps in a procedure. In this experiment, business students at the undergraduate college level were capable of learning and applying the requisite end-user computing skills on their own, and were not dependent on classroom instruction.

Most students will enter the work force upon graduation. The hoped-for results of increased emphasis on the applied aspects of the material rather than a focus on teaching software package fundamentals is that these future employees and business leaders will have an improved appreciation of the importance of computers within their organizations, will be better prepared to apply and use knowledge within their organizations, and will be able to better manage these resources. With the elimination of software basics, or at least greatly reducing the number of classes devoted to teaching these basics, and the use of demonstrated proficiencies to insure a grasp of the fundamental skills, it should be possible for faculty who teach introductory software courses to focus their attention on the intellectual aspects of the material such as skill development and problem solving rather than the mechanics of using the software.

The results of this study suggest that students at the undergraduate level are familiar enough with computers and software concepts to learn the mechanics of using a spreadsheet program such as *1-2-3*, and that matching the teaching approach with the students' preferred learning styles is important. While prior research (Baker et al., 1996; Kolb 1976; Scudder and Kucic 1989) focused on MBA-level students, results of this study strongly suggest that electronic spreadsheet packages in undergraduate level business courses can be effectively taught using differing methods. By extension, it also should be possible to do the same with respect to word processing and database packages (Scudder and Kucic 1989), an issue for additional research.

Another issue for future research revolves around the concept that undergraduate students change their view of the learning process as well as of the role of faculty during their four (or more) years in college. A final research issue comes from a casual observation that independent learning seems to be the most desirable approach in the "real world" of business, a world for which educators are preparing their students to enter.

In sum, the fact that an association exists between teaching approaches, individuals' chosen learning styles, and computer skills proficiency supports the notion that teachers may have to consider offering their students more than one method or type of instruction under which to work and learn (Baker et al. 1986). While dependent learners would still be offered the more traditional teaching approach, minimizing of the number of lab sessions required to teach commercial software packages would provide faculty the opportunity to focus more on computer concepts, the management of business information systems, and problem solving in their classes rather than on teaching computer skills. ■

Notes

1. Copies of the test instruments are available from the first author.

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Improving Job Satisfaction of Employees Who are Deaf and Hearing

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Abstract

Approximately 9 percent of the American population are deaf and hard of hearing, yet less than half of them are estimated to be working. With the passage of the Americans with Disabilities Act (ADA) and the realization of the need for and benefits of a diverse workforce, more employers will hire the deaf. The focus of this article is on practical applications of how to meet the diverse needs of employees who are deaf and hearing that work together in problem areas of communication and socialization. Recommendations discussed include positive attitudes, familiarity, support of supervisors, diversity training, American Sign Language (ASL) training, interpreters, computers, and TTY telecommunication devices. Recommendations come from a sample of 152 employees, seventy-six who are deaf and seventy-six who are hearing.

Introduction

This article provides some general statistics and sets forth the proper terms for employees who are deaf. Next, from a literature review, problem areas between employees who are deaf and hearing are discussed, followed by survey responses of these two groups. The article finally provides recommendations from a sample of 152 employees, half who are hearing and half who are deaf that meet ADA and diversity guidelines. There is a need to train employees with disabilities (Tracy 1995). Thus, diversity guidelines are recommended that emphasize training employees to function effectively together for improving communications and socialization of all employees and to increase job satisfaction.

Under the Equal Employment Law Public Law Section 501 of the Rehabilitation Act of 1973 and Americans with Disabilities Act (ADA) of 1990, all citizens of the United States, including people with disabilities, have equal opportunity to have security and employment. But, is there equal employment opportunity for people with disabilities? Of thirty million Americans with disabilities, 68 percent are eligible to work; however, only 15 percent are employed (King 1993).

[Recommendations are made] that emphasize training employees to function effectively together…

There are over 23 million Americans, or 8.6 percent of the population, who are deaf and hard of hearing (Holt and Hotto 1994). Since there is no legal definition of deafness comparable to the legal definition of blindness, "deaf" and "deafness" can have three possible descriptions:

1. Cannot hear and understand any speech.
2. Cannot hear and can understand speech through lip reading.
3. Can hear little and understand words shouted in the better ear (National Center for Health Statistics 1994).

Comparisons between various groups are presented to better understand characteristics of deaf and hearing populations. Males are more likely than females to be deaf or hard of hearing (10.5% of males vs. 6.8% of females are deaf or hard of hearing). Whites are more than twice as likely as African-Americans to be deaf or hard-of-hearing (9.4% of whites vs. 4.2% of African-Americans). Non-Hispanics are also more than twice as likely as Hispanics to be deaf or hard of hearing (9.1% vs. 4.2%). The prevalence of hearing problems is greater for those who are not high school graduates and decreases as family incomes increase. More people who are deaf live in rural areas. The number of deaf and hard of hearing in the labor force includes: 43.7 percent employed, 2.2 per-

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cent unemployed, and 54.1 percent are not in the labor force. (National Center for Health Statistics 1994).

There have been many articles on ADA and diversity. Although approximately 9 percent of the U.S. population are deaf and hard of hearing (Holt and Hotto 1994), to date there have been very few publications on employment of the deaf in journals that are targeted to the hearing population. Even though those who are deaf have demonstrated a level of performance equal to hearing coworkers on each of ten criteria associated with employment success, both before and after the ADA, less than half of those who are deaf and hard of hearing are estimated to be working (Johnson 1993). Thus, the deaf community is a relatively untapped labor source that employers should consider recruiting.

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This article extends the current literature by providing descriptive statistics on the methods of communications used between employees who are deaf and hearing. More importantly, it provides employers who presently have workers who are deaf, and employers who plan to recruit them, specific recommendations on how to meet the diverse needs of both their employees who are deaf and hearing. The researchers of this article have not found any journal articles that provide detailed recommendations for meeting the diverse needs of both groups of employees, nor any that have studied a large sample of employees including both employees who are deaf and hearing.

Employees Who are Deaf and Hard of Hearing

The deaf community views itself as being separate from those who are hearing because they confront different problems and issues. Thus, they do not wish to be grouped together and called hearing impaired. In fact, the deaf community does not accept the term "hearing impaired" because it is offensive to them. The terms "people who are deaf and hard of hearing," "people with a hearing loss," "people who are deaf," and "people who are hard of hearing" are preferred (Block and Farb 1997).

People should avoid making the terms "deaf' or "hard of hearing" nouns and correctly use these terms as adjectives, as is done in this article. The reason being, when we say "Chris is one of the deaf," the emphasis is on deaf (noun). However, when we say, "Chris is an employee who happens to be deaf," the emphasis is on Chris as a person, being deaf is just one characteristic that makes Chris different than other employees.

Problem Areas Between Employees Who are Deaf and Hearing

People who are deaf have not enjoyed the same employment opportunities as their hearing peers and often face discrimination in a labor market denying them access to higher paying positions which they could successfully fill (Schildroth, Rawlings, and Allen 1991). Or if they meet the job specifications, their deafness is used to screen them out of the selection process (Emerson, Foster, and Royer, 1987). Also, employees who are deaf are paid less than employees who can hear. Compared to a hearing population, people who are deaf are less educated, experience higher unemployment and underemployment, have lower incomes, experience lack of opportunity for advancement, and are more vulnerable to job stereotyping (Compton, 1993; Foster 1992; MacLeod-Gallinger, 1992). Moreover, females who are deaf face greater job discrimination than males (MacLeod-Gallinger 1991 and 1992).

There are barriers to job advancement, supervisors lack sensitivity with their employees who are deaf, and job accommodations are lacking, especially in the area of communications (Mowry and Andersen 1993). There are communication problems between employees who are deaf and hearing. The first language of people who are deaf is American Sign Language (ASL); and, like other minorities, English is their second language. Therefore, it is challenging for people who are deaf to read and write proficiently. Employees who are deaf do well with one-on-one work communications with hearing employees. However, group meetings and socializing are very difficult and frustrating (Foster 1992).

The two primary problem areas between groups who are deaf and hearing are communications and social need satisfaction. Both agree there is a need to improve communications. However, social need satisfaction is different between the groups as employees who are deaf are less satisfied with social life at work. Thus, more social problems exist for employees who are deaf than hearing (Compton 1993).

Although a college education is a major key to success, 48 percent of those who are deaf leave school without a high school diploma (Schildroth et al. 1991). Most have limited access to a college education. Gallaudet University in Washington, DC specializes in educating students who are deaf, while other universities offer reasonable accommodations that are often difficult for students to fully utilize. Only around 25 percent of those who go to college will graduate, versus around 50 percent for the hearing population. Given that only 8 percent go on to college, the result is merely 2 percent of high school graduates who are deaf earn a baccalaureate degree within five years. Among those gaining employment, 71 percent end up in blue collar jobs versus 50 percent of the hearing U.S. job force (Welsh and Foster 1991).

Survey Responses of Employees Who are Deaf and Hearing

Previously, problem areas between employees who are deaf and hearing were identified from secondary sources. With the co-sponsorship of National Association of the Deaf (NAD), seventy-six members who are deaf with jobs and seventy-six hearing employees who work with employees who are deaf were randomly surveyed, for a total of 152 respondents from diverse U.S. locations. Hearing employees were matched with employees who are deaf. Of the seventy-six matched pairs, twenty-five had the same job and boss and fifty-one had similar jobs with different bosses. The first question asked how these two groups communicated. In Table 1, respondent's answers to methods of communications are presented.

Table 1
Method of Communication between Deaf and Hearing Employees

Method of Communication	*% Deaf Respondents*	*% Hearing Respondents*
Only sign language	36	44
Sign language, speech, and lip-reading	16	12
Speech, lip-reading, and written	16	20
Speech and lip-reading	12	12
Sign language and written	8	4
Only written	4	4
All other	8	4
Use of Interpreters		
Interpreters used	36	12

The second question was, "Are employees who are deaf and hearing treated equally?" See Table 2 for responses to this question. Five participants who are deaf and three hearing responded "yes and no," thus were included in the "no" response category. With approximately 25 percent of survey respondents (20% deaf and 28% hearing) not answering the question, it is difficult to say how employees would have answered if forced to select yes or no, which would influence total percentages of yes and no answers. Although about half of each group believes that they are treated equally, the employees who are hearing are far more satisfied that they work in an environment that includes friendly people and that they have close friends at work. Also, employees who are deaf reported communication problems that do not exist for employees who can hear.

According to respondents of open ended questions, some employees who are deaf said they are often left out when interacting with co-worker who can hear during coffee breaks and lunch time. An employee who is deaf noted, "Where there is group discussion or conversations, either social or work related, I generally get left out, then get a summary from one person later."

Many employees who are deaf believe that they are not part of the network that enables them to understand what it takes to advance in their careers. Employees who are deaf do not believe they have the opportunity that hearing employees have for getting training and job advancement. Some of the participants who are deaf complained about their employers or hearing co-workers not sharing all information on training and promotions.

Table 2
Are Deaf and Hearing Employees Treated Equally?

Responses	*% Deaf Respondents*	*% Hearing Respondents*
Yes	56	48
No	24	24
No responses	20	28

The third question was, "What can managers/organizations employing people who are deaf and hearing do to improve the work situations?" The most common response of both groups was that their supervisor and/or organization could improve the work situation by offering sign language class and by providing interpreters for meetings.

The last question was, "What can peer(s) of deaf and hearing participants do to improve their work situation?" Both groups responded that their peers could improve their work situations by having communication access and providing American Sign Language (ASL) classes for hearing people.

Conclusion

The most common method of communications between employees who are deaf and hearing is sign language. Only about half of the respondents stated that employees who are deaf and hearing are treated equally. Employees who are deaf and hearing had specific recommendations for employers/managers and for peers that can improve communications and socialization of employees who are deaf and hearing. Thus, their recommendations that can increase job satisfaction are presented in the next section.

Recommendations for Improving Communication and Socialization

The reality of the diverse workplace today suggests that organizations will continue to employ people who are hearing and deaf. Although it may seem obvious that

employees who cannot hear oral communications are generally left out of the conversation, employers, supervisors, and co-workers are not taking the necessary action to include employees who are deaf.

If workers who cannot hear are not included, they cannot contribute their valuable ideas that can solve problems and lead to better decision making. Thus, in this section, the survey respondents' suggestions offer practical ways to better meet the needs of co-workers who are deaf and hearing.

Although the ADA states that "reasonable accommodations" be made for disabled employees, there are no clear answers as to what is legally required, and what is considered to be reasonable in one organization may not be reasonable in another. Thus, the following recommendations from survey respondents are suggestions rather than legal requirements of the ADA. Some of these ideas have low or no cost, yet can increase job satisfaction, which may offset the cost.

The primary problems of communication and socialization are related. Lack of communications is a major reason for the social problems. Communication is an important factor for developing relationships between employees who are deaf and hearing; and is therefore of great importance to the employee who is deaf working in a hearing environment. Many employees who are deaf do not enjoy socializing with co-workers because they cannot hear conversations, whether in or out of the office. If the ability to communicate can improve, so can social friendships/networks and chances for advancement. Thus, the primary area that should be worked on in organizations is communications. Improved communications will result in greater job performance of all employees, while helping to meet social needs to improve job satisfaction of employees who are deaf.

Develop Positive Attitudes

Within all areas of recommendations for improving job satisfaction, attitudes of hearing towards employees who are deaf is a critical factor, as well as attitudes of the employees who are deaf towards hearing employees. Even if hearing co-workers and supervisors make special efforts to meet the needs of employee who are deaf, but do so showing resentment and burdensome special treatment, the employees who are deaf will not adequately have their needs met. Also, negative attitudes of employees who are deaf will frustrate employees who can hear.

Become Familiar with Each Other

Employees who are deaf and hearing are often anxious or distrust how they can communicate with each other. With time, they become more familiar with what to expect from each other and can become warm and friendly. Supportive supervisors can be good models by making efforts to communicate with employees who are deaf and co-workers who can hear may follow the role model. If supervisors make the effort to include employees who are deaf, co-workers generally will too.

Provide Diversity Training

Organizations can provide training for hearing employees who work with employees who are deaf. Training to provide an understanding of the culture of the deaf employees versus hearing employees will improve sensitivity to the needs of employees who cannot hear. For example, the training could include placing participants into small groups and having hearing employees, one or two at a time, wear earplugs so that they cannot hear. The employees who can hear then carry on a conversation talking about the employee who cannot hear. The employee with the ear plugs becomes sensitized to the feeling of observing without being able to effectively participate. The exercise should be followed by a discussion led by a qualified person to debrief participants regarding the exercise. Through experiencing being deaf, employees may make greater efforts to include employees who cannot hear in communications.

Provide American Sign Language Training

A next step would be to train the employees who are hearing and deaf to communicate on the job. Organizations can teach ASL to employees who can hear so they can effectively communicate with employees who cannot hear. Ideally, a voluntary buddy system would be created so that at least one co-worker who can hear will become proficient at ASL and serve as the interpreter for the co-worker who can not hear.

Provide Interpreters

Another more expensive option in the long run is to hire interpreters during meetings to sign for employees who are deaf. Recall that ASL and interpreters were the most common recommendations by employees who are deaf and hearing.

Provide Computers and TTYs

Improved computer networks and TTYs can also be provided. Meeting agendas and minutes can be taken on screen by computer and displayed overhead for employees who are deaf to read as meetings progress. With the use of an interpreter or keyboard, employees who are deaf can communicate as active participants during meetings. With improved technology and lowering costs, this computer option is rapidly becoming viable for all sizes of organizations.

Provide Equal Opportunity for All

One last issue: organizations need to provide a variety of training for all employees so that they can grow on the job and have the same opportunities for

advancement. Thus, employees who are deaf, although often a small minority in the workplace, deserve equal opportunities. With equal opportunities, the numbers of employees who are deaf can grow, providing a valuable asset to all types of organizations.

Conduct a Cost-Benefit Analysis

Although many survey participant recommendations have been made, some are rather expensive while others are not. The individual employee, manager, and organization must conduct their own cost-benefit analysis for their situation based on their own social responsibility commitment and implement a program that best meets the needs of the employees who are deaf and hearing as well as the organization. Is the organization already making special accommodations for other diverse groups? If yes, employees who are deaf deserve equal treatment. Although not clear in many situations, we must remember that reasonable accommodation is required by law. ■

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Articles in Books:

Peterson, R. and L. Tracy. 1985. Problem solving in American collective bargaining: A review and assessment. In David Lipsky, Ed., A*dvances in industrial and labor relations*, Vol. 2, Greenwich, CT: JAI Press.

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