Show Bookmarks

Excerpt from

Technology and Society

By

Beverly White

About the Author

Beverly White has a Master of Arts in mathematics from Lehigh University. She is currently Executive Director of Education Technology Services for the Greenville County School District, Greenville, South Carolina. In her current position, Bev is responsible for all instructional and administrative computing services as well as its computer network and Internet services.

The following is a sample excerpt from a study unit converted into the Adobe Acrobat format. A sample online exam is available for this excerpt.

The sample text discusses changes that have occurred and will occur in business and society as a result of evolving technology. It's important to consider how business and society have adapted to technological changes so that we can anticipate what might happen as a result of future changes.

Those future changes are going to be important to you personally. Even as you prepare for a job in today's business environment and live in today's society, you must think ahead about what skills you'll need to remain marketable in the future.

A person entering the workforce today will, on average, make five career changes during the course of the working years. Those five career changes won't simply be changes where you move from one employer to a similar or better position with another employer. Those five changes are actually changes of entire careers—moving from one type of job to another. And the job that today's worker ends up doing years from now will probably be a job that doesn't even exist today.

The concept of rapid change is exciting and scary. But you don't need to be worried because you can learn from the past and anticipate the future. That's a large part of what this study unit is about. But your interest in computers prepares you for the material you'll be covering.

After reading through the material in this excerpt, feel free to take the sample exam based on this material.

IMPACT OF TECHNOLOGY 1

Business Improvements 6

Point-of-Sale Terminals 6
Automated Internal Accounting 7
Keeping up with Changes 12
Coopetition 13

EXAMINATION

Technology and Society

IMPACT OF TECHNOLOGY

When you think about it, you might not remember a time before computers. Computerized cash registers and scanners are unremarkable. Buying and selling stocks and other items on the Internet may be a bit newer, but that sort of e-commerce is already commonplace as well. Production lines around the world are being computerized. The major automobile manufacturers use giant automated production lines to move vehicles through the assembly process. Many manufacturers, including automotive manufacturers, even use robots for many portions of assembly work (Figure 1).

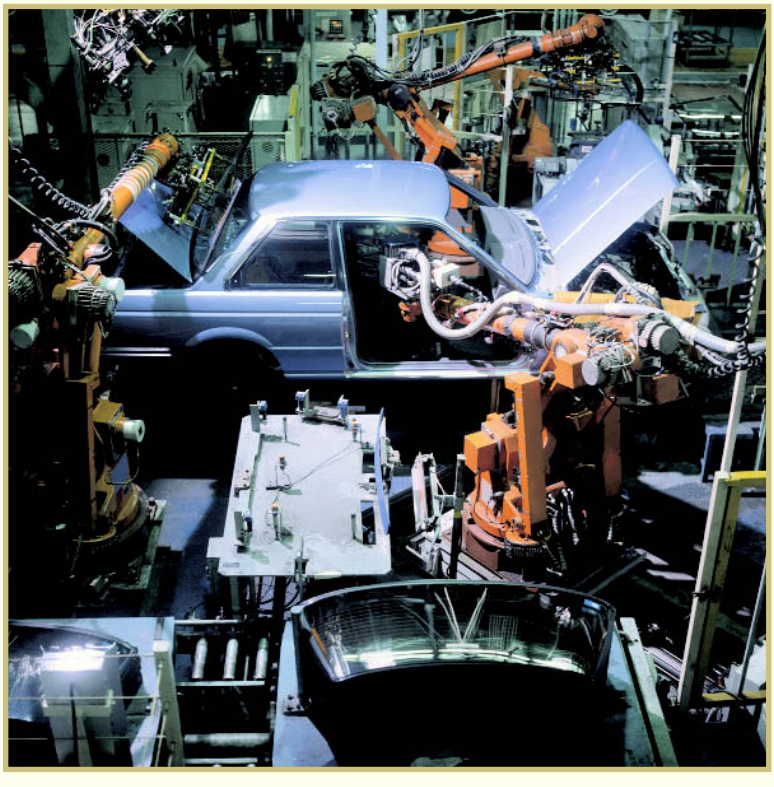

FIGURE 1—Computer-assisted production lines are now commonplace.

Big business can afford to implement costly robotics because of the magnitude of the operations. But such solutions aren't often realistic for small businesses. However, in the case of computer-controlled production lines, this solution has become feasible for manufacturers of all sizes. Visit any manufacturer and you'll see how widespread this practice has become (Figure 2).

FIGURE 2—Whether large or small, most manufacturers have incorporated computer technology into the production process.

At a John Deere manufacturing plant in Georgia, the production flow has been analyzed so that each task is timed and every movement detailed. That enabled the plant to use technology while still employing production line workers. The "chain" that moves the units under production from station to station along the production line is advanced at specific intervals under the control of a computer. The product being assembled remains at each location for a predetermined period of time. When the appropriate time has elapsed, the "chain" starts again automatically and moves the product to the next assembly point—all without human intervention. The humans working on the production line must be sure to complete the essential work in the allotted time in order for the product to be successfully constructed. But the human

workers don't have to do the additional chore of manually starting the chain moving to take the product to the next position and put another product in place. The plant views the process as a successful integration of people and technology.

Technology exists to simplify buying and selling processes as well. Consider just the payment portion of a credit card cycle. Many companies allow you to log on with a user identification procedure and see the charges that have been posted to your account. At any time, you can print out a statement if you need to do so. You can authorize the transfer of money directly from your bank account to the credit card company so that you don't even receive a bill in the mail. That way, you don't have to write a check and mail it to the company—the company receives the money electronically, which simplifies the posting process. No one has to open an envelope, enter the appropriate account number, and process the check. So you see that, although credit cards have been around for quite a while, advances in technology have made it possible to automate additional processes without compromising security.

Let's look at another financial process that has been made possible using computer technology. Perhaps your employer deposits your paycheck directly in your bank account. You then receive a statement showing various deductions and year-to-date totals. If you're away on the day your check is issued, your money is still transferred into your account on the appropriate day and time. An added advantage of this process is that you don't have to take the check to the bank and deposit it. The money is placed in your account early in the morning on payday—even before you receive the statement. You don't have to miss lunch to run to the bank or cut an appointment short and race across town to get to the bank before it closes.

Information technology (often shortened to simply *IT*) is the term used to include everything from faxes and phones to computers and the Internet. Information technology is an appropriate term to use, since it's information rather than strictly technology that's the driving force in the dramatic changes that continue to transform businesses and industries. Information technology is increasing efficiencies, cutting

costs, driving customization of products and services, and increasing the speed of commerce.

Not only are existing businesses being transformed, but also, as a result of IT, whole new industries and products are emerging. A prime example of that trend is the hundreds of thousands of new jobs created by the Internet.

It's generally agreed that the U.S. economy has undergone fundamental changes. Reference is occasionally made to the "new economy" in recognition of those changes.

Without instantaneous global communications, the new economy wouldn't be possible. It's critical to be able to send and receive all sorts of data worldwide. And it's essential to be able to do it easily and inexpensively. Data could be anything from documents to video and multimedia. Costs of data transmission have decreased dramatically, which is a measure of economic progress.

A *transistor* is a solid-state electronic device that's used to control the flow of electricity in electronic equipment.

Other changes are taking place with remarkable speed. When you consider that the time from invention to production for the ballpoint pen was 50 years, it's amazing that the transistor was in production a mere 10 years after it was invented. The pace of change in technology is so rapid that there's even a law to express it.

Moore's law is named for Gordon Moore, a founder of Intel. Moore's law states that the processing power of microchips doubles every 18 months or so (Figure 3). Consider the following facts:

- In 1978, Intel Corporation introduced its 8086 chip, which contained 29,000 transistors.
- Four years later the 286 was on the scene with 134,000 transistors.
- Three years after that, the 386 had 275,000 transistors.
- The Pentium Pro, introduced in 1995, had 5.5 million transistors in its core central processing unit.
- The Pentium II, issued in 1997, had 7.5 million transistors.
- The Pentium III, introduced in early 1999, had 9.5 million transistors.

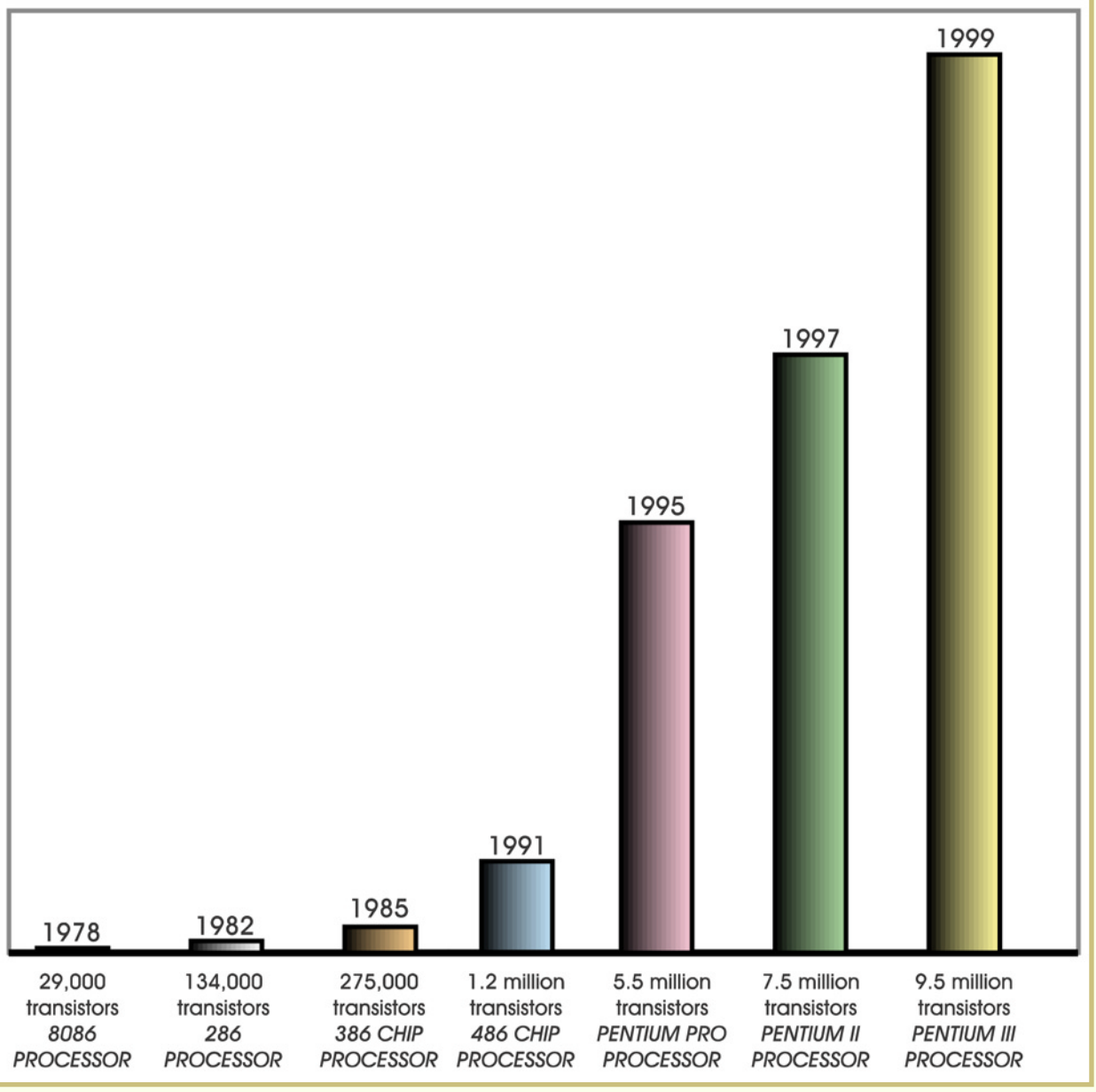

FIGURE 3—The power of computer processing grows at a phenomenal rate.

Notice that the time between "generations" of chips gets shorter but the processing power as indicated by number of transistors gets larger.

Another observation that follows Moore's law is that the cost of computing is dropping by nearly 25 percent per year. As you might expect, the cost of computing power has been dropping sharply. In 1978, the price of Intel's 8086 was 1.2 cents per transistor, and $480 per *million instructions*

per second, or *MIPS.* Less than 20 years later, the Pentium Pro's introductory price amounted to 0.02 cents per transistor, and $4 per MIPS. This trend of falling prices is expected to continue.

So computer prices are going down, and computing power is going up. The bad news is that the product you buy today will be outdated in a very short time because new products are being developed more rapidly than ever.

Business Improvements

Point-of-Sale Terminals

When you purchase an item in a grocery store, the price of the item is displayed when the checkout clerk scans the *Universal Product Code,* or *UPC* (Figure 4). Do you remember a time when each item was individually priced? Before UPCs, there were price stickers affixed to every item on the shelves, or the amount was stamped directly on each product. If the price of an item changed, the price sticker had to be replaced, or the price stamp had to be changed to the proper price. In order to check out, the checkout clerk had to locate the price on each item and key in the proper amount on the cash register. Your receipt would consist of a list of prices with no indication of the product purchased.

FIGURE 4—A Typical UPC

Technology changed all of that. The cash register became a *point-of-sale (POS) terminal.* The prices of items are all stored in a central computer. When the UPC is scanned, the computer looks up the current price of the item. Both the product name and the price are displayed on your receipt. That's the transaction that you see.

There are other transactions in the background that you don't see. The sale of the item decreases the inventory of that item by one. The computer does this calculation automatically as your groceries are checked out. If the available supply of an item falls below a pre-specified reorder number, the computer triggers a reorder for the item. When new items are received, they're added to the inventory in the computer as they're stocked on the shelves. Changing the price of a product is simply a matter of changing the price stored in the computer for that product. That's certainly less labor intensive than changing the price on each and every item on the shelf.

It's not just grocery stores that use POS terminals. You see them in clothing stores and hardware stores and large department stores. They're just about everywhere. The capabilities of POS terminals have improved business processes, making businesses more productive by automating previously labor-intensive processes. Reduced labor costs reduce overhead, allowing businesses to be more competitive in pricing the products they sell.

Automated Internal Accounting

When you think of a business accounting department, do you envision a bunch of people wearing green eyeshades recording numbers in large ledgers? That was a fact of business life not so very long ago. Technological advances changed the business accounting process dramatically. Both internal and external processes involving accounting have been affected. One example of how accounting has changed is illustrated in both the following text and the scenarios involving Acme and Sharp Point Pencilmakers in Figure 5 and Figure 6.

If a businessperson wants to order some item from an external vendor, the usual process is to complete a purchase requisition from which the accounting department creates a purchase order. A copy of the purchase order is sent to the vendor; a copy is sent to the department making the purchase request; and a copy is retained in accounting. When the order arrives, an invoice is included in the package. The requesting department checks that the items received are the ones ordered, and that the items on the invoice match those actually received. Notations are made on the invoice indicating receipt of items ordered and authorizing payment. The invoice is then sent to accounting, where payment is processed and a check is sent to the vendor (Figure 5).

Advances in technology have automated this entire process. A department wishing to purchase an item from an external vendor logs on the business computer system and completes an electronic purchase requisition. The person within the business who has control of the department's budget electronically approves the purchase requisition, which is then converted automatically into a purchase order. The requesting department may print out a copy of the purchase order if it's desired. The purchase order is electronically routed to accounting, and an electronic copy is sent to the vendor. When the order arrives and the department checks that the invoice is correct, authorization to pay the invoice can be done electronically. Accounting can then either send a check to the vendor or pay it by an electronic transfer of funds. Although the electronic process takes just as long to describe or illustrate, it saves tremendous time and paper when implemented (Figure 6).

Although many businesses still print out the purchase orders in multiple locations for tracking purposes, the entire process could be handled with no paper at all. The internal procedures of businesses have not, in many cases, kept pace with the changes that are possible by fully utilizing technology. However, even partial utilization of the electronic processes can improve business productivity by significantly decreasing the amount of time that elapses from the beginning of the process through its completion.

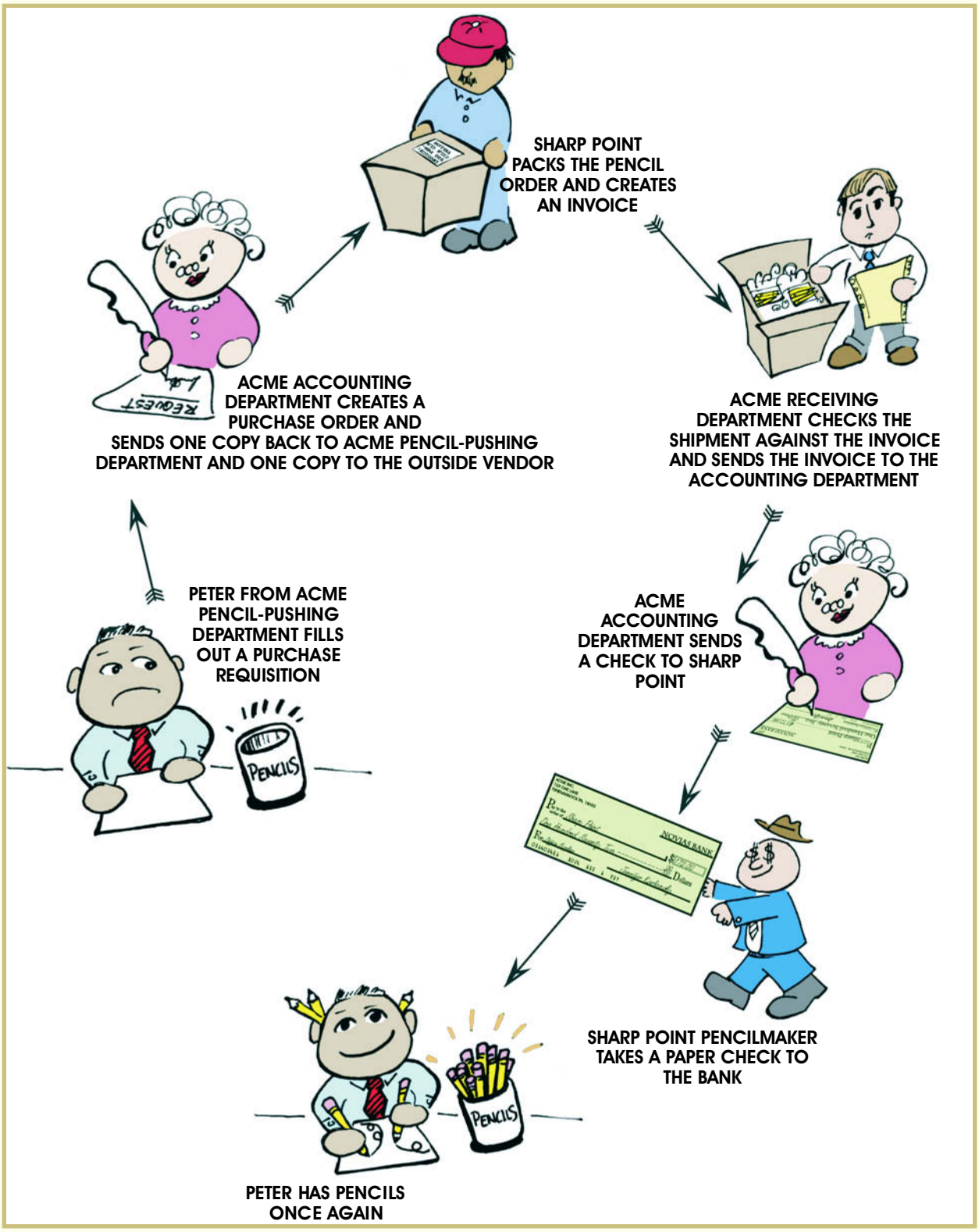

FIGURE 5—The paper-based accounting process is cumbersome, requiring significant processing time and paper supplies, not to mention sizable storage for paper files.

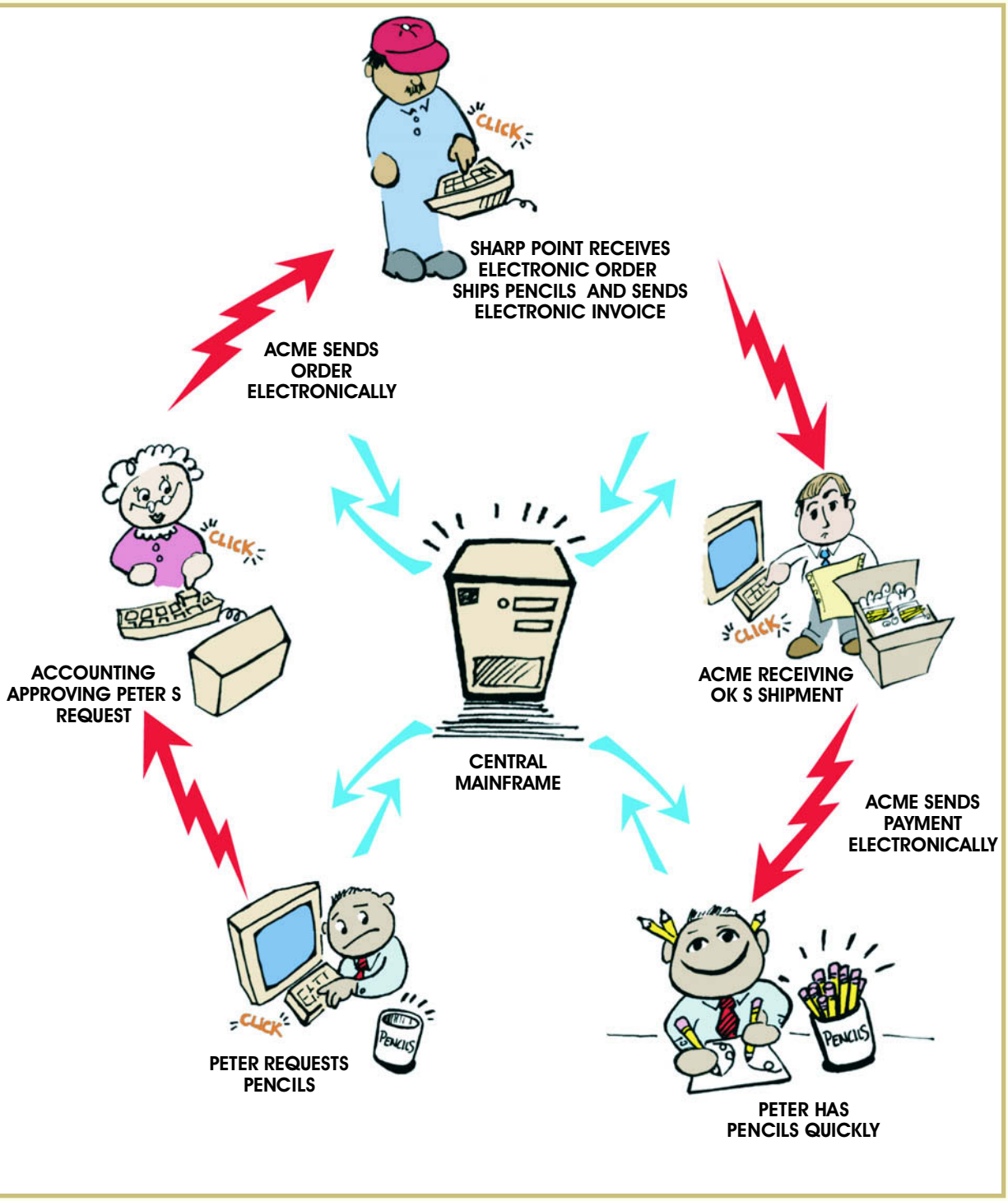

FIGURE 6—An electronic procurement system is quicker, less costly in the long run, and requires little if any paper storage.

Business phone services can also provide methods of electronically auditing usage and streamlining complicated billing processes. A large business has many phones with many different numbers. Sorting out the monthly phone bill so that charges are routed to the appropriate departments can be a time-consuming process. Through the use of technology, the phone company can now electronically transfer a file showing the details of all calls and charges for all phones in the business. When the business receives that file, the data is sorted and routed electronically to the appropriate departments. Payment can be authorized electronically by the actual departments from which the calls were made. This process gives the individual departments necessary information for determining how money and time are being spent. Control is maintained at the lowest level, which increases business productivity.

Still another way businesses and institutions are using IT is by setting up *procurement card* systems. Procurement cards are used by corporations and institutions to reduce paperwork and streamline small-purchase procedures. The business specifies the types of purchases that may be made using the cards. Constraints are placed on the amount that may be expended as well. The cards enable the person who needs a supply item to make the purchase directly. Extensive paperwork and lengthy approval processes are eliminated for eligible purchases. Detailed records of purchases are transmitted electronically on a daily basis from the bank, which supplies the cards to the business. When purchases are reviewed and verified, funds are transferred electronically to the bank. Business productivity is improved through the minimization of paperwork and delays.

A *procurement card,* or *purchasing card,* is a payment mechanism designed to help companies maintain control of small purchases, while at the same time reducing the associated administrative costs, such as authorizing, tracking, paying, and reconciling of such purchases.

None of these technology applications represents a dramatic departure from traditional business practices. But each illustrates how applying technology to one facet of a business's operation can have effects that are more far-reaching than the mere automation of the process itself.

UPCs and scanners didn't just automate the checkout process. They also enabled online inventory. Procurement cards change the purchasing process, but they also enable electronic billing and payment.

Keeping up with Changes

In businesses, senior-level executives are spending more time than ever keeping abreast of technology and its applications. Still, they're often uncomfortable dealing with technology issues. The IT environment is complex. The essential disaster and contingency plans are mind-boggling. The whole area seems a chaotic clutter of components. A comfort zone must be established for management to deal effectively with critical information. Skillful management of information technology is essential to the success of today's businesses.

The Hawthorne Effect

It isn't possible to point to a specific application of technology as being solely responsible for improved business productivity and competitiveness. In fact, just by paying attention to a specific business process, gains in productivity and competitiveness may be realized.

A research program was carried out in the 1930s at the Hawthorne Western Electric plant. Although the study centered on human relations, the results were surprising. The study revealed that productivity increased as a result of workers being singled out for study and thus made to feel important. This result is called the *Hawthorne effect.* It explains the phenomenon of improved productivity simply by virtue of someone closely studying the process.

So increases in business productivity and competitiveness could be attributed, at least in part, to the Hawthorne effect. In other words, if someone were to study the processes in order to automate them, then that study alone could partially account for the gains that usually occur.

Standardized mass production has given way to flexible production of goods and services. Economic growth depends upon trade, tax, and employment policies that reflect this reality. Productivity has increased so much in manufacturing that fewer workers are needed to make things. The same is true in agriculture, where far fewer workers are needed to produce more crops, dairy, and livestock in greater than ever before.

Eighty percent of today's workforce spend the day moving things, processing and generating information, or providing services to people. Since 1969, virtually all the jobs lost in the production and distribution sectors have been replaced by office jobs. Instead of using lathes and forklifts, workers now are more likely to use faxes, copiers, telephones, and PCs.

So the companies that manufacture, sell, and service those new tools—the technology companies—have become extremely important.

Competitive advantage throughout the business world stems increasingly from customization, design quality, and customer service. All of these are made more efficient through the use of technology.

Coopetition

The word *coopetition* has been used to describe collaboration among competitors. Management guru Peter Drucker talks about the collaborative dynamic of networks, partnerships, and joint ventures. Those are all forms of cooperative competition, now dubbed *coopetition.* Coopetition requires social capital, physical capital, and human capital.

Coopetition is the act of working together on a joint project by partners who wouldn't otherwise be allies.

The social capital of coopetition is encouraged by collaboration and alliances. Coopetition may pertain to physical capital such as plants, equipment, and technology. Coopetition may be important human capital: intellect, character, education, and training in driving innovation and growth. All are essential to the success of coopetition.

Although competition for market position has increased over the years, so has the frequency of collaboration among competitors. Rather than creating giant, all-purpose companies, technology has enabled the business world to thrive through partnerships, networks, and joint ventures.

Coopetition enables specialized, targeted businesses to do what they do best while partnering with another company to provide services outside their area of expertise. Both companies benefit through increased productivity and competitiveness.