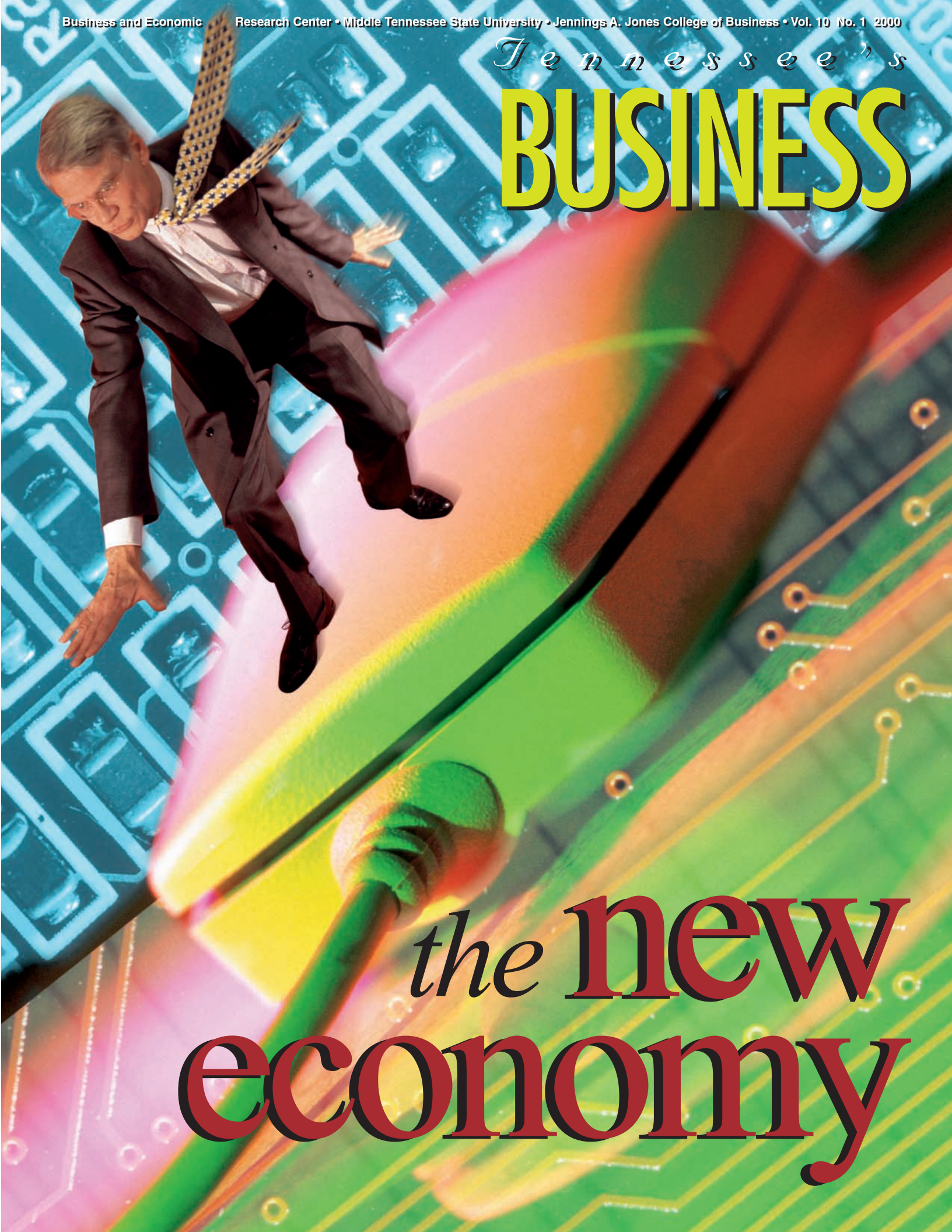
Business and Economic Research Center • Middle Tennessee State University • Jennings A. Jones College of Business • Vol. 10 No. 1 2000

Tennessee's

BUSINESS



the new economy

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BUSINESS

Published by the
Business and Economic Research Center
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Recipient of the 1991, 1996, and 2000 AUBER Award of Excellence in Publications

MTSU AA125-1100

Editor's Note

The information age is fully upon us, and many terms are used to define it—among them, "the new economy." Exactly what is the new economy? Perhaps, lacking a single definition, the new economy can best be explained by describing its characteristics.

The new economy emphasizes sophisticated communications technology instead of mass production, a place where people work with their brains more than with their hands. Innovation, frequent change, and global, free-market economic competition are its hallmarks. It represents a revolution more profound than the change from an agricultural to an industrial economy.

The new economy represents working with information and ideas more than with the raw materials of manufacturing. Industrial power was based on production and distribution; however, the new economy is based on information, which is easier to produce and can be instantly distributed by computers throughout the world.

Information is generally easier to produce than manufactured products. It is not as labor-intensive. Consequently, the new economy is more competitive because the economic barriers to enter it are not as great as in a traditional industrial setting. To excel, firms must continually—and rapidly—innovate to stay ahead of fierce competition. New products and services can emerge and be distributed in months as opposed to years in the typical industrial economy.

Therefore, the emphasis of our economy has shifted from rationing scarce material goods to making choices from a variety, if not overabundance, of ideas. Consequently, management faces new rules of competition and new forms of organizing a business. How to manage and compete in the information age is a tremendous challenge. In addition, although no economy is either inflation or recession proof, productivity of information is harder to measure than productivity of material goods.

Where or how will the new economy revolution end? No one knows. Then again, given the nature of information, it might never end (*http://www.hotwired.com/special/ene*).

—Horace E. Johns, Editor

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CONTENTS

A Tale of Two

The Old and the New

Economies

by Roderic Hewlett

It was the age of Internet, It was the age of e-business....

Every few years, claims of a new paradigm are launched in the business world, and everyone says the corporate world is undergoing a revolution. For corporate warriors, the tired banner of revolution and change generally means another program that will run its course and fade away. During the 1980s many employees in the corporate world, especially finance organizations, were provided personal computers with dubious capabilities and told to go forth and be productive. In many cases, the computer actually slowed employees in completing their routines.

Gradually software developers, hardware designers, and communication providers developed tremendous capabilities that signal the fulfillment of the 1980s' productivity promise. The amazing electronic commerce movement can be placed under the now familiar umbrella term of "e-commerce," a product of market forces seeking methods to improve products and services at reduced costs. Economists refer to this process as innovation; the result is increased productivity. Companies involved in producing technology-based products are termed "new economy" companies.

The U.S. economy is enjoying a record-setting run of growth, high employment, and low inflation. A few years ago, economists suggested this combination of low unemployment, low inflation, and real economic growth was not attainable, much less sustainable.

Many experts credit technology, or new-economy products, with productivity enhancements that are fueling the current record economic expansion ("U.S. Workforce," p. 1). Many economic statistics gathered by government agencies lend support to the technology/productivity argument. According to U.S. Department of Labor statistics, manufacturing output per hour grew by 6.4 percent in 1999 and 10.8 percent in its final quarter. This output trend continued as output per hour increased by 6.9 percent in the first quarter of 2000. Unit labor costs for the manufacturing sector—a major share of total manufacturing costs—fell by 5.9 percent in the final quarter of 1999, resulting in an overall reduction in labor costs of 1.4 percent for 1999. The first quarter of 2000 witnessed a reduction in unit labor costs of 2.9 percent (Department of Labor). As productivity improves, non-inflationary economic growth fuels an expanding economy. Most sectors of the U.S. economy mirror this performance, evidenced by the 6.4 percent real growth of GDP in the first quarter 2000 (Department of Commerce).

The new economy is the synthesis of government investment and research with private entrepreneurship. The backbone of the new economy is the amazing array of communications devices, the Internet, and advanced computing technology. The U.S. government funded the initial development of the Internet. Many modern technological developments in software and hardware trace their origins to government investments in space exploration and defense. Government was uniquely positioned to make huge investments in technology that dwarfed the capacity of any large private-sector organization. The new economy is truly the product of a mixed economy, guided by the "invisible hand" of capitalism, spurred by the actions of the private and public sector.

continued on page 4

continued from page 3

Many new-economy products credited for this productivity boom fall under the e-commerce banner. As consumers and businesses go online, the ubiquitous world of e-commerce unfolds. The various products and services are too numerous to cover in just a few pages, but highlighting a few important new-economy products vividly demonstrates the impact these products are imparting on the old economy.

Business to Consumer (B2C)

Increasingly, old-economy companies—retailers, manufacturers, wholesalers, and service providers—use new-economy technologies to reach out to customers. Whether buying products or services or looking for jobs, consumers are logging onto the World Wide Web (WWW) in record numbers. Businesses are responding to consumer demand by entering the e-commerce retailing business. According to a recent InfoWorld survey of 105 businesses, 64 percent of respondents now have B2C models, compared to 49 percent from the prior year (Dugan 49). Many companies cited "time to market" and "worker shortages" as primary motivations for entering WWW retailing. Roughly half of the respondents suggested e-commerce was moderately to drastically altering their business model, while about a fourth suggested e-commerce was having little impact on their business model.

The development and operation cost to enter e-commerce markets can be high, and returns can seem distant. Some e-commerce projects have gotten off to a slow start but are gaining momentum. However, benefits to organizations engaged in e-commerce are more ubiquitous than just reducing product cycle time and augmenting sales staffing. E-commerce enhances businesses' ability to introduce products that meet customer needs while improving financial, marketing, human resource, and other essential operations. A brief survey of a few innovative new-economy products demonstrates the productive power of the WWW.

Treasury organizations are harnessing the power of the WWW through innovative cash management techniques. The use of electronic bill presentation and payment systems (EBPP) can significantly improve a business's cash conversion cycle. The basic premise allows businesses to bill customers and collect payments electronically. Customers can verify the accuracy of their bill online while arranging payment. Reduced mail float, reduced check float, and abbreviated payment clearing steps increase free cash flow; reduction in mailing and handling of paper bills and payments reduces payment credit errors and business costs. Companies can design their own EBPP system or outsource this activity. Variants of EBPP range from simple e-mailing of bills to more sophisticated versions that link to a business's financial management software, automating many other accounting activities such as check reconciliation and accounts receivable posting.

Many modern technological developments in software and hardware trace their origins to government investments in space exploration and defense.

Businesses use e-commerce not only to improve operations but also to improve their knowledge about their organization—by storing and assessing great quantities of information about their customers and retail trends. This process can be developed in-house or outsourced. Knowledge management encapsulates employee knowledge, customer feedback, and consumer trends to develop true "learning organizations" (Arner, p. 44). To augment a company's knowledge management system, companies can access intellectual information and purchase patents online. Properly managed, this new technology offers companies opportunities to improve communication and information management within the organization and with customers. Information can be converted to knowledge that leads to innovation and growth.

The uses of e-commerce to increase the "bottom line" are nearly endless. Even hardened veterans of the productivity wars are convinced of the benefits. Harnessing the power and productivity of retail e-commerce requires some advance planning (Ruud and Deutz, p. 28). To maximize e-commerce investments, experts suggest that organizations first take the following steps:

- Decide to develop the site with internal resources or outsource portions of the project, and develop an estimate of both capital and operating expenditures.
- Develop a site plan that integrates long- and short-term organizational goals.
- Define potential customers and corporate image; then focus the e-commerce message for these customers.
- Develop the site with an eye to current and future process integration.
- Consider security and other risk management issues (e.g., payment fraud and hacking).
- Determine the scope and scale of e-commerce operations (not everything a business sells may fit a retail e-commerce strategy), and work to prevent bottlenecks in the operation.

An e-commerce Web site should enhance a business's economic value. Using net present value or economic value-added techniques, a business's e-commerce program can be evaluated much like any other capital investment. If benefits exceed costs, undertaking the e-commerce project enhances shareholder wealth (King, p. 48).

The shear scope of online retailing demands that businesses seriously consider taking the plunge. A recent study by the Boston Consulting Group shows online retail sales will nearly double from $33.1 billion in 1999 to a whopping $61 billion in 2000 (Kane).

Business to Business (B2B)

An emerging e-commerce trend is the B2B transaction. Companies can establish B2B capabilities through vendor-provided services and/or in-house resources. Many B2B products integrate current in-house systems—financial management software, treasury management, inventory management, production management systems, and other business networking systems.

Integrating these important business systems forces business practices to redesign. The payback in timely management decision-making and customer satisfaction can be tremendous. The degree of integration should be tailored to each organization's needs. The banner titles of enterprise resource planning (ERP) and customer resource management (CRM) identify knowledge-based integrated business systems to enhance employee involvement, customer satisfaction, control, planning, and quality. These integrated products interactively tie major areas of the business together. In many cases single-point entries in purchasing, production, receiving, and human resources update financial reporting data in finance. These systems can integrate a business's supply

chain, allowing online bidding and scheduling. Planners can analyze an array of integrated data from the computers on their desks. Managers can use real-time data to tailor their operating and planning decisions. Costs for implementing these systems can be large, but carefully planned systems generally provide high returns on investment through operating efficiencies and enhanced decision-making.

Commercial banks increasingly provide customers with an array of financial products that boost productivity, organizational knowledge, control, and ultimately shareholder value. Most chief financial officers will readily recognize products such as:

- account reconciliation,
- automated clearing-house services and check clearing services,
- controlled disbursement,
- tailored demand deposit accounts (zero balance accounts and sweep accounts),
- electronic data interchange (EDI),
- information reporting including optical scanning,
- purchasing cards,
- retail and wholesale lockbox services,
- treasury management software.

The finance organizations typically act as the hub for information integration and value enhancement activities in a business. Developing e-commerce capabilities linked to the finance organization is a natural starting point since much of the information an organization tracks is resident in a finance organization. New-economy technology-driven products are driving finance organizations to transform from "bean-counter" organizations into stylized intra-company business consultants. Members of the finance organization use their knowledge of business operations and organizational data to transform business organizations operationally and strategically.

To further the expansion and productivity afforded through e-commerce, a 30-member consortium composed of financial, accounting, government, and technology organizations is currently developing an e-commerce standard, the International Business Reporting Language (XBRL). XBRL, a new freely licensed specification, provides a reliable and efficient automatic exchange and extraction of financial data across all technology formats, including the Internet. Information entered in XBRL format can be produced as an HTML document for a Web site, a printed document, a specialized report, or documents required for government disclosure (SEC).

Security Considerations

Information security has always been a major organizational issue. Going online creates new security concerns. Viruses, worms, and "hackers" that plague the technologically connected world also put e-commerce investments at risk. Businesses must develop information security practices to protect their e-commerce investment.

Information and business intelligence privacy are major concerns. Most businesses design firewalls into e-commerce systems to protect confidential information, but there must be breaks to allow customer, employee, and supplier access, allowing "hackers" an opportunity to access or corrupt confidential information. Business and customer information should be encrypted to precluded information compromise.

Security issues should be taken seriously but are not insurmountable. Businesses should complete a risk analysis of developing an e-commerce capability in addition to programming security costs into the initial capital budgeting process. Another consideration is the development of back-up and data recovery systems. The result should be technology and e-commerce decisions that enhance a business's shareholder value, considering all risk factors.

Organizations That Can Help

Professional organizations are currently at the forefront of standardization and implementation of new-economy products. Colleges and universities offer courses or maintain centers dedicated to e-commerce:

- the American Institute of Certified Public Accountants (AICPA), with its publication *Journal of Accountancy;*
- the Association for Financial Professionals (AFP), with seminars on e-commerce cash management and technology integration and publications such as *Finance IT*, *CIO Enterprise*, and *AFP Pulse* (*www.afponline.org*);
- the Institute of Management Accountants (IMA), with its publications *Management Accounting Quarterly* and *Strategic Finance* (*www.imanet.org*);
- Vanderbilt University, with its electronic commerce research laboratory (eLab, *http://ecommerce.vanderbilt.edu*).

Concluding Comments

New-economy products and services are vital ingredients for economic growth. Much media focus is on the market capitalization of new-economy companies or the amount of goods and services produced. Market capitalization and gross domestic product considerations are important measures, but potentially the most important and overlooked economic benefit is the transformational value their products have on productivity of all businesses worldwide.

The world is moving online; the long-awaited productivity payoff is unfolding. Issues of implementation, cost, and security are serious, but the benefits to organizations and resultant economic growth are real. The dilemmas and benefits reflect a quote from Dickens: "It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness." ■

Roderic Hewlett, an associate professor of business administration at the University of Dubuque, is a graduate of MTSU's Doctor of Arts in Economics program.

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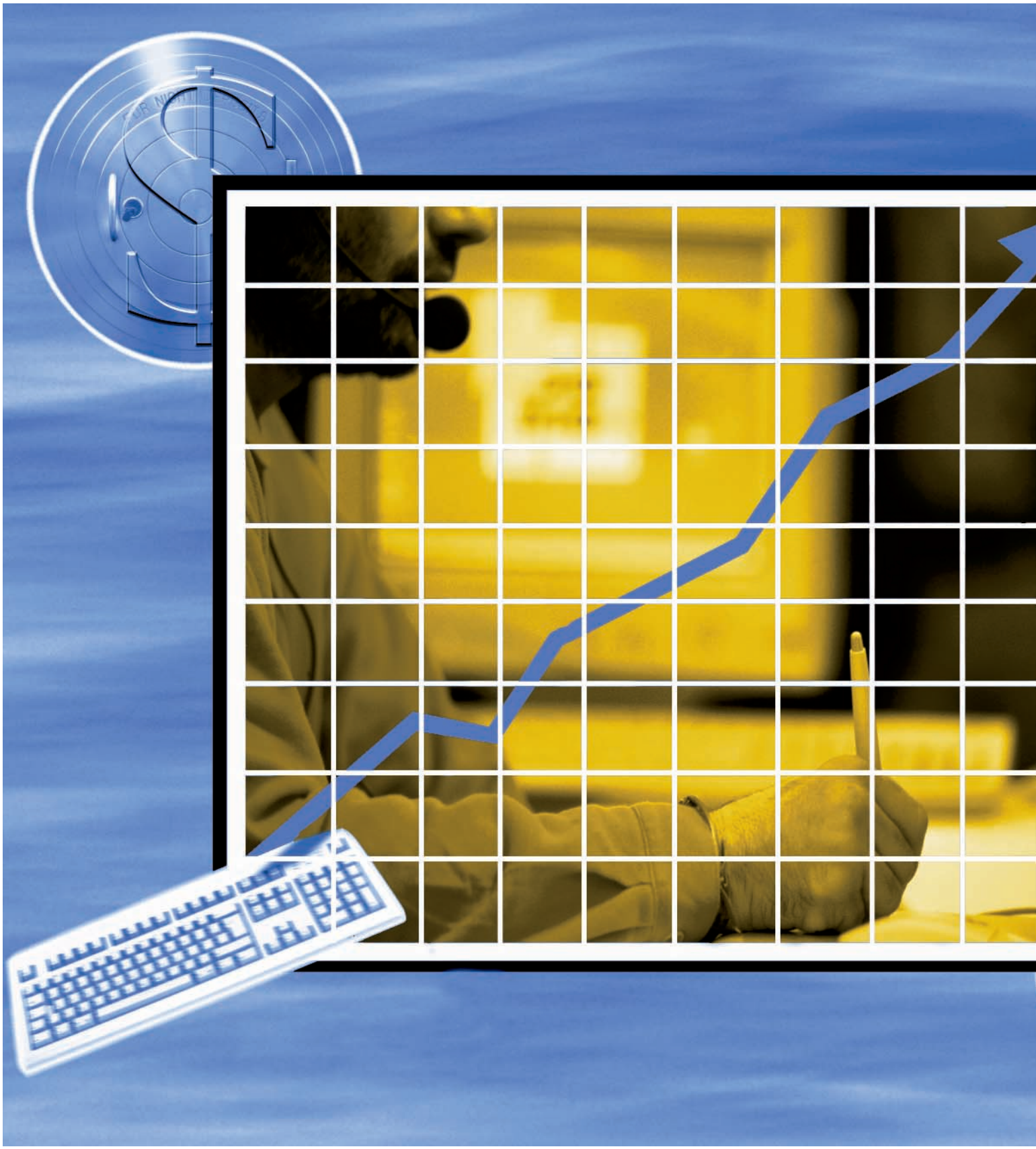
New Tools . . . New Rules



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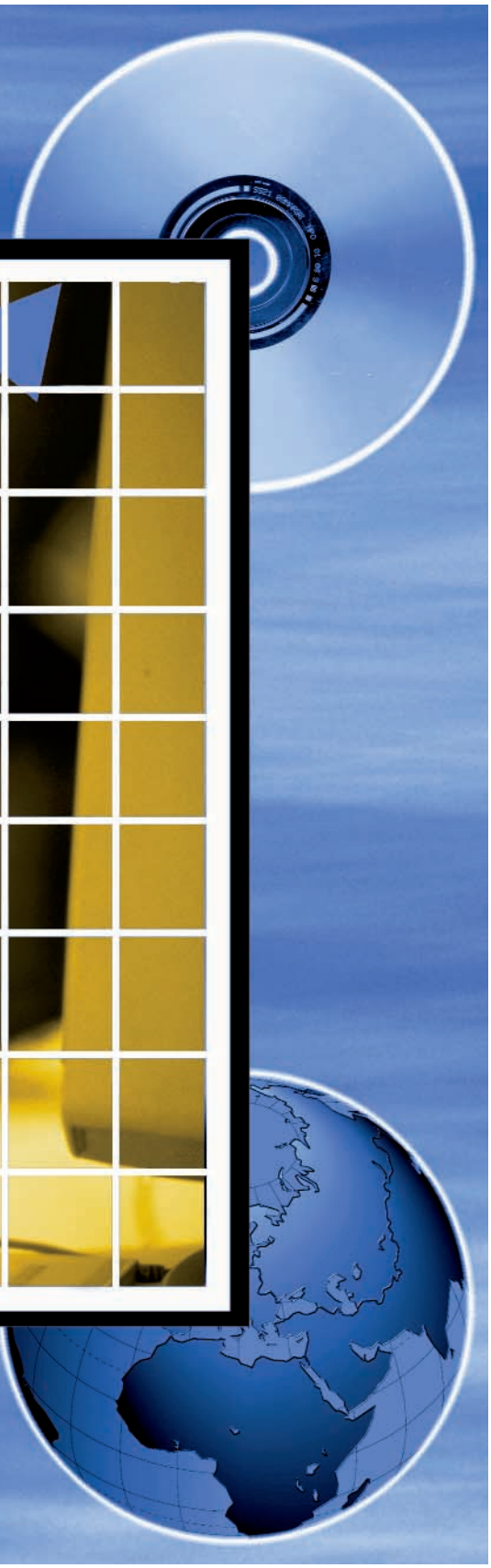


How the Internet Is Changing the Rules of Business in Tennessee and Beyond

by Glenn Perdue

In approximately 300 B.C., a revolution swept through China. This revolution—partially based on the application of a new technology—changed the face of warfare and shifted the balance of power throughout the region. What exactly was this revolutionary new technology? The stirrup.

Observing northern nomads traveling by horseback, King Wu-ling of Zhao took note of the riding tack used, particularly their stirrups. During this period, battlefield movement occurred either by foot or by chariot. Chariots had limited maneuverability and were ill suited to hostile terrain, while foot soldiers were slow and cumbersome. Wu envisioned mounted soldiers using stirrups to gain simultaneous advantages of speed, agility, and power. By applying this new technology, Wu realized more victories on the battlefield and gave birth to the cavalry.

Fast forward to 1454 A.D. The Catholic Church was selling papal "indulgences"—printed pardons of sins that guaranteed entry into heaven—as part of a multi-city fundraising drive. In the city of Mainz, Germany, a visiting papal officer solicited bids for the printing of these pardons. He was pleased by the low bid supplied by Johannes Gutenberg, but even more pleased with the quality and consistency of the final work.

Gutenberg had converted a winepress into a printing contraption able to do work much faster, better, and cheaper than that of manual transcribers—typically monks. In the process, Gutenberg's printing technology ignited a knowledge explosion by making information more easily replicable and thus more accessible to the masses.

Fast forward to 1965. While working with the Defense Department's Advanced Research Projects Agency (DARPA), Robert Taylor observed how groups of researchers used one of three different systems to communicate and share insights. He noticed how these groups seemed to evolve into research "communities" and how one group could often benefit from insights being developed by the other two.

Taylor realized that he could help his researchers by merging these disparate systems into a shared "super-network." He also realized that it would be easier and cheaper to maintain a single shared system. These insights led him to propose Arpanet, the precursor to today's Internet. Based upon shared standards of data communication and presentation, Taylor saw how an open network could lead to a more productive use of research time and computing resources.[1]

In these examples, several common themes exist:

- **New Rules**. Innovative applications of technology often lead to the development of new rules—whether on the battlefield, in the marketplace, or in the lab—that cause changes in human behavior and enable the creation and/or redistribution of economic wealth.
- **Productivity Goals**. Technology is typically developed with the goal of opti-

continued on page 8

continued from page 7

mizing the productivity of constrained resources such as land, labor, time, factory capacity, and shelf space. It is a fundamental drive to economize—to do more with less. Thus, our desire for things faster, better, and cheaper is not new; it is hardwired in the human psyche.

- **Killer Applications**. Initial applications of technology may differ greatly from "killer applications" that emerge down the road and almost always differ from what the originator had in mind. A case in point is the telephone. In the early stages of the its development, Alexander Graham Bell felt his new invention would be best used to transmit symphony orchestra music.
- **The Value of Connections**. Whenever new technology enables new or better connections between people, the prospect for creating new economic value exists. Again, these connections may occur on the battlefield, in the marketplace, or in the lab.

New Economic Rules

Traditional economic theory—and by extension much of business strategy—is based upon precepts such as resource scarcity that worked well in explaining the economics of our physical world during the agricultural and industrial eras. However, today we find ourselves questioning these traditional assumptions as we apply new technologies that lead to new economic conditions. For example, computer processing power, bandwidth, storage capacity, information, and ideas often grow over time to become more abundant, thus defying traditional notions of scarcity that underpin classical economics.

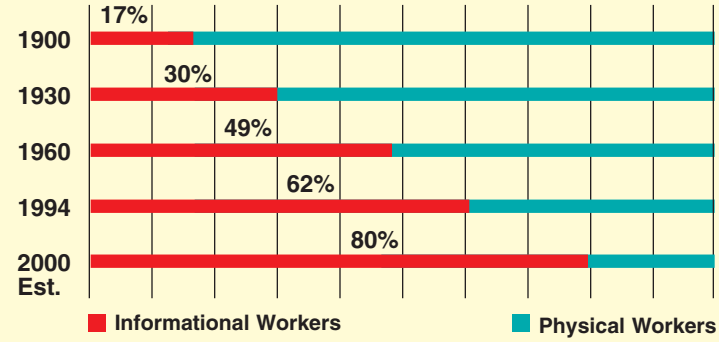
Similarly, Newtonian physics worked well in explaining gravity and other observable physical phenomena in our physical world. Then in the early 1900s, Max Planck and Albert Einstein showed us that, at the subatomic level, Newton's laws fell apart. Quantum theory caused us to reconsider rules of the universe we had held as sacred and immutable for over two centuries.

In both cases, new realities emerged as we went further and looked deeper through the application of new technologies.

In 1994, I began actively researching new economic conditions enabled by the Internet and other digital technologies in conjunction with client consulting work and as research for my current book project on technology strategy. The following is a top-10 list that summarizes these new economic conditions:

- *The rise of the informational worker;*
- *Reduced interaction costs;*
- *Reduced content distribution costs;*
- *Digital resource abundance (vs. physical resource scarcity);*
- *Network effects: the hidden value of connections;*
- *increasing returns (vs. diminishing returns);*
- *switching costs and lock-in;*
- *knowledge multiplier effects and time compression;*
- *unbundling the informational from the physical; and*
- *the new customer: empowered, but not necessarily enlightened.*

Figure 1. Inversion of the U.S. Workforce (1900-2000)



Source: U.S. Bureau of Labor Statistics, Bureau of Census, McKinsey and Company

I must note that entire books, including mine, are being written on these subjects. Despite the challenge of exploring these topics in an abbreviated manner, let's amplify a few of these observations a bit.

Underlying the new economic realities we now face is a shift from physical work during the agricultural and industrial eras to informational work in our current era (Figure 1). Digital technologies underpin this shift as a key enabler.

What is the nature of the information-based work that now makes up at least 80 percent of all labor activity in the United States? In general, this work is either interactive or non-interactive. Here "interaction" includes the searching, monitoring, and coordinating activities that people engage in when exchanging goods, services, and information. In contrast, non-interactive informational work includes data manipulation, analysis, and information synthesis activities conducted by individuals.[2]

Research by McKinsey and Company suggests interaction costs in the U.S. now consume about 51 percent of all labor costs, or about one-third of Gross Domestic Product (GDP). E-commerce sites that enable the purchase of anything from books to Beanie Babies to securities to automobiles provide evidence of online opportunities to reduce these costs. Indeed, online market forums reduce—and in some cases eliminate—the need for costly human interaction that may not add adequate value by today's standards. For example, equity trades costing about $200 through a traditional commissioned broker now cost as little as $8 online.

Beyond reducing interaction costs, Internet-based applications can also reduce the costs associated with managing and distributing content. Content includes things as unglamorous as phone listings, bank records, and product specifications as well as richer sources of information such as music, video, software, graphics, maps, and books that can exist in a digital form.

The rise of the Application Service Provider (ASP) model for "renting" software online is evidence of the opportunity to reduce costs related to interaction and content. Given the compelling economics associated with the delivery of application software as an online service, it is estimated that ASP spending will grow to $7.8 billion by 2004, a 92 percent compound annual growth rate from 1999 to 2004.[3]

Through the Internet, we are reducing costs and creating entirely new cost structures. At their core, these new economy cost structures are made possible through resource abundance.

Abundant informational resources lead to marginal costs that rapidly approach zero. Consider e-mail. If you pay $19.95 a month to send and receive e-mail—the pri-

mary reason most people use the Internet—the first message has an incremental cost of $19.95, but each additional message for the month is basically free. However, to get e-mail in the first place, you invested around $2,000 in a computer. These cost dynamics are pervasive online and provide opportunities to exploit information-based economies of scale.

Dismissed by many as a remnant of the industrial age, economies of scale are alive and well in the new economy. High up-front investments (e.g., the $2,000 computer) and fixed operating costs (e.g., the $19.95-a-month access fee) often dominate the outflows of cash in online businesses, whereas variable costs, a dominant part of industrial-age cost structures, are often nonexistent online. Given this, higher usage levels, which may have little or no incremental costs associated with them, enable more rapid absorption of static outlays. Therefore, as the number of online users, page views, or transactions increase, average total costs plummet.

Beyond opportunities to reduce costs and exploit information-based economies of scale, the Internet gives us an opportunity to provide value through new connections. Robert Taylor saw this opportunity as he observed his fellow researchers at work. Yes, one large super-network would be cheaper to maintain, but it could also lead to better scientific insights by enabling new connections between people—network effects.

Using Taylor's situation as an example (Figure 2), assume research team *A* has three people with three possible connections among them; *B* has four people with six connections; and *C* has five people with 10 connections. These three individual networks of 12 users have a sum total of 19 possible connections.

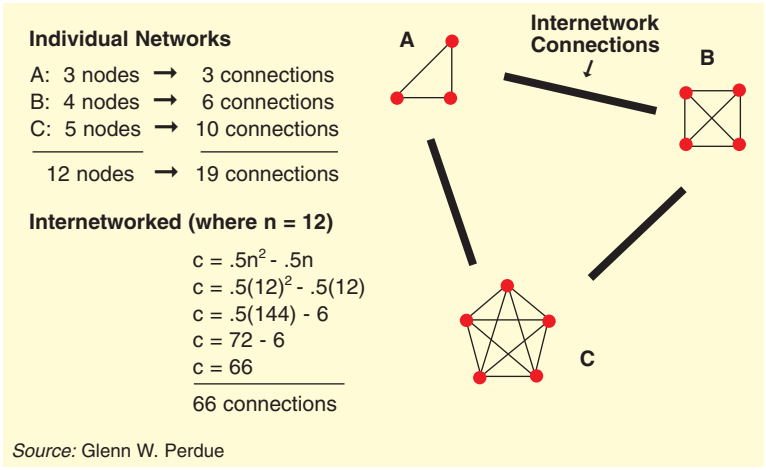
What happens when all of these researchers become interconnected as a part of Taylor's larger super-network? The number of possible connections between researchers skyrockets to 66!

Using a simple one-to-one network model, the number of possible connections (c) in a network can be expressed as a function of the number of nodes on the network (n) as follows: $c = .5n^2 - .5n$.

The real insight here is that the number of possible connections rises exponentially as users are added. This insight underscores the economic value that can be realized by creating new connections between buyers and sellers, collaborative work team members, and others in network-based environments over the Internet.[4]

We now see that as usage levels increase online, average total costs may decline while value increases. These cost and value-creation dynamics, coupled with the tendency for users to get "locked in" due to switching costs, set the stage for increasing returns. What exactly are increasing returns? That may be best answered by contrasting it to diminishing returns.

Figure 2. Network Effects Illustrated



Source: Glenn W. Perdue

In the 1760s French economist Robert Jacques Turgot codified early concepts of diminishing returns that were later refined by David Ricardo. Turgot's general observation was that as enterprises attempted to increase output, productivity, revenues, market share, or some other positive metric of success, they would encounter resistance from production system limitations, resource scarcity, and other market forces. These opposing forces would then cause gains from additional inputs to yield smaller and smaller returns, thus "diminishing returns."

In contrast to these earlier views of the world where market shares and profitability tended to gravitate toward a relatively predictable level, increasing returns dynamics enable those that get ahead now to get further ahead in the future. Increasing returns dynamics are based upon positive feedback loops that amplify earlier successes and offer the prospect of market dominance for extended periods of time.[5]

Another idea from classical economics is the notion of money multiplier effects. The concept here is that any single expenditure has a ripple effect within the economy as a dollar moves from one recipient downstream to another and another. The same happens with knowledge, giving rise to what Professor James Brian Quinn calls the knowledge multiplier effect.[6]

Without electronic communication, information moves at speeds dictated by physical constraints—about four miles per hour by foot, 40 miles per hour by boat, or 400 miles per hour by plane. Via the Internet, digital information moves at about 670 million miles per hour. Further, it is not constrained by the size of the last print run, as a physical document would be, since online information is infinitely sharable and replicable. These new rules allow us to compress time by instantaneously sharing information at little or no expense, thus accelerating knowledge multiplier effects.

Everywhere we look, we see the effects of time compression and knowledge multipliers. Information that previously trickled out to investors over periods of days or weeks is now compressed into periods of minutes and hours. A recent study by Paine-Webber indicates that the average daily price change for the Nasdaq index approached three percent for the first five months of 2000, whereas average daily price swings during 1995, 1996, and 1997 were all below one percent.

Of course, increased stock market volatility would probably not be considered a positive result of Internet adoption, but what about an improved car-buying experience? Pre-Internet, car shoppers would make the rounds at local dealerships, take some test drives, then finally surrender to the last salesman of the day as he excuses himself for a third time to "see what he can do" with his sales manager.

This less-than-enjoyable car buying experience resulted from high search costs, high transaction costs, and asymmetric information (the fact that only the salesman and the other guy in the back room knew what was really going on). As many are finding, the Internet can help.

continued on page 10

continued from page 9

In 1999, over half of all new-car purchases were researched online. The Internet has allowed consumers to "unbundle" most activities associated with buying a new car from the physical process. The result is that new-car markets have become more efficient, while the new-car buying experience has become more bearable for the consumer.

As a result of new online tools and new economic rules, new players such as Auto-By-Tel have emerged as important conduits between automobile buyers and sellers. Indeed, the ability to strip away informational activities from constrained physical processes is leading to the rise of new players, new business models, and entirely new industries that challenge old assumptions and threaten incumbents.

In all of this, a general trend has emerged: bargaining power is shifting from producers to consumers. Printing, television, the Internet—all of these communication media—have conferred more power to individuals by providing them with more information.

In considering the impact that the Internet has on buying activity, we must be careful not to confuse online transactions (as reported in e-commerce statistics) with the ability of the Internet to influence sales more broadly.

As stated earlier, the Internet influenced about half of new-car purchases in 1999, yet only about three percent of new cars were actually bought online. Figure 3 contrasts 1998 business-to-consumer (B2C) purchases in terms of purchase size and whether the online medium actually transacted the sale or simply enabled the buyer to research and/or order online. This report indicates that "influenced" sales ($66 billion) were six times greater than transacted sales ($11 billion).

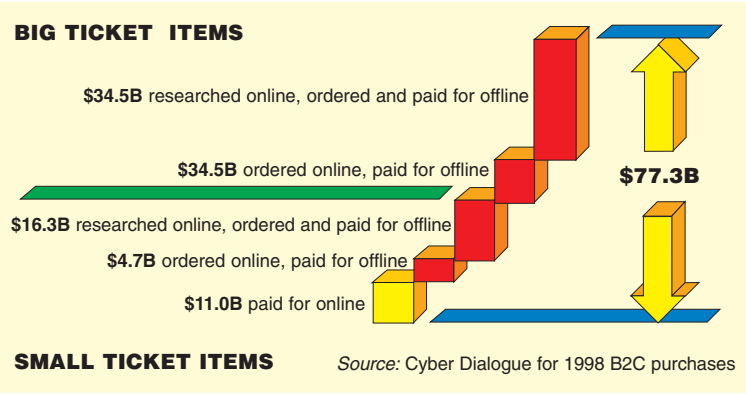
Online "influence leverage" varies from industry to industry and product to product. For instance, using the new-car sales values referenced earlier, we see that the Internet influences 16 times more car sales than it transacts, and of course, similar dynamics exist in the business-to-business (B2B) world.

The bottom line is that the Internet is allowing buyers to find a broader population of potential sellers and make more informed decisions based upon an abundance of online information. In the words of Vanderbilt University professor Rick Oliver, today's consumers are "informationally empowered"; but are they enlightened?

If technology makes communication with customers easier, and if customers are better informed, it would seem that business leaders should simply listen to the customer more. However, this is not necessarily the case.

Despite how the Internet may be taking us a step closer to that mythical state of "perfect information," new information is often not forward-looking. New-car shoppers want to know the market price of their desired vehicle today. Most consumers are focused on what they can touch, feel, and buy today, not what they might buy in the future.

Figure 3. Transacting vs. Influencing Sales Online



Source: Cyber Dialogue for 1998 B2C purchases

Therefore, companies that blindly listen to the customer may be led astray. Customers typically lack the vision and perspective to look ahead.[7] Innovative businesses must show customers the path forward.

In considering the difficulty consumers have in reframing their current needs in the context of future offerings, we are reminded of the minivan and the fact that no "soccer mom" ever called an automobile manufacturer to ask for a minivan before the first one was produced. In fact, GM and Ford passed on the minivan initially due to a lack of market research justifying it, but Chrysler embraced the minivan and won big.

Yes, the new consumer has more information and commands a stronger voice in the market but is not omnipotent and typically cannot envision what new technologies are capable of providing. The new consumer is certainly more empowered but is still not fully enlightened.

The Internet will affect all industries, some more than others. My research suggests that the biggest changes will occur in industries that are content-rich, interaction-intensive, or both. Therefore, the stage is set for big changes in financial services, healthcare, education, entertainment, government, and even the world of non-profit organizations.

Some Tennessee Examples

We are experiencing the unfolding of this new economic landscape with the rise of companies like IPIX, empactHealth.com, and Buckman Labs. These companies are exploiting the new economic rules of abundance, reduced interaction costs, and time compression, among others, to build successful new economy businesses in Tennessee.

- **IPIX** (*http://www.ipix.com*)—With the tagline "visual content solutions for the Internet," it's hard to imagine that the core IPIX technology—an electronic fish-eye lens that gives users a full 180-degree perspective—was originally developed as a means of providing machine operators with a safe way to view hazardous materials being handled by remote devices at the Oak Ridge National Laboratory. IPIX technology now allows shoppers to take virtual tours online and is credited with enabling the largest recorded e-commerce transaction to date—the $40 million sale of a Gulfstream aircraft in December 1999. IPIX had one of the most successful public offerings by a Tennessee company and is the biggest technology transfer success story ever originating from Oak Ridge.
- **empactHealth.com** (*http://www.empactHealth.com*)—With Hospital Corporation of America as its first client and lead investor, Nashville-based empactHealth is poised to dramatically improve the efficiency of the health care supply chain. According to empactHealth, U.S. health care organizations spend $83 billion annually on supplies and equipment. About 30 per-

cent of this amount ($23 billion) is consumed in requisitioning, ordering, invoicing, tracking, and inventory management—wasteful interaction costs that empactHealth will reduce as an online trading hub for hospitals, clinics, and doctors' offices.

- **Buckman Labs** (*http://www.buckman.com*)—Buckman Labs is a Memphis-based industrial chemical company with over 1,300 associates scattered throughout 90 countries worldwide. Central to its value proposition is the ability to quickly develop new chemical compounds for ever-changing client needs. Buckman thrives on product innovation that results from shared knowledge. Says chairman Bob Buckman, "Information only has value when it's moving."

  Like 3M Corporation, Buckman measures its success in product innovation and knowledge sharing as a function of new product sales. From 1987 to 1991, new product sales as a percentage of total sales were 15-25 percent. Since 1993, new product sales have consistently approached 35 percent with some operating units as high as 60 percent.[8] Bob Buckman credits investments the company has made since the 1980s in online knowledge bases, discussion forums, laptops, and distance learning with its current successes but is quick to point out that the real focus of these investments is people, not technology.

  Buckman Labs was presented with the 2000 MAKE award as the "most admired knowledge enterprise" worldwide in a field of contenders that included General Electric, Hewlett-Packard, Nokia, World Bank, Arthur Andersen, and Microsoft.

The New Economy in Context

Through the Internet, we have turned information technology outward toward customers and markets. The rise of these market- and customer-facing applications has created sea change in a world where information technology was traditionally pointed inward, toward production activities and back-office administration.

The Internet is causing us to reconsider accounting rules, market structures, distribution systems, management practices, organizational designs, and, more fundamentally, the very concepts of *time* and *place* in business. However, just as the discoveries of Planck and Einstein did not cause us to simply throw away Newton's rules, the new economic rules discussed herein do not render industrial-age rules obsolete. Newton's apple still falls from the tree, and physical resources are still scarce.

The biggest changes will occur in industries that are content-rich, interaction-intensive, or both. Therefore, the stage is set for big changes in financial services, health care, education, entertainment, government, and even the world of non-profit organizations.

The German philosopher Friedrich Hegel may offer the most helpful insight into this age-old struggle between conflicting perspectives with his *Dialectic*. The general idea is that any established concept (e.g., Newtonian physics or classical economics) forms the basis of an initial "thesis." Inevitably an "antithesis" made up of opposing views (e.g., quantum physics or information-age economics) emerges to challenge traditionally held beliefs. However, in the end, a new and better perspective typically emerges from this struggle to provide a new "synthesis" that is truer and more enduring.

Today we are developing a new synthesis that better explains new economic conditions and new views of business strategy. Consider the following quote from economist W. Brian Arthur of the Santa Fe Institute regarding the existence of increasing returns dynamics in the new economy:

> *Glimpsing some of these properties in 1939, English economist John Hicks warned that admitting increasing returns would lead to "the wreckage of the greater part of economic theory." But Hicks had it wrong: the theory of increasing returns does not destroy the standard theory—it complements it.*

It's safe for us to assume that Newton's rules and the economics of our physical world will remain relevant for years to come. Therefore, the new economy will not live in isolation; it will co-exist with the old.

We began with a brief discussion of King Wu and the stirrup. As a result of his insight about the stirrup and its application in battle, King Wu changed the rules of warfare in his age, but his new cavalry did not replace the infantry. Instead, he combined them to create a new and more powerful fighting force. They, too, co-existed. ■

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[1] *Scientific American* (April, 2000), "Inventor of the Internet," p. 48.

[2] *The McKinsey Quarterly* (1997, Volume 1), "A Revolution in Interaction" by Patrick Butler et al.

[3] International Data Corporation (IDC) and the Information Technology Association of America (ITAA).

[4] For an in-depth analysis of network effects, reference any of several publications by U.C. Berkeley professor Hal Varian.

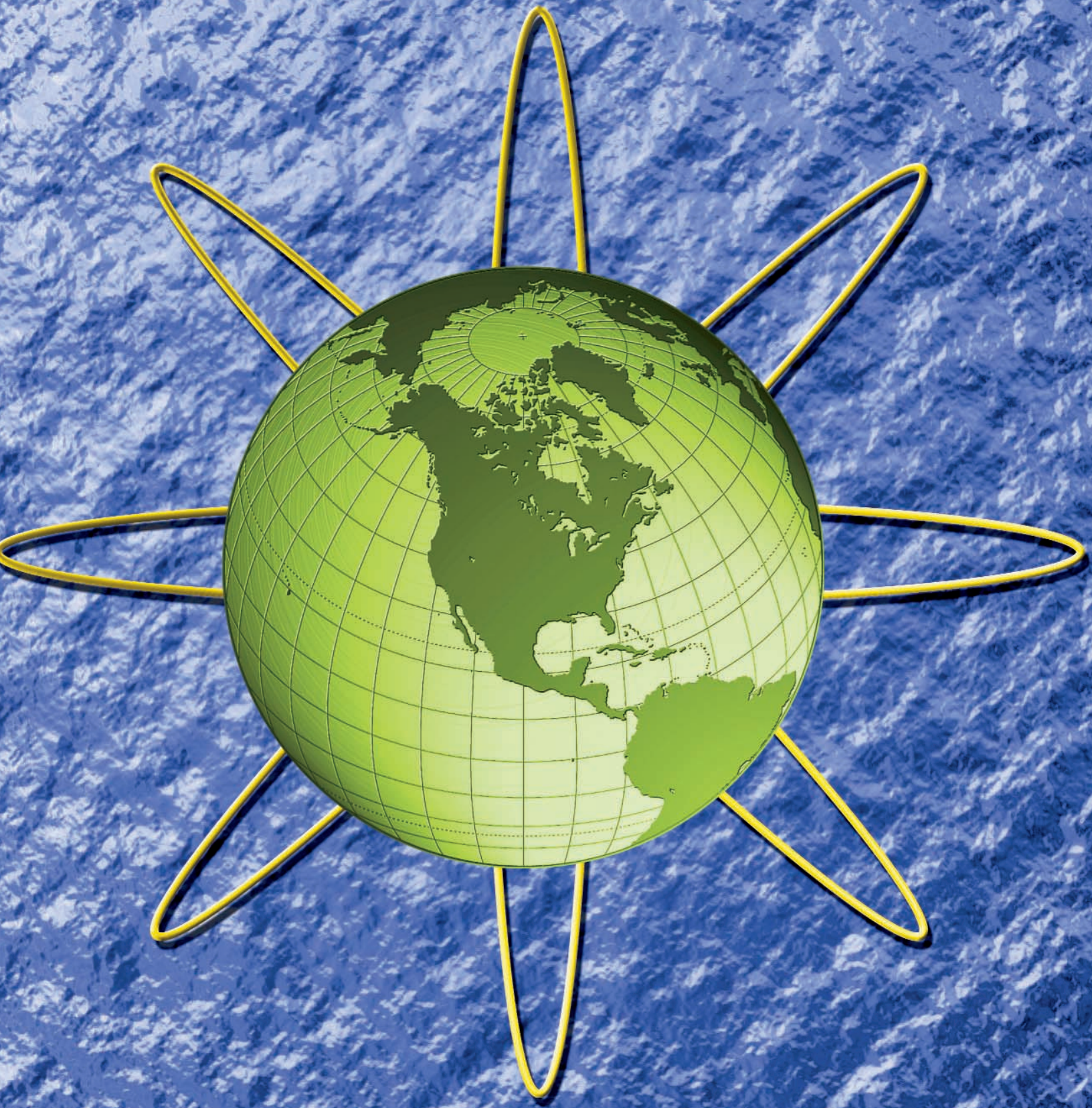
[5] *Harvard Business Review* (July-August, 1996), "Increasing Returns and the New World of Business" by W. Brian Arthur. (Other work by Professor Arthur addresses the issues of technological standards, switching costs, customer lock-in, and path dependency in the new economy.)

[6] *Innovation Explosion: Using Intellect and Software to Revolutionize Growth Strategies*. Free Press © 1997, by James Brian Quinn et al.

[7] For a fuller discussion on the risks of "listening to the customer" in times of rapid technological change, see *The Innovators Dilemma: When New Technologies Cause Great Firms to Fail* (Harvard Business School Press © 1997), by Clayton M. Christensen.

[8] Company data and personal discussions with Chairman Bob Buckman in Memphis, Tennessee, on June 8, 2000.

Bio-Economics



The Industrial Age substituted energy for muscle power, and the Information Age networked the world. The Bioterials Age will customize organic and inorganic materials and processes to virtually all human needs....

by Richard W. Oliver

Although economics is often called the dismal science, nothing could be more exciting than the economics of the next century. Biotech and new materials technologies (what I call "bioterials") have the potential to create a whole new set of commercial dynamics in medicine and agriculture. They will also touch off a new industrial renaissance that will increase the functionality and decrease the cost of virtually all manufactured goods. Bioterials will completely alter the nature of human interaction with the environment and will end diseases that afflict humans, plants, and animals. These new technologies will feed and clothe a population that Malthus could never have dreamed possible.

The economics of the last century were driven first by the mechanical might of the Industrial Age and then by the electronic expansion of the Information Age. In the next 15 years, bioterials will be recognized as more important than the Internet or, in fact, the entire information revolution.

The Industrial Age

A broad view of economic development of the industrialized world reveals two waves of technologically driven economic change in the 20th century. The first was characterized by the employment of energy or power sources as a substitute for human muscle power. The use of steam, gasoline, and eventually electrical power enabled an assembly-line production technology that exploited the benefits of task specialization.

The real gains reaped from a new energy source, however, were organizational. Electricity, for example, required companies to rethink their entire business process, redesign machinery and equipment, modify labor skills, and move people out of the factory and into the office. Because such transformations were gradual (and internal to organizations) they tended to be less visible than outward manifestations. Two fundamental and in some sense opposing principles underlie the economics of industrial technologies: increasing returns to scale and decreasing returns to scope.

Increasing returns to scale. The most basic economic law of industrial technologies, this principle holds that expanding the size of productive capacity lowers unit costs of production by enabling the cost advantages of assembly-line production. Although it is conventional wisdom today, its "discovery" early in the Industrial Age fueled much of the centralizing actions of businesses and governments. Similarly, the larger the political unit, the lower the costs and the greater the benefits. Both proved to be true, subject to the second law of the era.

Two fundamental and in some sense opposing principles underlie the economics of industrial technologies: increasing returns to scale and decreasing returns to scope.

Decreasing returns to scope. This law holds that for any manufacturing technique the productive capacity created by widening its scope and adding more labor and/or capital inputs will eventually diminish and ultimately cease to be cost effective. This occurs for one of two reasons: the management cost of coordinating production becomes prohibitive, or the unit costs of raw materials begin to increase to the point where they are not justified by their profit-making potential.

The Information Age

The invention of the transistor at Bell Labs in 1947 revolutionized all communication devices—radio, TV, the "wireline" telephone system, and the main frame computer. It was the inflection point of the Information Age, which had been lying dormant since the invention of the telegraph and the telephone in the late 1800s. It also led to the creation of many new devices—cell phone, CD player, VCR, PC, palm-sized electronic organizer. Most important, it created networks that allowed not just the high-speed, *stand-alone* information power of these devices, but the cheap, instant, and *interactive* communication between these devices and their users.

The transistor and its successor technologies in microprocessors touched off the rapid expansion of telecommunications and data networks that enabled the great economic transformation that continues today. Rapid declines in the cost of collecting, processing, and distributing information allowed companies to improve production processes, lower management costs, and increase responsiveness to changes in demand for their products. *The Economist* recently labeled the impact (primarily the decreasing costs) of such networking power as "the death of distance." It could easily have added "the death of time," as these networks made information exchange in the world instant as well as cheap.

Exploiting the full power of rapid information processing took several decades. It was only when computer technology began to change manufacturing processes in the late 1970s that the new laws of networking took hold. Computers began to facilitate communication across functions within and between firms. With marketers, engineers, and manufacturing managers from many related firms working together more closely on a real-time basis, production and distribution could be adjusted to better meet the needs of customers.

In individual factories, advanced manufacturing techniques allowed "mass customization"—the production of individually customized goods at the cost of mass-produced goods. The most vivid example was in the auto industry, which pioneered

continued on page 14

continued from page 13

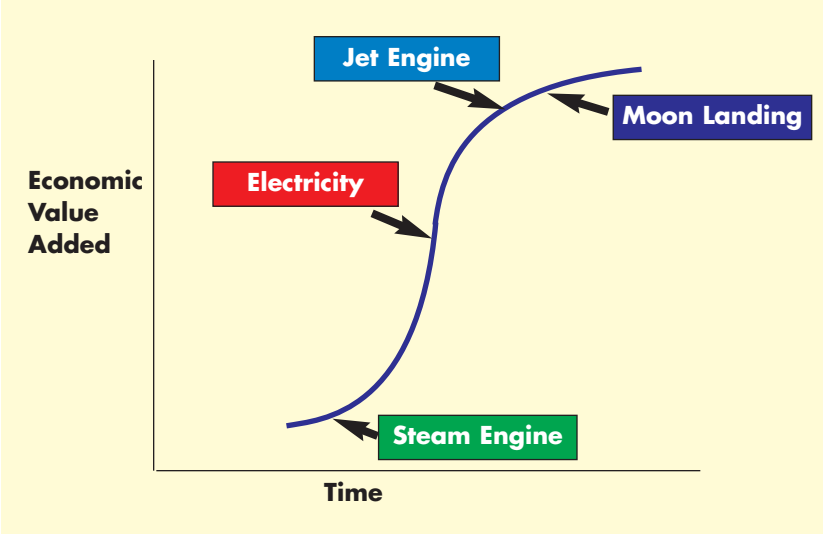
the use of such technologies to reduce product development times, increase the quality and variety of models, and reduce costs.

More recently, companies have been taking advantage of the Internet to keep in closer contact with suppliers and customers, resulting in better inventory management and the ability to customize mass-produced products for particular market groups. The effects of such improvements are beginning to manifest themselves in increased productivity. Like the Industrial Age, the economics of the networked economy are driven by two fundamental laws, but this time they work in concert: information's continuously decreasing cost and its increasing value when shared in a network.

The economics of the networked economy are driven by two fundamental laws working in concert: information's continuously decreasing cost and its increasing value when shared in a network.

Continuous declines in information costs. Since at least the 1960s, the raw cost of computer processing power has declined by roughly 50 percent every 18 months. This phenomenon is known as Moore's Law in honor of Gordon Moore, the Intel co-founder who first observed it. Even at the end of the century, nearly 50 years after the invention of the transistor, the cost decreases and the functionality increases of information technology show no sign of abating.

Chart 3.1 Strategic Inflection Points of the Industrial Age



Increasing returns to network participants. The increased interconnection of computer networks and integration with traditional telecommunications networks has increased the value of being connected. Put simply, the benefits resulting from being attached to a network increase proportionately faster as the number of network users grows. In fact, each new addition to a network geometrically increases the value to all current participants. In the Information Age, therefore, the returns to scope increase—the opposite of what occurred in the Industrial Age.

Nowhere is the impact of this law more evident than in the explosion of users—both buyers and sellers—on the Internet. The maturing of information devices (their greatly reduced price and wide availability) and creation of the World Wide Web by the mid 1990s spurred the rapid migration of commercial enterprises and users to the Web. Its full economic potential—for consumer and business-to-business commerce—is only now being realized, and its economic benefits are growing proportionately.

The Bioterials Age

The economics of bioterials are poised to dwarf the euphoria about electronic commerce. Now the discovery of recombinant DNA, cloning, and the restructuring of the subatomic architectures of many materials promises to feed, clothe, and shelter about 10 billion people by 2050. Although the nature of work in the Bioterials Age seems somewhat unclear (will we all work in labs?), the underlying laws of bioterials that will govern the world of work are already becoming very clear.

Bioterials: endless replication—the new economic paradigm. Biotechnologies display all of the characteristics of innovations capable of revolutionizing the structure and organization of diverse sectors of the economy in the next century. In a 1989 report, the Organization for Economic Cooperation and Development (OECD) identified four essential characteristics of a new technological and economic paradigm: an entirely new range of products accompanied by an improvement in many products and processes; a reduction in the cost of many products and services; social, political, and environmental acceptability; and pervasive effects throughout the economic system. Without question, bioterials more than qualify as a new economic paradigm.

To appreciate this potential, it's important to understand the history of biotechnology. The modern biotechnology industry was born a quarter century ago when scientists successfully spliced DNA from two distinct organisms to form a new one. DNA's ability to replicate or recombine itself is at the heart of this technology. "Recombinant" DNA was revolutionary in the sense that humans were now capable of altering matter at a cellular level to suit their needs. Capable of endless replications, cells could be viewed as factories whose outputs could be controlled by human modification of their inputs—the DNA that determines their characteristics.

The widest commercial application of recombinant DNA has thus far been in the pharmaceutical sector. There the focus is on discovering and developing methods to prevent, diagnose, treat, and cure dozens of life-threatening and serious diseases and conditions for which satisfactory medical therapies or preventive agents currently do not exist. Genetic modification has the potential of turning the traditional medical paradigm on its head. Instead of waiting for something to go wrong and then trying to fix it, we are already beginning to gain the capacity to detect problems before they

begin. Biotechnologies are mainly proactive, aiming to take corrective action at the cellular level before problems occur, thus reducing the financial, physical, and emotional cost of staying healthy.

A second sector that has already reaped many benefits from biotechnology is agriculture. The traditional agricultural production model starts with seeds and fertilizer, adds considerable quantities of fungicides for weed control and pesticides (which in some cases can have their own adverse effects) for insect control, resulting in a crop. Combining the superior aspects of particular varieties (crossbreeding) with better fertilizers has succeeded to some extent in reducing crops lost to pests and increasing yields. Unfortunately, it is a very slow process.

It takes many generations to appreciably increase pest resistance, and even the best fertilizers fall victim to decreasing returns when used too heavily. Increasing the amounts of fertilizer eventually results in steadily decreasing crop yields. Thus, the traditional approach of improving plants and animals over several generations (mimicking what nature has been doing throughout time) has proven valuable but slow. Furthermore, adding artificial stimulants such as fertilizers and problem inhibitors such as pesticides and fungicides has allowed only incremental improvements in agriculture.

Biotechnology, on the other hand, allows agricultural production to literally leap ahead of the incremental improvements of chemical applications and slow crossbreeding improvements. By modifying the cellular structure of seeds themselves, biotechnology can accomplish in one generation the improvements that once took a dozen. It reduces generational improvements to a single growing season while simultaneously increasing the quality, quantity, and geographic scope of production. Much the same can be said of the improvements in agricultural animals.

Most of the early commercial activity in biotechnology (as much as 90 percent) and new materials science is focused in health care and agriculture. Therefore, it is tempting to conclude that the economic effects of bioterials, although profound, will be very limited in scope since these two sectors account for only about 15 percent of total economic activity. Such a conclusion ignores the potential impact of bioterials in industrial production. Early observers of electricity and computers erroneously predicted a limited impact. Likewise, it would be easy to limit our understanding of the capacity of bioterials to modification of organic materials at a cellular and atomic level solely for the benefit of agriculture and health care.

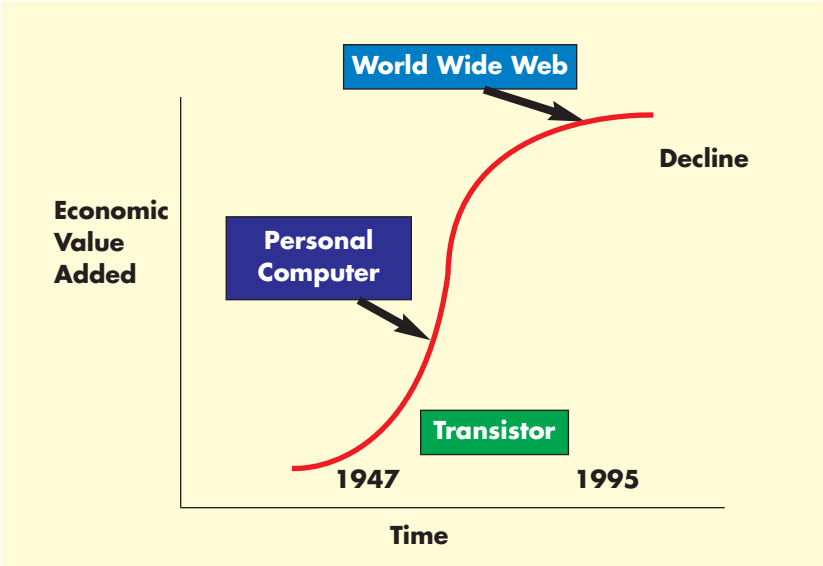
The ability to modify matter at its most basic level has the potential to reshape the way we think about production in terms of both the cost of raw materials and the actual production process. Although efforts to lower production process costs have been going on for years, firms have less control over the costs of raw materials. The economic gains that have occurred have been in the area of better coordination and more efficient use of these materials.

Now, however, the scientific advances in bioterials technologies promise to change the very nature of the raw materials used in manufacturing and even provide sources of energy. For instance, pulp and paper manufacturers depend heavily on wood, the availability of which is determined by the amount of forested land (which is decreasing) and the growth rate of trees (a once unchangeable biological process). Recombinant DNA opens the possibility of greatly speeding up the rate at which trees grow and perhaps increasing the quality and durability of the wood they yield. Clearly this would fundamentally alter the rules of production in any industry for which wood products—including paper, furniture, and housing—were an important part. In some cases as well, the new materials may even manufacture themselves into finished products.

The timber industry is but one example among thousands of potential ways in which basic control over raw materials can alter the production function to lower costs and improve quality. In addition to the input side, virtually unlimited potential exists with respect to environmental remediation of toxic by-products. The action of genetically modified bacterial agents actually transforms waste into harmless (in some cases commercially useful) materials. Scientists have only begun to scratch the surface of cellular modification. It has been estimated that less than one percent of *single-cell* organisms have been genetically documented, to say nothing of multi-cellular organisms.

The ability to modify matter at its most basic level has the potential to reshape the way we think about production in terms of both the cost of raw materials and the actual production process.

Chart 3.2 Strategic Inflection Points of the Information Age



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continued from page 15

The Atom and the Gene

The words *atom* and *gene* suggest the vast potential of this new economic era. Both words connote tremendous power. Earlier in the 20th century the word *atom* conjured up a positive, exciting world in the popular imagination; later in the century it has taken on some negative connotations associated with bombs and the perceived perils of nuclear power. In the new century it will again be thought of in a more positive way. Although the word *atom* has been with us in popular speech for some time, the word *gene* is relatively new. In the new economic era, these words are the equivalent of the computer chip in technology terms but with many thousands of times the importance.

The word *gene* is from Greek and Latin and is used in a number of forms to convey many ideas such as creation, beginning, or origin, as in *Genesis*; pervasive, leader, or all encompassing, as in *general*; basic or root as in *generic*; rapid multiplication, as in *generator*; and succession, as in *generation*. The Romans and Greeks also applied the term to things feminine as the giver of life.

Despite its rather ancient heritage, the word itself is a product of the early 20th century. The use of the term *gene* was first suggested by the biologist William Johannsen, writing in the *American Naturalist* in 1911: "I have proposed the term 'gene' … to be used in the science of genetics … 'gene' is nothing but a very applicable little word easily combined with others." The gene contains the very motherload of economics for the next century. It wasn't until late in the century, after the Watson-Crick discovery of the structure of DNA in the early 1950s, that the word found its way into public discourse.

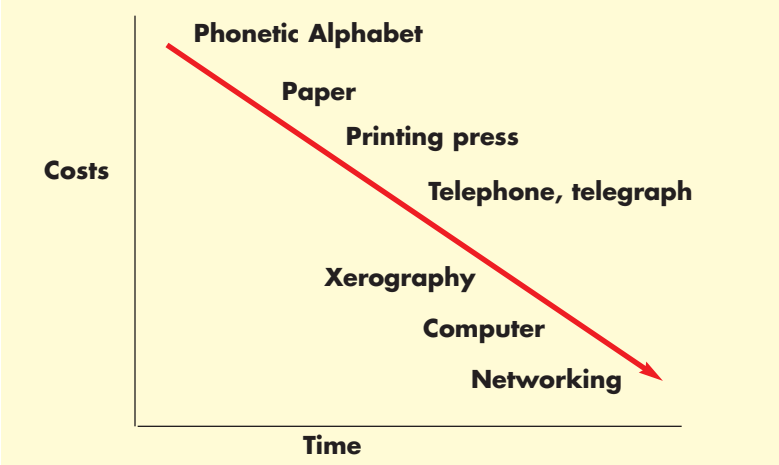
Even more fundamental than the gene is the atom. This word comes from Latin and Greek but was most widely popularized by the French. The ancients first used it to mean a "cut" from a strong stalk. The Greek philosopher Democritus (the philosopher from whom we get the term *democracy*) was a major proponent of the word, arguing that the atom was the smallest unit of measure and the basis upon which the universe was formed (thus the basis for a democratic society). Perhaps presaging the speed at which the new economic era would proceed, the term was also used to represent the smallest unit of time (with about 1,880 atoms in an hour).

In the 1600s the French adopted the term *atome* to mean something so infinitesimally small as to defy further division. Its first use in English was in the scientific literature of the late 1400s, but it didn't come into general public use until the early 1900s. Arthur Conan Doyle, in his popular *The Return of Sherlock Holmes*, had his famous character describing a crime scene clue in which "*the bust … had been smashed to atoms where it stood*."

Hidden in this vast repository of subatomic structures and genetic codes lies the capacity to customize organic and inorganic materials and processes to virtually all human needs. The challenge of the next several decades is to discover and exploit the secrets of the gene and atom for human advantage—in other words, to make every atom and cell a factory.

Hidden in this vast repository of subatomic structures and genetic codes lies the capacity to customize organic and inorganic materials and processes to virtually all human needs.

Chart 3.3 Decline in the Cost of Producing, Storing, Manipulating, and Transmitting Information



With such thinking, the enormous potential of the economic laws of bioterials comes into focus.

First law of bio-economics: The daily doubling of knowledge. The first law holds that knowledge in the bioterials industry, at the height of its power, will double every day. The storehouse of knowledge about bioterials has been increasing steadily since the mid 1970s and should reach a speed of doubling ever day early in the next century. Thus, the bioterials economic cycle will be short and almost vertical in trajectory compared to the longer and more horizontal growth rates of the industrial and information eras.

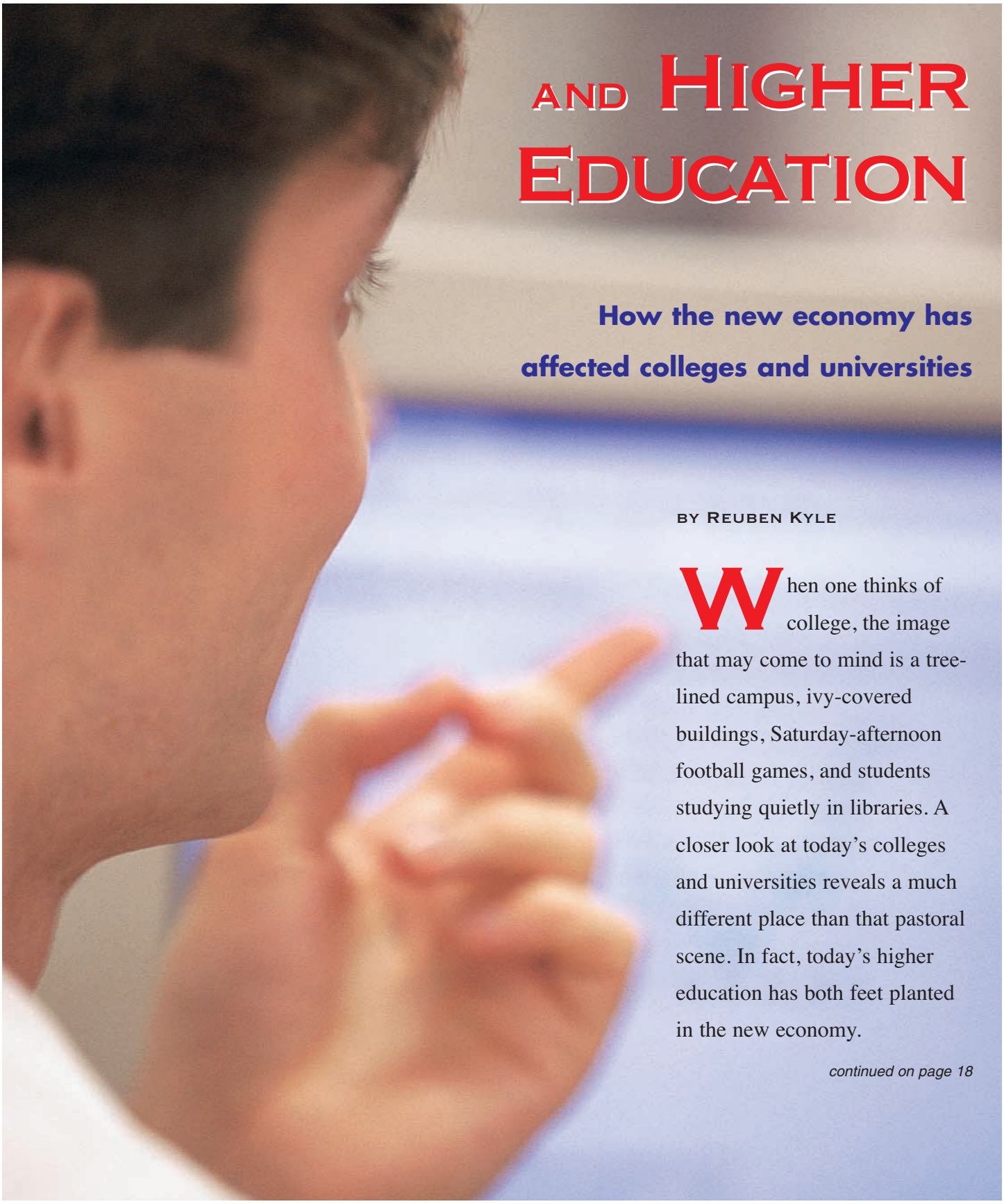
Second law of bio-economics: The global scope of bioterials is inversely proportional to its subatomic scale. The widespread diffusion of bioterials knowledge portends the greatest economic boom in history. While spillover benefits accrue in many mature economic sectors to some degree, the potential in bioterials is so large and diverse as to defy description.

Third law of bio-economics: accelerating vertical growth rate. This growth rate includes all aspects and crosses all boundaries of the economy—geographic, industrial, social, and cultural. In the Information Age everyone had to adjust to constant change. The rate of change in the Bioterials Age will be constantly accelerating.

It would be foolish so early in an economic cycle to claim that all the economic laws of the period are known. Nevertheless, certain economic imperatives are becoming clear and demonstrate that the Bioterials Age will prove to be not just a revolution of technologies, but of economics as well. ■

Richard W. Oliver is a professor of management at the Owen Graduate School of Management at Vanderbilt University. This article is an excerpt from his book, The Coming Biotech Age: The Business of Bio-Materials *(McGraw-Hill).*

The New Economy and Higher Education



How the new economy has affected colleges and universities

BY REUBEN KYLE

When one thinks of college, the image that may come to mind is a tree-lined campus, ivy-covered buildings, Saturday-afternoon football games, and students studying quietly in libraries. A closer look at today's colleges and universities reveals a much different place than that pastoral scene. In fact, today's higher education has both feet planted in the new economy.

continued on page 18

Delivery of distance-learning courses now takes many forms: mail correspondence, radio, television, videotape, two-way teleconferencing, compressed video, and the Internet.

continued from page 17

The Internet, one focal point of the new economy, was developed with funds from the federal government with the help of university researchers. Beginning in the late 1960s, the Advanced Research Projects Administration (ARPA), a division of the U.S. Department of Defense, developed the ARPAnet to link together universities and high-tech defense contractors. Still later, the telecommunications network that created the backbone of what is now the Internet was linked at university computer facilities. Since the 1980s that function has moved to private for-profit enterprise, but universities still form an important part of the interlinking of computer networks that makes up the Internet.

However, the purpose of this paper is not to provide a history lesson; it is to discuss the role of higher education to the new economy. The first issue examined is how the new economy has impacted the services that colleges and universities provide, both the types of services provided and the methods of delivery of those services. A second issue is how colleges and universities conduct their business. As a sector of the U.S. economy, higher education consists of about 3,600 firms (institutions of higher education) dispersed geographically and diverse in terms of their educational offerings. These "firms" enroll over 14 million student "customers" and have "sales" of more than $200 billion annually, about three times the sales of the computer manufacturing industry.[1]

The *New Economy Index* offers a definition of the new economy, appropriately: "a knowledge and idea-based economy where the keys to job creation and higher standards of living are innovative ideas and technology embedded in services and manufactured products" (*http://www.neweconomyindex.org/section1_intro.html*). Because its purpose is the creation and transfer of knowledge, higher education is essential to this new economy.

The Demand for Education in the New Economy

The economic incentives for pursuing post-secondary education are powerful. The latest figures indicate that those with a bachelor's degree earned almost 56 percent more than high school graduates and nearly 100 percent more than those with less than a high school diploma.[2] Not surprisingly, enrollments have responded to those earnings premiums. Despite a smaller number of high school graduates in the early 1990s, higher education enrollments increased by 13 percent between 1987 and 1997, which compares with a 10 percent increase in the U.S. population over the same period. This increase occurred because the percentage of all 18- to 24-year-olds, the traditional college age group, enrolled in post-secondary education increased from 26 percent in 1980 to 32 percent in 1990 and 36 percent in 1997.[3]

The growth in post-secondary enrollments has been across most disciplines. Surprisingly, the emphasis on technology associated with the new economy has not translated into a growth in enrollments in the sciences and engineering. As a share of total degrees awarded, engineering has remained constant over the past three decades, and degrees in the physical sciences and mathematics have declined. Even more surprising is the enrollment in computer and information sciences: after exploding in the early 1980s, it peaked in the mid '80s and declined through the 1990s. Over the past three decades, degrees awarded in business increased from about 13 percent of total degrees awarded in 1970-71 to almost 20 percent in 1995-96, but that, too, conceals a peak in the early 1990s with a decline through the middle of the decade. It seems that education—not just technical or business training—is important.[4]

Response to the Demand for New Programs

Having said that, there are many new curricula directed toward the demands of the new economy. Particularly at the graduate level, many new degree programs in information technology and electronic commerce have developed. For example, the American Assembly of Collegiate

Schools of Business (AACSB), the accrediting association of business programs, reports 13 North American graduate degree programs and 37 M.B.A. programs with e-commerce emphases (*http://www.aacsb.edu/e-business/index.html*). A search on the MBAinfo.com database, which details 2,200 M.B.A. programs from 1,150 universities, business schools, and management colleges in 126 countries worldwide, indicates worldwide there are 40 programs in e-commerce at 34 institutions (*http:// www.mbainfo.com/*).

Vanderbilt University's Owen Graduate School of Business was among the earliest M.B.A. programs in the country to offer an emphasis in electronic commerce (*http://mba.vanderbilt.edu/external/OwenTEC.pdf*). Today, half the school is pursuing the subject, and the program has grown to include a dozen professors, 19 courses, and a center devoted to e-research. According to *U.S. News and World Report,* Vanderbilt's e-commerce graduates are receiving starting salaries 50 percent higher than their classmates in other emphases. "I mean, this rocks!" marvels Professor Donna Hoffman, who created the program with her husband and colleague, Tom Novak.

The curricula of these programs differ widely across universities. Typically they include some combination of traditional M.B.A. foundation courses, technical computer courses, and courses devoted to topics in electronic commerce.

The University of Alabama's Culverhouse College of Commerce and Business Administration offers what it refers to as a techno-M.B.A., ranked fourth in the country by *ComputerWorld*. This innovative 24-month program begins with a technical boot camp and follows a lock-step curriculum in which students do an internship with a participating business (*http://cbaweb.cba.ua.edu/misweb/index.htm*).

Other universities, including MTSU, prefer to incorporate electronic commerce developments into the entire curriculum. MTSU offers master's degrees in information systems and computer science. This year MTSU is offering courses in computer information systems, management, and marketing for those interested in e-commerce.

The technology of the new economy has changed what happens in the classroom of even the old-style courses. Classroom technology has undergone a revolution. No longer confined to the chalk and blackboard, overhead projectors, and 16-mm movies of the past, classroom teachers have access to all the modern presentation tools available in the corporate boardroom: computers, VCRs, the Internet, and presentation viewers. Readers are invited to see this technology in use on the MTSU campus in almost every lecture hall but at its best in the new Business and Aerospace Building. For a sampling of the application of this new technology, the reader is directed to the Web sites of MTSU faculty members Dr. Duane Graddy, Economics and Finance (*http://www. mtsu.edu/~dgraddy/*), and Dr. Jack Purcell, Philosophy (*http://frank.mtsu.edu/~jpurcell/homepage.html*), for state-of-the-art examples.

No longer confined to the chalk and blackboard of the past, classroom teachers have access to all the modern presentation tools available in the corporate boardroom.

Delivery of Educational Services in the New Economy

As we have seen, universities are responding to the new economy by expanding enrollment, offering new programs, and taking advantage of new teaching and learning technologies. Perhaps most exciting is the impact of the environment on the ways in which universities deliver their services. The time is long past when students entered the academy and sequestered themselves, perhaps in some remote rural location, for four years while they studied. According to *The Wall Street Journal*, of 15 million U.S. college students, only one in six fits the traditional age cohort and attends for four consecutive years.[5] First, a high percentage of students work at least part-time while enrolled. The Bureau of Labor Statistics reports that, among persons 16 to 24 years old, over 50 percent of full-time students and more than 80 percent of part-time students are employed, and the National Center for Educational Statistics finds that 89 percent work at some time while enrolled.[6] In response to this phenomenon, colleges and universities have offered courses and degree programs in much more flexible formats than the old one-size-fits-all. Between 1998 and 1999, in a survey of 1028 two- and four-year institutions, the percentage offering online courses rose from 48 percent to 72 percent.

While there is nothing new about correspondence courses, new forms of "distance learning" are available.[7] A 1997-98 survey of post-secondary institutions indicated that one-third of two- and four-year institutions offered distance learning, which amounts to about 1,680 institutions, and an additional 990 institutions had plans to do so in the next three years.[8] Over 1.5 million students were enrolled in those courses. Delivery of these courses now takes many forms: the old printed media of mail correspondence courses, radio, television, VCRs, two-way teleconferencing, compressed video, and the Internet. There are many options, and students are electing to try them all.

Another approach to providing options to students is through off-campus course offerings. The MTSU Division of Continuing Studies and Public Service coordinates programs at 10 off-campus sites in middle Tennessee including junior- and senior-level undergraduate courses and graduate courses offered at community colleges, high schools, and business facilities. In the fall of 1999, 480 students took an average of slightly fewer than two courses each.

The extreme case of multiple sites is the University of Phoenix, a for-profit university that specializes in serving working adults (*http://www.uophx.edu/*). The university claims 85 campuses in 15 states and enrolls 68,000 students.

Representing an entirely new type of institution is Western Governors University. Founded by a group of governors of western states, this virtual university offers no courses of its own; rather, it coordinates access to the courses of more than 40 colleges, universities, and corporate institutions. Students earn degrees and certificates by demonstrating competence in specified areas of a program instead of

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earning credits by taking and passing courses. To prepare for the competency examination, students may take courses at the participating institutions via distance learning, either online or through correspondence. Could this institution be a new model for higher education? At the moment, the higher education community is evaluating the idea. The *Chronicle of Higher Education* reports that the Inter-Regional Accrediting Committee has postponed granting accreditation to the university pending further review (*http:// www.chronicle.com/free/2000/06/2000061201u.htm*). A participating member of the accrediting group says that the delay implies no criticism of Western Governors University, but that because of the university's unique concept, more information is desired.

Closer to home, the University of Tennessee Knoxville's (UTK's) College of Business offers a Physician's Executive M.B.A. program online (*http://www.pemba.utk.edu/*). The 12-month program, exclusively for physicians, requires four one-week, on-campus residence periods. The course work is primarily completed via the Internet. Similarly, Duke University's Fuqua School of Business offers a 19-month program called the Duke M.B.A.-Global Executive program. "Students spend a total of 11 weeks in residential classes at various program sites around the world, with the remainder of the program being delivered via interactive Internet-based technologies" (*http://www.fuqua.duke.edu/gemba.html*). Two years old, the program enrolls 80 students from all over the world.[9] Still, with a price tag of more than $85,000, this program is not for every student.

Here at MTSU in 1999, we offered correspondence courses, online courses, telecourses, and video-conferencing courses to over 800 students per semester. While that number represents only four percent of our enrollment, it is no longer simply an interesting experiment but a part of our regular program.[10]

Higher Education As a Player in the New Economy

So far we have discussed higher education as a player in the new economy through its preparation of the labor force, utilization of technology in the classroom, and delivery of academic services. Often overlooked is the fact that colleges and universities are large business enterprises with hundreds or thousands of "customers" visiting the facility every day, hundreds or thousands of faculty and staff, and a resident population actually living on campus. As a result, these enterprises must provide regular business services including administering the needs of those customers and employees, supporting the requirements of its service-producing activities, and dealing with many suppliers of necessary products and services. Here is another area in which colleges and universities are firmly involved in the new economy.

Students have access to a campus intranet and the World Wide Web via computer labs located across campus, even in the dorms and library.

Higher education institutions first become involved with their student-customers when they apply for admission. Today's colleges and universities typically provide for students' completion of the entire admission process online or via the telephone or fax machine. Every university Web site referenced in this article provides for online application. Prospective students can obtain information about the institution, its academic programs, its residence halls, and financial aid and make application for admission, residence, and aid from their own home electronically. In addition to rankings of colleges and universities in terms of the quality of their academic programs, now we find rankings of their connections with the new economy. See Yahoo: America's 100 Most Wired Colleges at *http://www.zdnet.com/yil/content/college/intro.html*.

Students have access to a campus intranet and the World Wide Web via computer labs located across the campus, even in the residence halls and library. Many campuses now expect students to use computers in their courses and as a means of communication with faculty and administration.

University libraries are also becoming wired. MTSU's library spends at least 18 percent of its total budget on electronic databases, online databases, and CDs. Books and paper documents won't disappear any time soon—never, I hope—but electronic media are now essential.

Not only admission procedures but also registration for classes can be accomplished using modern technology. In the past, registration for classes was often a painful process that involved standing in long lines, hoping to get desired courses, and starting over when those classes were not available. This is no longer the case. Students may register for classes on-line, as for example at the UTK site (*http://web.utk.edu/~sga/timetable/Fall_2000_Day/*); by telephone, as for example at MTSU's TRAM (Telephone Response at Middle) system *(http://www.mtsu.edu/infotech/tram.html*); or on campus at a computer-based scheduling center. Registration is not without its problems and frustrations, but they are nothing of the type suffered by past generations of students.

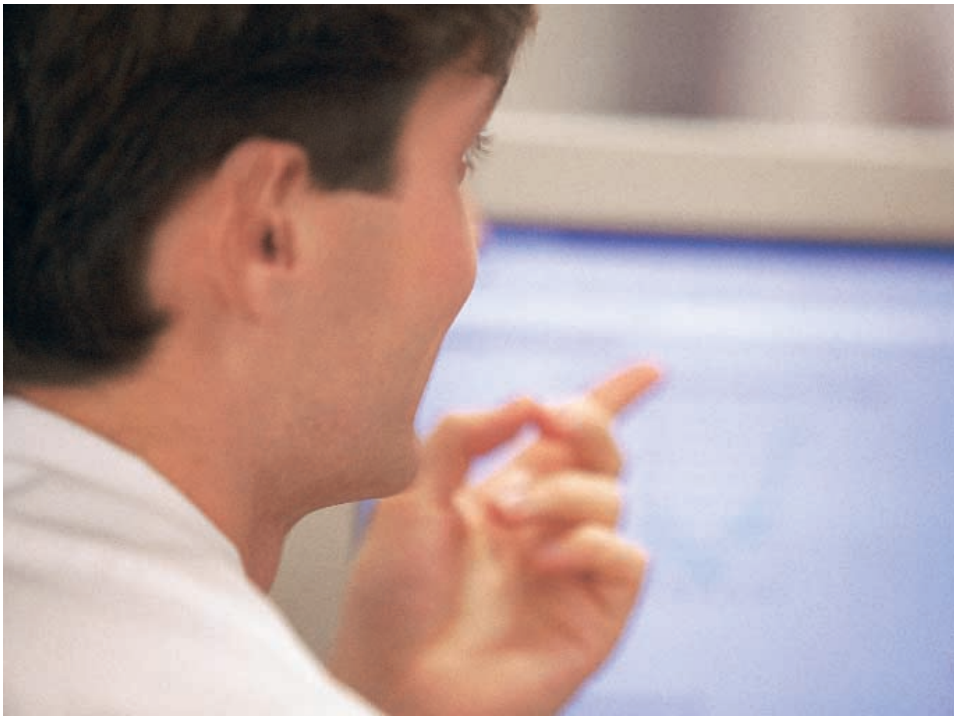
Students may also access their own academic records online to obtain information about their status, grades, and progress toward graduation. Finally, students may communicate with faculty members by e-mail. The excuse of not being able to catch faculty members in their offices is no longer valid. The tools of the new economy—e-mail and voicemail—make faculty members accessible to all at any time.

Other university administrative procedures, such as communication between administration and faculty and staff, are now accomplished through the campus intranet. Personnel records are accessible by university employees with protection of confidentiality. E-mail has replaced the written memo, and voicemail has replaced telephone message pads.

Finally, the university's business functions are now taking advantage of the technology of the new economy. For many years colleges and universities have managed their administrative, business, and personnel affairs on computers. Those functions have migrated with technological developments to computer-networked systems. Payrolls, personnel records, inventories, and capital resources are network-based systems.

Will Universities Disappear?

What about the future? In a symposium



The demand for knowledge is growing. Its delivery will certainly change, and the form of the institutions will respond to those changes.

on the future of the university, many prophets foresaw radical change for higher education. One prophet predicted that by 2025 traditional universities may be "a thing of the past…." The forces compelling this change include the information technology revolution, globalization, and economic factors. Venture capitalists are trying to lure even elite institutions into online education.[11] Academies date from the earliest recorded human history, universities appeared almost a millennium ago, the modern form of the research university developed in the late 19th century, and the huge expansion of public universities began only 50 years ago. Like other human institutions, higher education has evolved and adapted to new technologies, new environments, and an increasingly rapid pace.

The demand for knowledge—both the creation of that knowledge and its transfer—is growing. The delivery of that knowledge will certainly change, and the form of the institutions will, of necessity, respond to those changes. Still, there must be some institutional structure to facilitate the knowledge industry, and that will require some form of university, virtual or brick and mortar. In an article on the status of universities, the British news magazine *The Economist* concludes that "[t]he advent of cyberspace is less likely to destroy the university than to offer it novel ways of reaching out to more students at lower cost. And instead of dismantling the community of scholars, it may give it a new lease on life by creating new connections between academics working in adjacent disciplines but in unadjacent places."[12] ■

Reuben Kyle is an economics professor at MTSU.

Notes

[1] "Sales" refers to total spending on higher education. Clotfelter, C.T. "The Familiar But Curious Economics of Higher Education: Introduction to a Symposium." *Journal of Economic Perspectives*, Volume 13, Number 1 (Winter 1999), 13-36.

[2] National Center for Education Statistics, U.S. Department of Education, Digest of Education Statistics, 1998, Table 380, page 434.

[3] National Center for Education Statistics, U.S. Department of Education, Digest of Education Statistics, 1998, Table 186.

[4] National Center for Education Statistics, U.S. Department of Education, Digest of Education Statistics, 1998, Table 250.

[5] *U.S. News and World Report*, Mary Lord, "E-commerce is forcing schools to 'rethink the guts' of the M.B.A." (*http://www.usnews.com/usnews/edu/beyond/grad/gbecom.htm)*.

[6] Ann Grimes, "A Matter of Degree," *Wall Street Journal*, July 17, 2000, p. R29 (E-Commerce Special Supplement).

[7] "College Enrollment and Work Activity of 1999 High School Graduates," U.S. Department of Labor, Bureau of Labor Statistics, May 17, 2000; National Center for Educational Statistics, Findings from The Condition of Education 1997: Postsecondary Persistence and Attainment, July 1997 (*NCES 97-371) (http://nces.ed.gov/pubs97/97984.html*).

[8] Ed Neal, "Distance Learning: Prospects and Problems," *Phi Kappa Phi Journal National Forum*, Winter 1999, pp. 40-43.

[9] National Center for Educational Statistics, Distance Education at Postsecondary Education Institutions: 1997-98 (December 1999) *(http://nces.ed.gov/pubs2000/2000013.pdf)*.

[10] From *U.S. News and World Report*'s "America's Best Graduate Schools 2000," *http://www.usnews.com/usnews/edu/beyond/grad/gbemba.htm*, Fred Vogelstein, "The $85,800 distance degree, Duke's successful online executive M.B.A. program, could start a trend."

[11] MTSU Student Profiles, (Middle Tennessee State University, Institutional Research) Fall 1999, p. 15.

[12] "The University—Alternative Futures," *Futures*, Vol. 30, No. 7 (September 1998).

[13] Samuel L. Dunn, "The Virtualizing of Education," *The Futurist* (March-April 2000), pp. 34-38.

[14] Thomas E. Weber, "Allen is Wooing Elite Colleges to Teach Online," *Wall Street Journal,* July 28, 2000, p. B1.

[15] "Inside the Knowledge Factory," *The Economist*, October 4, 1997.

GOVERNMENT IN THE

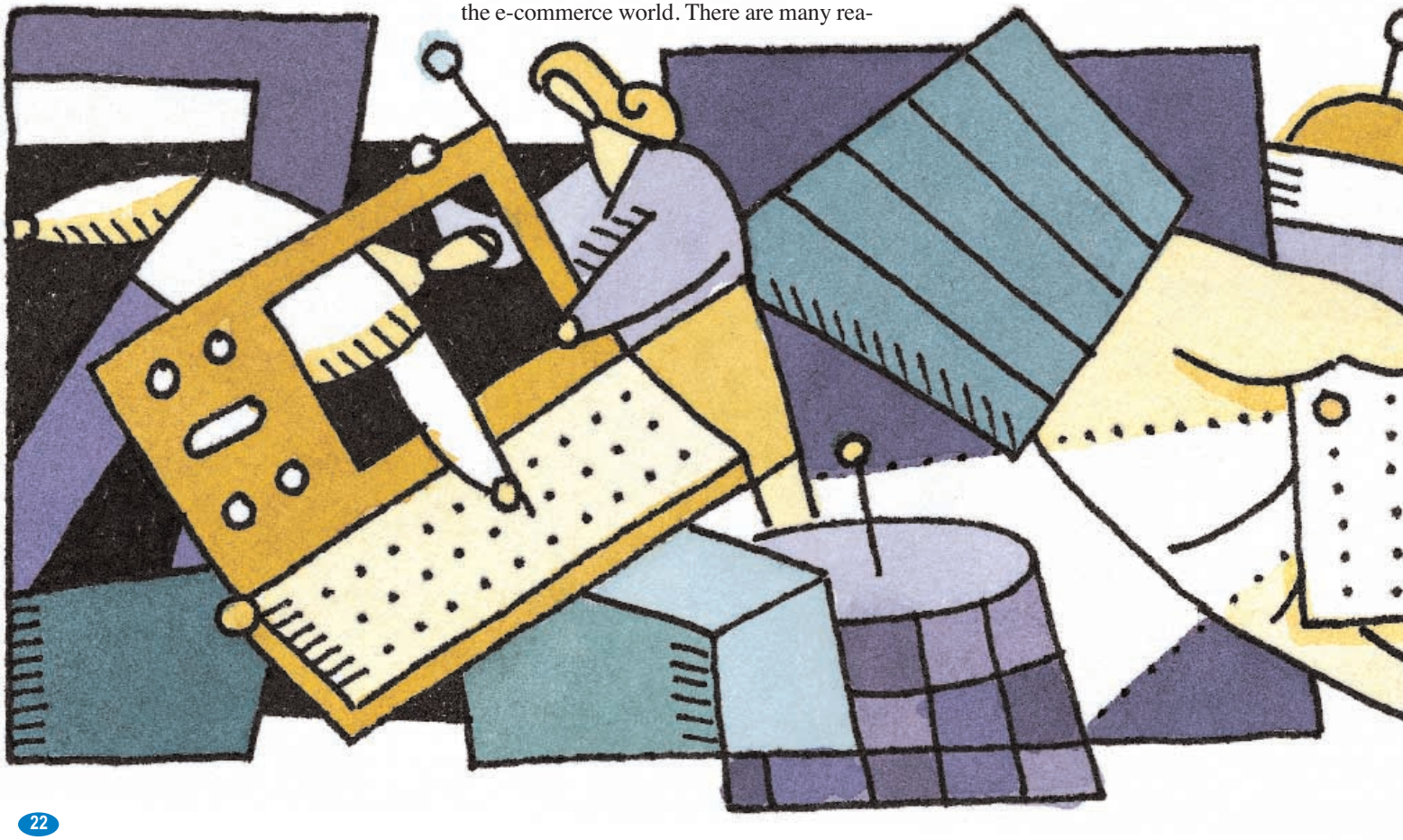
by Timothy H. Greer
and Mirza Murtaza

Participation in e-commerce by government agencies seems to have been overlooked, although the Internet owes its creation to the Department of Defense.

The Internet's impact on society is unprecedented, its growth extraordinary. Within four years the Internet has reached 50 million people.[1] Buzzwords such as B2C (business-to-consumer) and B2B (business-to-business) commerce have surfaced. Forrester research estimates B2C commerce will reach $108 billion and B2B commerce $1 trillion by 2003.[2]

Participation in e-commerce by government agencies seems to have been overlooked or neglected. Ironically, the Internet owes its creation to the Department of Defense. The history of the Internet lies in the military's desire for a more resilient communication system. The military did not want to lose all communication if one communication node was damaged or lost. Some agencies, such as the IRS, have embraced the Internet, but the perception is that government agencies are lagging in accepting and deploying e-commerce initiatives. This paper examines the issues and opportunities for government agencies in the e-commerce world. There are many reasons for a government agency to embrace the Internet as a tool for conducting operations—mainly efficiency and effectiveness.

The distribution of content is one of the most frequent instances of cost savings. Most organizations already have their documents, manuals, and reference material in a digitized format; publishing them on the Internet would be very simple. The Internet is composed of several entities, including the World Wide Web, virtual private networks, and intranets. The World Wide Web is what most people think of when they hear the word "Internet" since the Internet allows anyone with a browser to check stock quotes, buy books, and download files. Virtual private networks (VPN) and intranets are networks that utilize encryption and other security measures to ensure that only authorized individuals can gain entry to the network. An agency may want to consider both an Internet site, which could be accessed by anyone needing information from that agency, and an intranet site, which only the agency employees and clients could access, for its e-commerce presence. Many state agen-



cies already provide information via the Internet, ranging from listings of hurricane-damaged cars to state officials. This information is available 24 hours a day, seven days a week. Whenever constituents or clients need information or updates, all they have to do is browse the agency's Web page. They then have the choice of viewing or printing the page, drastically reducing the costs to the agency of printing and distributing the material.

Another frequent use of the Internet is for registration purposes. A reduction in input errors should result since the individuals input the information themselves and are normally asked to verify it before submission. Businesses have embraced the ability to allow the user to register online. This is another way government agencies could utilize the Internet to become more efficient in delivering services. The ability to deliver information proactively instead of reactively has great implications. The ability to publish information for employees about changes in their benefit packages would be valuable. Also, an agency could establish an online public forum for discussing broad-ranging topics to gain feedback and acceptance for the agency's decisions and policies. While there are many advantages to providing services on the Internet, there are a couple of issues that need to be considered. Security is undoubtedly a major concern of all participants on the Internet. Understanding the risks associated with the Internet is the first step in establishing a security strategy.

Security Concerns

As the last few years have demonstrated, electronic commerce has enhanced the capability of a business organization to succeed in a modern, highly competitive business world. This has led to heavier use of the Internet and, unfortunately, a higher level of vulnerability. Recent security breaches at some of the highest-profile sites have shown it is not difficult to take advantage of security holes in the Internet. Any data stored on a networked computer may be at risk of compromise.

In one of the active attacks, denial of service, an Internet site is flooded with data, choking access to the site. Several incidents of this type have been seen in recent months. To secure the data, a government organization must have a good access control policy, dictating what type of access is allowed to a user across an organization's network, along with proper enforcement. Additionally, setting up an effective intrusion-detection system is relatively easy and inexpensive as well as beneficial in the long run.

Another issue of concern for government and business organizations was the legality and binding nature of electronic documents. Congress recently passed the digital signatures law, granting electronic documents the same status once enjoyed by paper documents only. This legislation has some major implications for government organizations as, unlike business entities, most government offices require signatures for a document to be considered valid.

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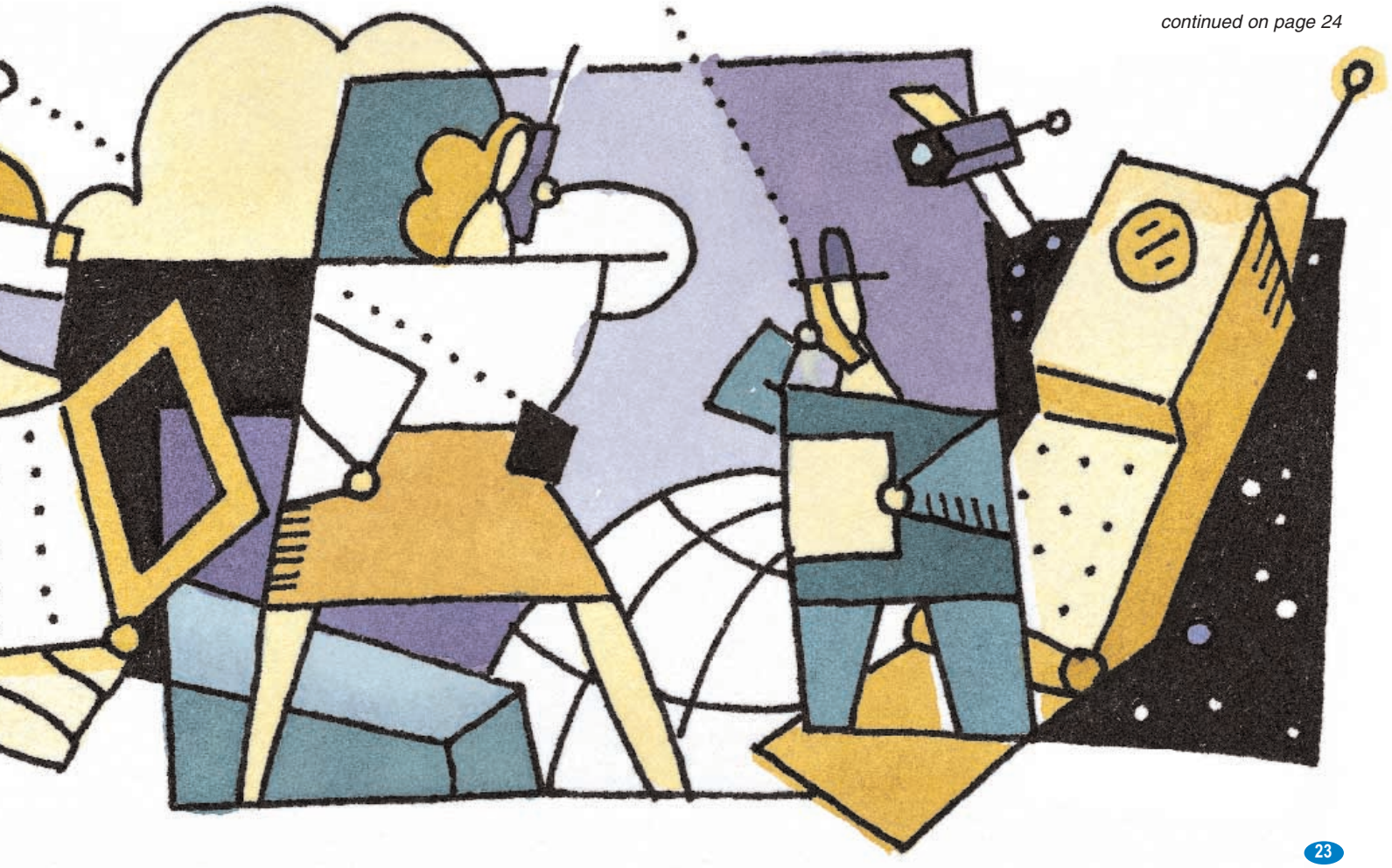

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There are some exceptions to the application of the digital signature law. Consumers must give their formal consent to accept electronic documents when signing a contract, and the law does not apply to some specific areas, such as family law. Still, the law has some far-reaching implications and is expected to facilitate widespread use of electronic documents in some industries, such as financial services. The law does not prescribe any specific method for the use of a digital signature and leaves it up to the contracting parties to decide about security and privacy issues. The contracting parties are responsible for determining that the party at the other end is who the party claims to be and that the document did originate with that party. In order to use digital signatures, the parties to a transaction must set up some ground rules. Important things to be considered include what type of encryption method (for secure transmission) should be used and who will serve as the certification authority (CA)—similar to a notary in the physical world—required to certify that a signature is that of a particular person. While security will probably always be an issue, continually employing current technology is a sure way to reduce the risks associated with e-commerce.

The Digital Divide

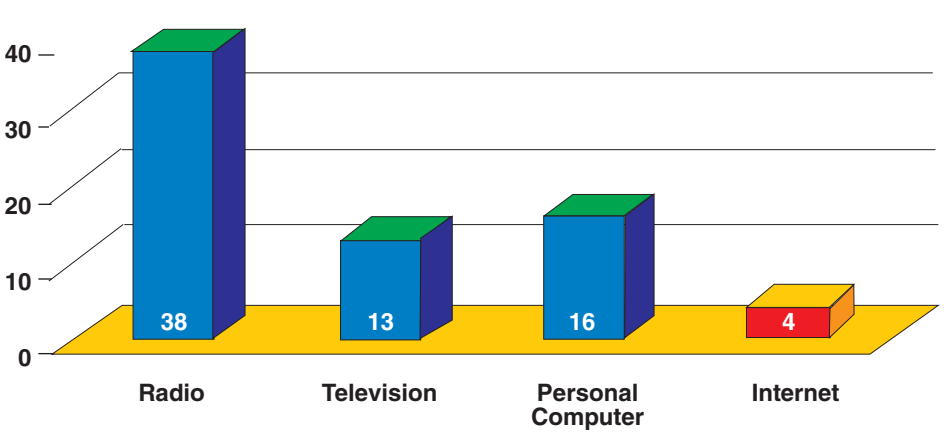
Another issue associated with e-commerce and government agencies is that of the digital divide across age, education, race, income level, and region. A government agency needs to know if its constituents are online. According to a government report, younger individuals with higher income and a four-year college degree living in urban/suburban areas have a much higher Internet usage rate. Although this may never go away, it will become less significant as new technologies become available and the cost of existing ones decreases. Public libraries and other institutions are increasingly making computing resources available to those who cannot afford them and providing training to those who are not experienced in using them.

Potential Applications

Potential applications for government agencies in the e-commerce world are boundless. While the media raged over B2C and B2B commerce, don't be surprised if in the near future the e-commerce darlings are B2G, G2C, and G2G commerce ("G" for government agencies). Think of the number of government contracts issued each year. An agency could feasibly buy everything from pencils to automobiles online. The purchases could be made directly or through an online auction to ensure competition. Some of the most popular Internet sites are online auctions. There is no reason why a state government or agency could not replace traditional sealed-bid auctions with online auctions. Another form of B2G commerce deals in leasing software applications through application service providers (ASPs). While this is not a new concept, the Internet has increased the potential benefits associated with leasing software. The application may be downloaded each time it is used, increasing accessibility, or the data may be stored on an online repository, decreasing onsite storage needs. The Internet also significantly decreases delivery time of the leased software application, which is simply downloaded, avoiding the traditional methods of shipping.

Another form of government e-commerce is G2C (government-to-consumer commerce). Several aspects of G2C are not new: electronic transfers of state subsidy checks have been around for several years. However, other potential applications of e-commerce include registering voters or cars and purchasing government-issued licenses online. These applications require the agency's Internet presence to be somewhat dynamic; numerous other applications would require only a static site, such as the IRS's site for downloading tax forms and publications. Any government agency could disseminate information quite easily and effectively using an Internet or intranet site, depending on the target audience.

While the previously mentioned potential applications of G2C and B2G commerce are being explored somewhat, the G2G aspect of e-commerce has not been embraced. Whether because of lack of expertise or security issues, many activities between government agencies are still conducted using paper or antiquated computer systems. While most states offer electronic transfer of funds and direct deposit, many agencies still require travel reimbursement sheets filled out on paper. There are many requests between agencies or employees that could easily be digitized, saving the agencies, state, and residents thousands of dollars each year. According to the Gartner Group, a digitized document costs pennies to disseminate compared to several dollars for a paper version.[3]



Conclusion

Conducting operations via the Internet is most attractive when convenience and time are important; traditionally, government organizations have ranked low on these counts. Of course, it is neither expected nor advisable to move completely from the old way of doing business to an Internet-only setup. Instead, a sure and steady move to "bricks and clicks" from "bricks and mortar" would be a wise approach while the growth of technology takes care of security and digital divide issues. ■

Timothy H. Greer and Mirza Murtaza both teach in the Computer Information Systems Department at MTSU.

Notes

[1] Morgan Stanley U.S. Investment Research: Internet Retail

[2] *http://www.forrester.com/ER/Press/ForrFind/0,1768,0,FF.html*

[3] *http://gartner12.gartnerweb.com/public/static/aboutgg/pressrel/pr.html*

Seeking the New Economy

BY E. JAMES BURTON

Dear *Tennessee's Business* readers:

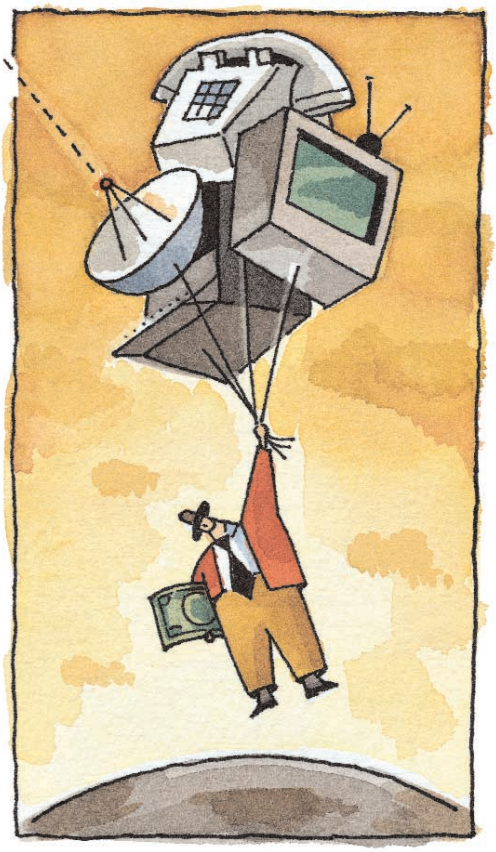
Welcome to the new economy: for some it is as welcome as a snake bite; for others it is a grand adventure into continuous discovery, a chance to blaze new electronic trails and "bravely go" wherever the future leads. Some may see it both ways. However one views it, the new economy is here to be reckoned with.

We in the Jennings A. Jones College of Business are probably in the group that views the new economy both ways described above. In some ways, it is a snake bite. Even if we had the financial means to hire faculty with Ph.D.s in e-commerce, they do not yet exist. Schools across the country are scrambling to develop programs to get "on the wave" of what is happening in the real world. Every meeting of business college deans I attend has one or both of two themes: reaccreditation or e-commerce. The recent Southern Business Administration Association meeting in Nashville explored what is happening in this new economy.

The new economy is also an exciting opportunity. In a country founded on entrepreneurship and small businesses, e-commerce and the new economy bring possibilities never before imagined. Students can work with professors to create and test business concepts without leaving campus, market research can be conducted from any connected computer in the world, and the market is worldwide.

However, there is much more to the new economy than just setting up a Web site and offering a product or service. Logistics, fulfillment, transportation, pricing, customer relations, and more also change and must be explored. New models must be developed and tested. Some will fail; some will succeed instantly.

New economy personnel have different qualifications. I recently consulted with a new economy company. The management team was being formed. The resumes of the top officers provided some revealing insights: only the financial people had academic business training backgrounds; the others were bright people with liberal arts degrees but previous experience in some form of new economy commerce. We are making up the new economy as we go.



We at MTSU are desperately seeking to bring the new economy to the classroom.

The Japanese are attempting a fulfillment model that seems strange to Americans. Some vendors are using convenience stores as the delivery system for goods purchased via e-commerce. Consumers go online to find desired goods, then designate a convenience store for pick-up and payment. The abundance of convenience stores and shopping habits of the Japanese make this appear to be a viable model for them.

In Finland there is another twist: the cell phone is being used as a transaction medium. Certain vending machines have been designed to work with cell phones. A customer can use a cell phone to get a soft-drink from a machine, and the charge will be posted to his/her account via the phone.

The new economy presents other interesting opportunities. Typically, businesses have been valued using a number of models involving historically established data such as earnings or cash flow. The new economy has seen companies achieve impressive market capitalizations with no earnings, negative cash flow, and no proximate expectation of earnings or positive cash flow. Learning to value businesses under such market conditions is a challenge both for investors and for academics trying to teach principles upon which students can build careers.

We academics know that the new economy is

- *Expensive*—The cost of preparing students to compete in a marketplace so dependent on expensive and rapidly changing technology will increase dramatically over the next few years.
- *Fast*—The new economy is forcing change at a pace faster than the academic world has traditionally been able to assimilate. It will be difficult for academics, who tend to move cautiously when it comes to changing curriculum, to adjust to Internet time.
- *Frustrating*—Much of what we have "known for sure" for years is no longer true. While academics are considering carefully and completely whether something can be done, someone in the real world just does it.
- *Exciting*—It opens doors to partnerships that never before existed. Research takes on new dimensions as the ability to work with colleagues around the world is a reality.

Like our colleagues across the country, we at MTSU are desperately seeking to bring the new economy into the classroom. We want and need the support of our alumni and friends to make this happen.

Sincerely,

E. James Burton, Dean
The Jennings A. Jones College of Business
Middle Tennessee State University