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In This Issue: **Designing Organizations for Value**

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The Elusive Underpinnings of U.S. Venturesomeness (If Not Prosperity)*

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Let us return to the puzzle about why the United States has not fallen behind in economic growth. According to convergence theories, poorer countries naturally grow faster than richer countries. Even the mild version of the "techno-nationalist" argument that can often be heard in U.S. policy circles suggests that any catch-up in the research capabilities of poorer countries will boost their naturally higher rates of growth. The tougher version takes this one step further, predicting that if the research gap is reduced, richer countries will suffer an absolute decline in living standards.

But the erosion of its lead in science and cutting-edge technologies has not kept the U.S. from maintaining (or even increasing) its lead in per capita income. What accounts for the discrepancy between the predicted and actual outcome?

The analysis presented in previous chapters suggests the following explanation: average per capita incomes depend on the *average* productivity of the workforce rather than, say, the performance of a few star scientists or technologists. An abundance of IT-based innovations optimized for the U.S.—and, crucially, the ability and willingness of consumer and business users to make effective use of these innovations—has sustained exceptionally high growth in the productivity of the U.S. service sector, and thus in U.S. per capita incomes. And so the growth of high-level research abroad, while perhaps reducing the U.S. share of scientific articles and patents, has benefited the U.S. economy by providing more raw material for innovative combinations. Even the off-shoring of mundane tasks and the immigration of journeyman programmers have helped by increasing the resources available to deploy these innovations at home.

This explanation is more consistent with modern experience than the "techno-nationalist" version in an important respect: it is not "zero-sum," and thus the success of the U.S. in using technological innovations to increase productivity does not harm other countries. In fact, even if innovation hasn't raised all boats the same distance—and many countries in the South have been left far behind—it has elevated many boats to a significant extent. Taking the long view, we see that differences within the "northern" OECD countries in productivity and incomes are small compared to the gap between where these countries were in the 19th century and where they are today. In contrast to the huge advances the U.S. economy has made over the last century, the extent of its outperformance of other economies within the OECD in the last decade is but a trifle.

The explanation raises further questions, however, about the causes of differences across countries and eras. Why, for instance, is the level of IT deployment in the U.S. higher than in most countries in Europe, when its overall rate of conventional investment and capital formation is lower? More important, putting aside differences in individual countries, why has the North, as a whole, significantly improved its capacity to nurture and harness technological innovations?

These questions take us back to Adam Smith's 1776 classic, *An Inquiry into the Nature and Causes of the Wealth of Nations*. Several scholars have updated the *Inquiry* to encompass the now prominent role of technological progress. To name just a few of my favorites, Nathan Rosenberg and L. E. Bridzell's *How the West Grew Rich* (1986), Joel Mokyr's *The Lever of Riches* (1990), and several books by Alfred Chandler provide insightful historical perspectives on the great technological advances that have been made after 1776. And a contemporary analysis is provided by Baumol, Litan, and Schramm's *Good Capitalism, Bad Capitalism, and the Economics of Growth and Prosperity*.

In this chapter I provide a perspective on the sources of U.S. economic prosperity that reflects both the thinking of these books and the fieldwork and arguments presented earlier in these pages. I do not have much to say about the financial system, which clearly plays a critical role in a well-functioning economy, but instead concentrate mainly on factors that promote the venturesome use of innovations. Although my main focus here is the U.S. economy, I do not claim that the United States has the only possible system for "delivering the goods," nor do I suggest that blindly copying the U.S. system makes sense for countries whose economies have not performed as well.

*This article is a compressed version of Chapter 15 ("The Elusive Underpinnings") of Amar Bhidé's *The Venturesome Economy* (Princeton University Press, 2008). It is reprinted here with the permission of the publisher.

Supply Side: A Point of Departure

What we may broadly think of as the "supply side" perspective is a useful point of departure for my hypotheses. Supply-side theories are relevant because they emphasize the importance of *long-run* economic growth—as opposed to the control of cyclical fluctuations, which appears to be the primary aim of much public policy—and the role of innovations in promoting growth. Supply-side theorists also specify conditions that can discourage innovation and growth, such as excessive regulation, insecure property rights, and confiscatory taxes; and these conditions may explain *some* of the differences in the economic performance of OECD countries. But supply-side theories, as we shall see, fail to explain the even larger differences between 19th- and 20th-century performance. Analysis of the differences between the "old" and the "new" economies provides a more complete understanding than standard supply-side theories of the conditions that now make technological innovation such a potent economic force.

A 2006 study by OECD economists of the effects of regulation on the productivity of the service industry can be used to illustrate the nature and contributions of supply-side research. The study concludes that productivity in the services sector is lower in countries where regulation is high, and that this effect is concentrated in industries that use or produce IT. Regulations also appear to affect the extent to which IT is used. The study estimates that, from 1985 to 2003, about 12% of the cross-country differences in IT investment (as a percentage of total investment) could be attributed to variations in the rules, with the light regulatory burden in the U.S. adding four percentage points to the IT share of its total investment as compared to the OECD average. More onerous rules in France, Greece, Italy, and Portugal pulled down the IT percentages by 2.5 to 3.5 points.[1]

Similarly, a paper by my Columbia colleagues Michael Van Biema and Bruce Greenwald argues that "the most important contribution that government is likely to make to improving productivity growth is to minimize the attention demands it makes on business management." The paper supports this hypothesis by analyzing the impact of different presidential administrations on productivity growth. The authors find a "remarkably consistent" relationship between high levels of regulatory activity (as measured by pages in the Federal Register) and declines in productivity growth.[2]

Although it seems plausible that excessive government regulation, confiscatory levels of taxation, insecure property rights, and a failure to maintain law and order—the principal bugaboos of the standard supply-side view of the economy—are bad for productivity growth, does their absence ensure rapid productivity growth? The colonial rulers of India imposed lower taxes and had fewer regulations than governments in Britain. Yet India's economy languished while Britain's leaped ahead.

Differences in the growth rates in the U.S. and other Western countries during the 19th and 20th centuries also raise questions about the degree to which the basic supply-side formula is a sufficient (rather than a necessary) condition for rapid growth. By historical standards, economic growth in the 19th century—when per capita incomes doubled—was unprecedented. But in the 20th century, incomes increased four times as rapidly as they did in the 19th century. Given the higher "base," one might have expected growth in the 20th century to have been slower. Strikingly, the modern economy has also been less prone to lurch from exhilarating boom to devastating bust. In the 19th century, several depressions interrupted economic growth, whereas in the 20th century, apart from the Great Depression, downturns were relatively mild and short-lived—in spite of two great wars.[3]

Yet conditions in the 19th century conformed to the basic supply-side formula more closely than those of the 20th century. In the United States, government expenditures and taxes were extremely low—and, except during the Civil War, there was no income tax. There was no federal bureaucracy to impose minimum-wage laws, regulate health and safety standards, or resist monopolies and trusts. No Clean Water or Securities and Exchange acts had been passed. Medicare, Medicaid, and Social Security programs had not been conceived. And property rights—another mainstay of supply-side recommendations—were at least as secure, if not more so, in the 19th century than they are now.

Another puzzle: according to Solow's groundbreaking research, technical progress rather than capital accumulation was the source of nearly 90% of U.S. growth in the first half of the 20th century. In the 19th century, capital accumulation made a larger contribution to growth than did technical change.[4] Yet the new products invented in the 19th century were extraordinary. Inventions between 1850 and 1900 include the monorail, telephone, microphone, cash register, phonograph, incandescent lamp, electric train, steam turbine, gasoline engine, and street car, as well as dynamite, movies, motorcycles, linotype printing, automobiles, refrigerators, concrete and steel construction, pneumatic tires, aspirin, and

1. Conway, P., D. de Rosa, G. Nicoletti, and F. Steiner. 2006. "Regulation, Competition and Productivity Convergence." OECD Economics Department Working Paper No. 509, September. Although the overall results are consistent with other research (such as the paper discussed in the next paragraph), I am reluctant to attribute much significance to the numerical estimates. As discussed earlier, they are based on the implausible assumption that the same model applies to all countries—when it is far more likely that regulations affect the use of IT differently in France than they do in the United States.

2. M. Van Biema and B. Greenwald, "Understanding Productivity in the Service Sector." Columbia Business School Working Paper, January 9, 1997.

3. This paragraph paraphrases the observations of J. Bradford DeLong (2000), "The Shape of Twentieth Century Economic History," NBER Working Paper No. 7569, February.

4. Nicholas Crafts, "Globalization and Growth in the Twentieth Century," IMF Working Paper, 2000.

Why the Modern System for Nurturing and Deploying Technological Innovations Is Better Than Its 19th-Century Counterpart: A Summary

• Broader participation: the modern system draws on the contributions of more individuals both as developers and as users of new products.

• Greater organizational diversity and specialization: the evolution of new forms of organization enables the system to use the contributions of many individuals more effectively.

• Changes in common beliefs and attitudes—for example, with respect to technological change and thrift—have accelerated the adoption of new products.

• Intensified pressure to grow: the "grow or die" imperative faced by many businesses encourages them to look for help from new technologies.

• Professionalization of management and sales functions has improved the capacity of modern organizations to develop market and use new products.

• Expansion of higher education has increased the supply of individuals with habits and attitudes that improve their ability to develop and use innovations.

X-rays. These may well overshadow inventions credited to the entire 20th century.

The smaller economic impact of 19th-century inventions suggests that they weren't effectively commercialized; their widespread use was hampered by some combination of inappropriate features, high costs, poor marketing, or a paucity of venturesome consumption. Why in spite of a more congenial supply-side climate was this so? What changed in the 20th century that allowed the United States—and other countries with advanced economies—to extract more value from technological and scientific breakthroughs?

A ready answer is that modern economies have better "institutions"—or what two economists have called "social capabilities."[5] But that just begs the question: in what specific ways have institutions improved? Although it is easy to talk about institutions in the abstract, it is difficult to pin down their specific elements. And because the composition of good institutions is a complicated question with no simple answer,[6] I approach the problem by identifying what I take to be six of the most important features (summarized in the box below) of the modern U.S. system of innovation.

Broader Participation

One aspect of the modern system that has made it more successful at developing innovations suitable for widespread use is its capacity to harness the talent and effort of a large number of individuals. In the 19th century, new products were developed by a few individuals. Edison brought forth a remarkable cornucopia—incandescent bulbs, motion pictures, and gramophones—from a small facility in Menlo Park (New Jersey, not California) with fewer employees than the typical Silicon Valley start-up. Alexander Graham Bell had one assistant. Automobile pioneers were one- or two-man shows—Karl Benz and Gottlieb Daimler in Germany, Armand Peugeot in France, and the Duryea brothers of Springfield, Massachusetts. But small outfits couldn't develop products for mass consumption. The early automobiles were expensive contraptions that couldn't be used for day-to-day transportation because they broke down frequently and lacked a supporting network of service stations and paved roads. One or two brilliant inventors couldn't solve these problems on their own.

In the 20th century, the task of converting inventions into mass-market products pervaded society. As often as not, pioneers paved the way for many followers who built on and refined the first offerings. Planned and unwitting collaborations, taking place simultaneously and in sequence, made products that initially worked imperfectly commercially viable. Over the last three decades numerous innovations—such as electronic spreadsheets, the mouse, graphical user interfaces, and local area networks—have changed the personal computer from a virtually useless oddity into a ubiquitous artifact. A procession of individuals—Ed Roberts, Gates and Allen, Jobs and Wozniak, Bricklin and Frankston, Mitch Kapor, Robert Metcalf—made all this happen. Few of their individual contributions were actually breakthroughs *per se*, but collectively they created an industry that changed the world.

Similarly, the Internet does not have a solitary Alexander Graham Bell. Some of its leading figures have not acquired fame—even if they've become wealthy. Mention Sir Timothy Berners-Lee, for instance, and you will usually get a puzzled look. And it isn't just a few visionaries or researchers who have turned the Internet into a revolutionary medium of communication. Innumerable entrepreneurs, venture capitalists, executives of large companies, members of standard-setting institutions, researchers at universities and commercial and state-sponsored laboratories, programmers who have written

5. Kazushi Ohkawa and Henry Rosovsky, *Japanese Economic Growth: Trend Acceleration in the Twentieth Century* (Stanford: Stanford University Press, 1973).

6. As my colleague Richard Nelson has pointed out. See Richard R. Nelson, *National Innovation Systems: A Comparative Analysis* (New York: Oxford University Press, 1993); and "What Makes an Economy Productive and Progressive? What Are the Needed Institutions?" LEM Working Paper Series 2006/24, September 2006.

and tested untold millions of lines of code, and even investment bankers and politicians have played important roles in the Internet revolution.

Venturesome consumption also now includes individuals from many walks of life. Some new products and services—the Telstra Roadster 100, an electric sports car that retails for $100,000, and Virgin Galactic, which is selling tickets for suborbital flights for $200,000—are out of the reach of all but the very well-to-do. But the rich don't dominate the ranks of leading-edge consumers for most other innovations. It wasn't mainly the very well-to-do who lined up to buy half a million iPhones in just the first weekend of the product's release, in spite of their high prices. Within weeks, you could see them flaunted in New York's subways by people who didn't look like investment bankers or hedge fund managers. At Columbia Business School, the presumably heavily indebted students were far more likely to own an iPhone than the faculty.

Broad-based venturesome consumption has been crucial to the effective deployment of innovative mid-level products in the workplace. Personal computers and other IT products and services have helped raise U.S. productivity because of the effort and resourcefulness of a very large number of users. In 2001, some 60% of U.S. workers reported they had learned to use spreadsheets or databases, and 11 million said they did some kind of programming but were not professional programmers.

As a rule, IT has raised the intellectual challenge to workers, even if some innovations (such as touch screens in the fast-food industry) have helped "dumb down" certain jobs. The old-fashioned executive secretary typed on a manual or electric typewriter. The modern executive assistant not only has to have the same motor skills on a keyboard, but also the more cognitive skills and knowledge of using word-processing software. In addition, he may have to learn how to create PowerPoint presentations, coordinate meetings on an electronic calendar, make reservations for airlines and hotels online, or edit his boss's web page or blog.

Greater Organizational Diversity and Specialization

A second distinctive feature of the modern era has been an increase in the diversity of organizations that play in the innovation game. As a result, individuals now participate through many different specialized organizations and subunits and can choose the ones that are best matched to their abilities and interests. In contrast, in the 19th century, individuals made their contributions to innovation almost entirely through simple partnerships or small firms.

One important source of organizational diversity has been the rise of large, professionally managed corporations. As the business historian Alfred Chandler has shown, this form of organization, which appeared in the last half of the 19th century, became a major force for developing and deploying innovative products in the 20th century.[7] Companies such as DuPont, for instance, developed new materials such as nylon in their research labs, produced them on a mass scale at low cost, and created large markets for their use. By the 1960s, this organizational form became ubiquitous. In 1967, J. K. Galbraith observed that the 500 largest corporations produced nearly half the goods and services annually available in the U.S.[8]

Contrary to predictions, however, large corporations did not wipe out traditional forms of organization. In fact, shortly after Galbraith's book was published, the corporate share of economic activity stabilized. By the early 1980s, professionally managed venture capital funds began to see explosive growth, and the firms they invested in came to be regarded as the new standard-bearers of innovative enterprise. The once-hot large corporation was viewed as passé and on the path to eventual extinction. In fact, the emergence of VC-backed businesses, like that of the large corporation before it, represented an *increase* in the diversity of organizational forms rather than the supplanting or "creative destruction" of existing ones. Just as large corporations did not make the classic self-financed entrepreneur obsolete, VC-backed businesses did not knock out large corporations.

Instead different types of organizations now specialize in different innovative activities and complement each other's capabilities. Large publicly traded corporations, for instance, can undertake very large initiatives that require the coordination of many individuals and the pooling of many investors' capital. Self-financed entrepreneurs, in contrast, don't have either the capital or the organizational capacity to undertake such projects. But the same governance and control mechanisms that give big corporations an advantage in pooling capital and labor also discourage them from undertaking projects with high levels of "Knightian" uncertainty. Self-financed entrepreneurs, in contrast, can pursue projects with such uncertainty in large part because they are answerable only to themselves.[9]

These differences often lead self-financed ventures and large corporations to build off each others' contributions in advancing the technological frontier. For instance, between 1975 and 1980, it was individual entrepreneurs, and not large companies, who tried to create useful applications for personal computers when the uncertainty about the

7. See Alfred D. Chandler, *Scale and Scope: The Dynamics of Industrial Capitalism* (Cambridge: Belknap Press of Harvard University Press, 1990).

8. John K. Galbraith, *The New Industrial State* (Boston: Houghton Mifflin, 1967).

9. See my book, *The Origin and Evolution of New Businesses* (New York: Oxford University Press, 2000) and my papers, "Non-destructive Creation: How Entrepreneurship Sustains Development." Lecture at the Royal Society of Arts, London, November 17, 2004; and "How Novelty Aversion Affects Financing Options," *Capitalism and Society* 1, no. 1, 2006, article 1. http://www.bepress.com/cas/vol1/iss1/art1.

utility of these quirky toys was high. But after these efforts bore fruit, it was the launch of IBM's PC in 1981 (when the company accounted for more than 60% of the worldwide sales of mainframe computers) that "legitimized" the personal computer for the data-processing departments of large companies. After that multi-billion-dollar investments by Intel and Microsoft helped carry the PC into virtually every home and office.

Moreover, Knightian uncertainty and capital requirements are just two dimensions along which organizations choose to specialize. Others may include the choice of market (where the options constantly expand because of the process of "nondestructive creation" I discussed earlier); levels of know-how and products (high level, mid-level, or ground level); functions (some organizations, such as Qualcomm, specialize in research, while others, such as PR and ad agencies, specialize in marketing; yet others, such as Intel, are vertically integrated); and geographic scope. The large number of dimensions of specialization helps give organizations distinctive roles in the innovation process.

The specialization of the players in the innovation game provides two kinds of benefits. First, specialized organizations can develop more effective capabilities than if, like some 19th-century inventors, they "did it all on their own." Whereas an Edison had to develop new technologies and create marketplace buzz largely on his own, a Jobs can draw on the services of specialized design-houses on the one side and PR and ad agencies on the other. Second, organizations can more effectively utilize the contributions of individuals with different abilities and dispositions: the "mad scientist" (who comes up with breakthrough research) can work at a dedicated lab; the methodical engineer (who figures out how to "scale up" an innovative prototype) in the production function of a large corporation; and the flamboyant marketer at an ad agency.

Changes in Beliefs and Attitudes

Several common beliefs and attitudes that undergird the modern system of innovation—expectations of technological change, gratification from buying cool new products first, and the desirability of job-hopping—have distinctively modern, late 20th-century features.

In earlier times, a relatively small number of people—mostly visionary inventors and scientists—believed in the inevitability and desirability of technological progress. Now popular magazines, TV shows, and management books are predicated on the assumption that scientific and technological progress is inevitable. Many believe they can prosper by pursuing the next New Thing—and that if they don't, they will fall behind.

The widespread acceptance of such beliefs has helped turn progress into a self-fulfilling prophecy. Consider Intel co-founder Gordon Moore's famous observation that the number of transistors built on a chip doubles every 18 months. Semiconductor companies that believe in Moore's "law" invest the resources needed to make it come true. Other players such as PC manufacturers and applications-software companies design products in anticipation of the 18-month cycle. So when new chips arrive, they find a ready market, which in turn validates beliefs in Moore's law and encourages even more investment in building and using new chips.

The fear of being left behind similarly helps explain the speed with which IT innovations are deployed. In a 2006 study, J. W. Cortada noted that in many industries almost all companies would use "computers in the same way to perform the same functions. Thus, when bank[s] initiated ATM services, they seemed to do so all at once within a short period of time."[10] Although such herd-like behavior means that no competitor can rely on an exclusive use of IT as a sustainable source of profit, the behavior is still rational; a bank that doesn't install ATMs risks losing customers.

In principle, expectations of technological change could also slow change down. Why buy the $3,000 flat panel TV set now if the price will drop and the reliability of the models increase? But many users appear to derive utility not just from the functions that new products provide but from early adoption itself. As Keynes pointed out, people have both "absolute" needs (health, survival) as well as "relative" needs that we experience "only if their satisfaction lifts us above, makes us feel superior to, our fellows."[11] Early purchasers of flat panel TVs apparently enter into a tacit bargain with other consumers: they incur the higher risks and costs, which drive down prices and improve the quality for the consumers who wait. In return, those who wait give early purchasers the gratification of being first.

The gratification that many modern consumers enjoy may be contrasted with the pleasure of "conspicuous consumption" of the Gilded Age that Thorstein Veblen wrote about in *The Theory of the Leisure Class*—consuming expensive goods for the sake of displaying status or wealth. Only the wealthy can indulge in conspicuous consumption. According to Veblen, to satisfy its purpose—the demonstration of wealth—conspicuous consumption must be wasteful. In contrast, many early purchasers of the latest gadgetry aren't flush with cash (or even pretending to be); they seek to display, to themselves and to others, their technological sophistication rather than their wealth (though there's little evidence of, or reason to fear, the disappearance of the classic form of conspicuous consumption).

The widespread opening of hearts and wallets to new offerings also involves the dilution of prior beliefs in the moral

10. J. W. Cortada, "The Digital Hand: How Information Technology Changed the Way Industries Worked in the United States," *Business History Review* (Winter 2006), 755-66.

11. John Maynard Keynes, "Economic Possibilities for Our Grandchildren," In *Collected Writings*, vol. 9, *Essays in Persuasion* (1930) (London: St. Martin's Press, 1971-73).

and economic value of thrift. Through the end of the 19th century, according to Max Weber, religious convictions about thrift sustained the "spirit of capitalism." Weber argued that merchants and industrialists accumulated capital in the belief that they had a moral duty to strive for wealth as well as to lead austere lives.[12] But today, because venturesome production requires venturesome consumption, excessive thrift can injure rather than help capitalism. As it happens, modern consumers have been more inclined to keep up with (if not stay ahead of) the Joneses than to display excessive thrift.

The utility individuals now derive from using cutting-edge technology can also stimulate business purchases of IT if the IT staff put their love for the latest toys ahead of their employers' interests. Top executives aware of this tendency can resist it—or they may be subject to it themselves and argue for the adoption of cutting-edge technology under the guise of demonstrating their farsighted vision. Even managers with no love for technology *per se* may be concerned with keeping up with their competitors. If these competitors also have IT staff who are subject to "techno-lust," the entire industry may be stampeded into adopting new technologies.

Along with thrift, the expectation of long-term employment has also largely gone by the wayside, particularly in the last quarter century. Although relatively few people in fact ever experienced lifelong employment at high wages, it was once at least widely aspired to; starting and retiring at IBM or General Motors was a considered a good thing. Now employees often regard job-hopping as necessary for getting ahead and building their personal "brands." Conversely, employers don't look down on well-traveled resumés or reward the loyalty of employees who don't leave: promoting from within is out, and the path to the top is rarely up one ladder.

Frequent job-hopping promotes the development and use of technological innovations. According to AnnaLee Saxenian, one important reason for Silicon Valley's "regional advantage" in innovation is the high propensity of IT workers to change jobs. According to one of her interview subjects, people could change jobs without changing parking lots. These "spontaneous regroupings of skill" are said to allow whoever comes up with the best technology to attract the best people.[13]

On the deployment side, job-hopping helps disseminate the ground-level know-how necessary to effectively use innovations. Wal-Mart, for instance, has been a leader in the use of IT in managing its supply chain. Its alumni have helped propagate Wal-Mart's expertise not only to its direct competitors, but also to online retailers such as Amazon. Footloose employees of IT-using organizations may also be more likely to support the purchase of unproven new products, if only for their private gratification, because they don't expect to be around if it ultimately fails.

Intensified Pressure to Grow

In the modern era, many businesses have to "grow or die" because of the demands placed by competitors, customers, capital markets, and labor markets.[14] The pressure to grow creates strong incentives for IT producers to develop new products and for users to increase their deployment. HP illustrates the former. Co-founder David Packard writes in his memoir that, over the years, he and Bill Hewlett "speculated many times about the optimum size of a company." They "did not believe that growth was important for its own sake," but eventually concluded that "continuous growth was essential" for the company to remain competitive. That goal in turn led HP, which was until 1964 just a developer of scientific instruments, to enter the computer industry.[15]

Growth facilitates and encourages companies to use IT and other innovative technologies in several ways. First, the larger a business grows, the more it can support the fixed costs of deploying IT. Unlike Wal-Mart, a small retailer cannot afford to purchase a license for a sophisticated supply-chain management software package or pay for the in-house IT staff necessary to install and maintain the package. Moreover, since vendors' costs of marketing their packages also tends to be fixed, they tend to favor large customers who buy large (or many) packages.

Second, growing companies often start new facilities, in which it is both easier and more economical to adopt new technologies. While an old plant may be technologically obsolete, it may still cover its variable costs and make replacing it with a state-of-the-art plant irrational for its owners. Moreover, it can be operationally disruptive to pull out the old technology. Neither consideration applies to a greenfield facility. It is worth noting here that the main differences in the productivity of European and U.S. retailing are in the arena of "big box" retailers (like Wal-Mart), and that within this category, the U.S. edge derives mainly from its newly opened retail outlets.[16]

Third, efforts to grow can stimulate searches for innovative technologies that help companies realize economies of scale and scope. For instance, in 1988, Physicians Sales and Services (a company I have written a case series about) was once an "itty bitty company in Florida." In 1989, founder Pat Kelly declared that PSS would become the first national distributor of medical products to physicians' offices in the U.S. With just $20 million in revenues, it had no significant economies

12. See, for example, Max Weber, *Gesammelte Aufsätze zur Religionssoziologie*, Second Edition (Tübingen, 1922).

13. AnnaLee Saxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (Cambridge: Harvard University Press, 1994).

14. See Chapter 9 of my book, *The Origin and Evolution of New Businesses* (New York: Oxford University Press, 2000).

15. David Packard, *The HP Way: How Bill Hewlett and I Built Our Company*. Ed. D. Kirby with Karen Lewis (New York: HarperBusiness, 1996).

16. Robert J. Gordon citing research by McKinsey in a 2004 paper, "Why Was Europe Left at the Station When America's Productivity Locomotive Departed?" CEPR Working Paper. http://faculty-web.at.northwestern.edu/economics/gordon.

of scale that would justify nationwide operation. But the goal of becoming a national company provided the impetus to create such economies. For example, the company invested in an order-entry system based on handheld computers, which increased the speed of deliveries and enabled PSS to reduce the inventories it had to carry; and these and other IT applications allowed the firm to create national-level scale economies.

Professionalization of Management and Sales

The professionalization of management and sales functions has been another hallmark of modern organizations that has improved their ability to develop, market, and use new products.

Let's start with how new management techniques have affected companies developing new products. In the first half of the 20th century, as Alfred Chandler has documented, top managers of large companies such as General Motors evolved a systematic approach to decide what innovations to undertake, taking into account factors such as market opportunities, the firm's capabilities, expected capital requirements, and returns. Managers also developed techniques to control how the innovations were undertaken, enabling large companies to transform innovation into a "routine and predictable process."[17] For example, Eastman Kodak used computers to generate "pseudo photographs" with variations in contrasts, brightness, and balance of colors, and then used evaluations by panels of consumers and professional photographers to guide the efforts of the company's labs in creating new varieties of film.

As the digital revolution unfolded, IT producers followed in the footsteps of their "old economy" predecessors in adopting a disciplined approach to the development of their new products. For instance, according to co-founder Gordon Moore, Intel's process for R&D budgeting required each product group to "submit a project list ordered in decreasing priority, explain in sometimes excruciating detail why the list is ordered as it is, and indicate where the line ought to be drawn between projects to work on and projects to put off."[18]

Along the same lines, Cypress Semiconductor, according to CEO T. J. Rodgers, developed a "goal system" to monitor development projects. For example, designing and shipping the company's third generation of PROM chips was accomplished by completing 3,278 goals over roughly two years.[19] Cypress management reviewed project goals more or less continuously. After project teams met on Monday, goals were fed into a central computer. On Tuesday mornings, functional managers received printouts on the status of their direct reports' new goals. On Wednesday mornings, the vice presidents of the company received goal printouts for the people below them. On Wednesday afternoons, the CEO reviewed reports with the vice presidents.[20]

Critics of this managerial approach claim that it is excessively bureaucratic and stifles entrepreneurship. But unlike the inventions of solo inventors, complex development projects that use large teams simply cannot be undertaken without rules and organization. Below the apparently freewheeling open-source development of Linux lie elaborate processes and rules and, yes, a hierarchy. To play in the big leagues, even companies that start off with no management to speak of, such as Microsoft, have to routinize their approach to development—and hire managers from large companies to oversee the new routines. VC-backed companies hire executives from large companies to implement (albeit with suitable adaptation) systematic managerial processes from the get-go. Ad hoc improvisation certainly hasn't become obsolete, just as the self-financed entrepreneur hasn't become extinct; but at the same time, modern management techniques have improved the development of certain kinds of products.

Large IT companies (and not just consumer-goods behemoths such as Coca-Cola and Procter & Gamble) have also applied management techniques to improve the efficiency of sales and marketing. IBM, under the leadership of Thomas J. Watson Sr., was a pioneer in this regard. Decades before IBM ever sold a computer, and when electric accounting (or "tabulating") machines was its main product line, Watson built a formidable sales system. Salesmen were recruited on college campuses (rather than from the school of hard knocks) and were put through an extended in-house training program. Before attempting to make a sales call, salesmen were "expected to know more about the prospect's accounting" (IBM's machines were typically used in accounting departments) "than the prospect himself."[21]

More professional sales techniques increased the diffusion of IT products and the effectiveness of their use, and salespersons were trained to ensure that customers derived good value for their money. The development of an effective sales channel also encouraged IT companies to develop more products to make the fullest use of the channel.

If we turn to the user side, the adoption of modern management techniques has enhanced the capacity of buyers to effectively deploy the products they purchase. IBM's accounting machines, for example, cut costs dramatically, eliminated work that was "boring, repetitive and mind-numbing," and

17. Chandler (1990), cited earlier.

18. Gordon E. Moore, "Some Personal Perspectives on Research in the Semiconductor Industry," in *Engines of Innovation: U.S. Industrial Research at the End of an Era*, ed. Richard S. Rosenbloom and William J. Spencer (Boston: Harvard Business School Press, 1996).

19. T.J. Rodgers, "No Excuses Management." *Harvard Business Review*, July-August, 1990. Reprint 90409.

20. T.J. Rodgers, William Taylor, and Rick Foreman, *No-Excuses Management: Proven Systems for Starting Fast, Growing Quickly, and Surviving Hard Times* (New York: Currency/Doubleday, 1993).

21. Richard S. Tedlow, *Giants of Enterprise: Seven Business Innovators and the Empires They Built* (New York: HarperBusiness, 2001); and *The Watson Dynasty: The Fiery Reign and Troubled Legacy of IBM's Founding Father and Son* (New York: HarperBusiness, 2003).

"limited expensive accounting and actuarial mistakes."[22] IBM's salesmen analyzed their prospects' operations and informed them about "best practices." Ultimately, of course, it was customers who had to implement these best practices to effectively use their purchases.

In recent decades, "good management" has become particularly crucial in treating the service sector's lack or productivity, referred to by economists as "Baumol disease" (after the Princeton economist who identified the phenomenon). IT companies have developed many products that have the potential to improve the productivity of services. But realizing their value, according to Van Biema and Greenwald (in the study I mentioned earlier), is "above all a *management* issue." And the cases on which that conclusion is based are said to demonstrate "without exception that consistent and effective management intervention is the decisive factor in obtaining significant productivity gains." Although "management challenges in the service sector are in many ways more severe than those confronting manufacturing," the high productivity of "leading edge service companies strongly argues that proper management attention can produce vastly improved performance throughout the service economy."[23]

Now, ten years after Van Biema and Greenwald's study, the performance of the service sector appears to have "vastly improved." And it thus seems reasonable to infer that the overall level of management in the service sector has improved, possibly through the growth of better-managed, tech-reliant service companies such as Wal-Mart at the expense of their less efficient rivals.[24]

Expansion of Higher Education

Tertiary education, or "going to college," became much more widespread in the U.S. and other rich countries in the 20th century, especially after World War II. But has the expansion of college enrollments contributed to the growth of productivity and prosperity? It could be that the concurrent expansion of college enrollments and prosperity is just a coincidence. Or perhaps greater prosperity has allowed societies to underwrite the pleasures of a college education for more of its young, without realizing any economic benefit for the outlay. Making this argument, Charles Murray, co-author of *The Bell Curve*, asserts that "far too many" (even of those in the upper half of the IQ distribution) "are going to four-year colleges."

Murray argues that many students whose intelligence is at or just above average may cope with high school but can't survive college-level coursework in engineering or natural sciences—though in the humanities and the social sciences they can, unfortunately, squeak by. "It is possible for someone with an IQ of 100 to sit in the lectures of Economics 1, read the textbook, and write answers in an examination book," writes Murray. "But students who cannot follow complex arguments accurately are not really learning economics. They are taking away a mishmash of half-understood information and outright misunderstandings that probably leave them under the illusion that they know something they do not." A college education "makes sense for only about 15% of the population," or at a stretch 25%, he states. Yet "more than 45% of recent high school graduates enroll," in large part because of the "false premium that our culture has put on a college degree." Government policy has also made "college scholarships and loans too easy to get."

Murray, a graduate of Harvard College with a Ph.D. in political science from MIT, favors more training of short duration in "practical specialties" offered by vocational schools and two-year colleges. "For learning many technical specialties," writes Murray, "four years is unnecessarily long." Even in many high-tech occupations, a four-year college education is "no more important" than for "NBA basketball players or cabinetmakers. Walk into Microsoft or Google with evidence that you are a brilliant hacker, and the job interviewer is not going to fret if you lack a college transcript."[25]

What is the counterargument? Earlier in this chapter, I argued that in the 20th century innovation was much more inclusive than it was in the 19th century and that it now draws on the contributions of not just a few brilliant inventors but a wide swath of individuals—many of whom, by definition, have average IQs. Obviously some individuals—those doing cutting-edge research in nano-technology, or chief scientists at firms using such research to develop new products—benefit from knowledge that they accumulated by attending college and graduate school. But not everyone involved in developing or marketing new products makes much direct use of the knowledge acquired in a four-year college. As Murray points out, Steve Jobs and Bill Gates dropped out of college, and their enormously successful enterprises, Apple and Microsoft, have benefited from the services of programmers with similarly abbreviated educational careers.

Similar questions arise about the value of college educations for the "average" individual involved in the use of new technologies. In their classic 1966 paper, Richard Nelson and Edmund Phelps offered the general hypothesis that "education speeds the process of technological diffusion."[26] Decades later, Phelps suggested (in several papers) that continental Europe had been unable to capitalize adequately on the Internet revolution because of "a scarcity of university educations." In 2006, Phelps cited the example of a manager of a vineyard "who might have no idea" of what the costs and benefits of

22. Tedlow (2001), p. 226.
23. Van Biema and Greenwald (1997), cited earlier, pp. 8-9 and 16.
24. U.S. Karmarkar, "Will You Survive the Services Revolution?" *Harvard Business Review*, June, 1-9, 2004.
25. Charles Murray, "What's Wrong with Vocational School?" *Wall Street Journal*, January 17, 2007 A19.
26. Richard Nelson and Edmund S. Phelps, "Investment in Humans, Technological Diffusion, and Economic Growth." *American Economic Review* 56, no. 2 (1966).

What Colleges Add

Here I select (and condense) some of the responses by university chancellors and presidents to the question of how U.S. colleges enhance their graduates' economical contribution to society:

"The best American universities do three fundamental things. One is social-capital networking. Individual students learn from each other—and learn that relying on each other is in fact the way to go, that doing it alone doesn't work in this world. Second, universities embed what might traditionally be called a technical education—the components of knowledge—in an agile, broad inquiry that comes at questions from multiple directions. Third, we pose problems for our students to solve in order to make them feel that is a pressing issue."
—*Chancellor Nancy Cantor, Syracuse University*

"One of the great pieces of value-added that residential universities provide is the socialization that occurs by being mixed together with lots of people from different backgrounds, races, ethnicities, religions, countries of origin, disciplines, interests, and talents—and having to learn to get along and do things together in these 650 student organizations, and in their class projects, and so on. That really is every bit as valuable as what takes place in the classroom."
—*Chancellor John Wiley, University of Wisconsin–Madison*

"We've repeatedly heard from employers that our students are self-starters: they can be given a task and don't need a lot of directions to pursue this task. One important reason is that we have a kind of technical professional approach that fosters independent problem-solving, drawing on lots of domains. For instance, you can be an English major but specialize in technical writing and learn about science and technology."
—*President Jared Cohon, Carnegie-Mellon University*

a new insecticide would be "if he lacked an education in basic science and the humanities." A "modicum of knowledge of engineering, chemistry and other fields" goes a long way, Phelps suggested, in helping individuals evaluate new products and techniques.[27]

But why does this modicum require a university education? And just how does the knowledge acquired in Economics (or Sociology) 101 actually help a manager evaluate or implement an ERP system?

In my view, attending college (instead of a vocational school) can indeed help many individuals play a more effective role in developing and using innovations, but in a subtle way. Personal experience (in a *five*-year engineering program) makes me skeptical of how much basic knowledge is actually retained by students after they graduate; and knowledge of "technical specialties" (programming in FORTRAN, in my case) often becomes obsolete. But college curricula, which are invariably more kaleidoscopic than those at vocational schools or in technical apprenticeships, do offer other kinds of benefits: they require students to quickly familiarize themselves with a wide range of often unrelated subjects. This can improve both the ability—and equally important, the confidence[28]—to learn new things. Good colleges also require students to apply new knowledge for resourceful problem solving, and, because the costs of things going wrong are relatively low (compared to apprenticeships), students can take more risks.

Going to college, especially on a residential campus, also has value because it provides extracurricular social experiences. Students generally have to communicate and cooperate with a more diverse set of fellow students than they had previously encountered in their high schools, especially if the admissions office puts some weight on diversity. This kind of socialization can also be valuable in modern innovative activity, which often involves the teamwork of a changing cast of characters.

I do not have any hard data for my conjectures, but they are based on more than just personal experience and observation. In 2006, as a judge in the Kauffman Foundation's $25 million Campuses Initiative grant program, I asked nearly a dozen university presidents and chancellors how colleges in the U.S. contributed to the dynamism of its economy. Rather than touting specific knowledge, they spoke of the value of "learning how to learn" and developing confidence and socialization. Moreover, there was nothing in their remarks that would indicate that only individuals in the top 15% to 25% of the IQ distribution benefited from that value.

Is the U.S. Different from Other Countries?

The differences between the economies of the U.S. and other OECD countries are similar in manner though not magnitude to the differences we have just reviewed between the 19th-century U.S. economy and its modern incarnation.

27. Edmund S. Phelps, "Macroeconomics for a Modern Economy," *American Economic Review* 97 (2007), p. 554.

28. Learning about something entirely new poses "Knightian" uncertainty about whether the effort will be successful. Repeated prior success in learning new things reduces the uncertainty.

Differences in Attitudes

Here is a sampling of comments by CEOs, all of whom happened to be immigrants to the United States, about differences in the attitudes of their U.S. and non-U.S. customers:

"U.S. customers are more willing to spend several hundred thousand dollars on unproven products from unproven companies. They worry less about the company going bankrupt, and they relish the idea of being on the cutting edge. It's fun to be on the cutting edge, but it's challenging too. Early products don't work properly—nothing works as advertised for an early-stage product…In Europe and Japan, people are more concerned about making a mistake."

"In Germany, people expect everything to work perfectly. If it doesn't work, it's a problem. When somebody in the U.S. says, 'This is broken,' you ask them, 'How often do you use it?' They say, 'Well, maybe once a year. Come to think of it, don't worry about it.' In Germany, if it's broken, it doesn't matter how often they are going to use it: it's broken. In the U.S., there is a focus on being simple, and people don't want to waste time going through manuals. In Germany, they will invest the time to read manuals and fully understand your product. But then they expect it to work perfectly. Sales teams in Germany have the same approach. They are technically sophisticated, but if you ask them to sell something, they insist it has to be perfect.

"European IT people are more conservative. The mentality in the U.S. is, 'We'll give it a try, and if it works, great, and if it doesn't, we'll stop.' In Europe it's, 'We talk about it—we talk a lot about it—and when we feel good about it, we do it.' It isn't a trial-and-error type of culture. I came from France to business school in the U.S. In one of our first case studies, we had a group discussion to resolve a problem. Very quickly, the Americans said, 'We think we've got it. Let's just do it, then we can figure out whether it works.' As a European, I had a problem with that. I said, 'Guys, we really haven't looked at all the pros and cons. How can we make a decision?'"

"When I came to the States, I was amazed by the degree of openness of Americans to share even personal things. Consider money: money is very important in the States, but you ask to borrow someone's car, people say yes, very easily. In Europe, people say money is not important, but then try borrowing their car. The same thing happens with customers and their knowledge. In Europe, they see knowledge as an asset that they need to protect. There's also risk aversion. It's a very hierarchical structure in Europe. They may not know if they can share with you or not, but their instinct is to say no. In the U.S., people will say, 'What the heck, let me just tell you.'"

"When you go proactively for information to customers, the U.S. is better. When you are looking for reactive feedback, sometimes the Europeans are better. Why? Because a lot of Europeans in our market have a higher level of education than their American counterparts. If you ask for suggestions, they can become resistant, but if you don't ask them, they can be very vocal. So they may not be good beta customers at the very early stage, but later on, they may give you better feedback."

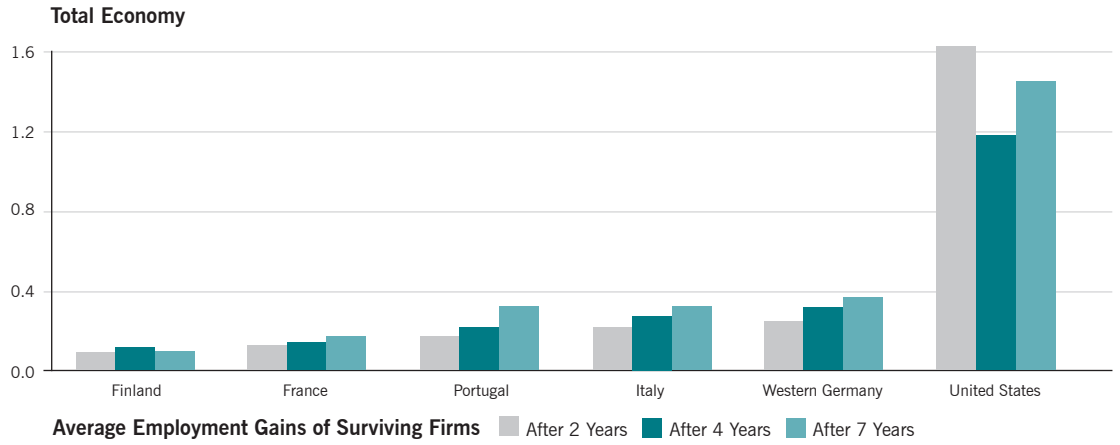
Consumers in the United States seem more willing to splurge on new things. This is not true across all products—the Japanese are famously more adventurous in their purchases of consumer electronics, and European youngsters embraced text messaging on their mobile phones long before their U.S. counterparts. But figures on aggregate consumer spending and borrowing suggest that, overall, U.S. consumers lead the pack in spending on new gizmos—whether they have the financial means or not.[29]

My interviews with the CEOs of over 100 U.S. venture-backed companies suggest that prospective customers in the U.S. are more willing take chances on unproven innovations developed by fledgling companies—and to provide candid feedback that helps refine those innovations (see box "Differences in Attitudes"). According to my interviewees, this was not because buyers abroad are less technically qualified. Rather, even if they are more knowledgeable, they are less willing to stick their necks out, possibly because of some combination of cultural norms (my interviewees' favored explanation), organizational rules, and the lower incidence of job-hopping (which could increase concern about bad investments in innovation).

The U.S. seems to offer more incentives and opportunities to grow businesses into large corporations. According to some historians, the United States has spawned many large companies because of a favorable legal and regulatory environment. In the formative years of the country, leaders such as Jefferson directed their fear of concentrated power toward

29. Steven Currall, from University College London, who has studied public attitudes toward new technologies (such as GMO and nanotechnology), wrote in an e-mail to me: "In the United States versus Europe, public attitudes toward emerging technologies (e.g., nanotechnology or GMO) appear to differ with respect to perception of the tradeoff of risk and benefit. In the U.S., the public seems more inclined to assess the level of risk in terms of not only potential negative consequences of the technology, but simultaneously in terms of potential benefits. In Europe, by contrast, the public places greater emphasis on first understanding the risks and then considering potential benefits. This orientation may make Europeans less likely to embrace emerging technologies until they feel that they have full information on possible risks."

Figure 1 **Net Employment Gains Among Surviving Firms at Different Lifetimes, 1990s**
(net gains as a ratio of initial employment)



Source: Scarpetta *et al.* (2002) OECD Working Paper No. 329

government—the issue of corporate power was moot. When the Second Industrial Revolution started, around 1880, a "tiny" government, according to business historian Thomas McCraw, left a "vacuum of power" that allowed American companies to attain "gigantic" size.[30]

Subsequently, "trust-busting" politicians did attempt to curb the power of large corporations, but as McCraw points out, antitrust legislation was "not synonymous with anti-bigness law." The "most conspicuous targets" of antitrust were giant companies, but "the majority of prosecutions" had been against groups of small firms engaging in collusive behavior.[31] Financial and labor markets—and customers—in the U.S. favor "winners" (including "up-and-comers") and shun losers. So winners get the capital, talent, and revenues that help them grow even more quickly. This tendency enabled Wal-Mart (which was founded in 1962 and went public in 1972) to rise to the top of the *Fortune* 500 list in 2002—and, not coincidentally, to become one of the largest users of IT in the world.

Growth rates of firms outside the U.S. are lower. This may be in part because the "system" doesn't feed winners and starve losers to the same degree. According to a McKinsey & Co. analysis, the top quartiles of U.S. firms by size—which are considerably more productive and larger than their European counterparts—also "attract resources and gain market share considerably faster than in the EU."[32] Similarly, regulations (and possibly opportunities for tax avoidance) encourage small firms outside the U.S. to remain small. As shown in Figure 1, start-ups (that survive) grow many times more rapidly in the U.S. than in Europe. And in service sectors such as retailing in Europe, a range of policies directly and indirectly discourages the growth of behemoths such as Wal-Mart (even though the *hyper-marché* concept supposedly originated in France with an outlet opened by Carrefour in 1963).[33]

The "development of modern sales management," according to historian Walter Friedman, "is a uniquely American story. The intense efforts to standardize salesmanship distinguished the growth of capitalism in America from that in other countries." Although "all European nations had peddling networks," none "created organized sales forces to the same degree." An important reason for this, as discussed above, was that "the scale of American firms was greater than elsewhere. The massive manufacturing concerns of the early 20th century hired salesmen in the hundreds (and even thousands)."[34] Sales efforts were "central to the growth of the U.S. economy." Sales and marketing were not "afterthoughts to the coming of industrialization, but were part and parcel of the same phenomenon. Large firms were capable not only of producing on a great scale, but also of persuasion, pressure and the fostering of an evangelical exuberance. The 'visible hand' of management…could not have succeeded…without the 'visible handshake' of a team of salesmen out on the road."[35]

In contrast, British companies, which operated on a smaller scale, and German manufacturers, who "were

30. Thomas K. McCraw, "American Capitalism," in *Creating Modern Capitalism: How Entrepreneurs, Companies, and Countries Triumphed in Three Industrial Revolutions*, ed. Thomas K. McCraw (Cambridge: Harvard University Press, 1997).
31. McCraw (1997), p. 330.
32. Ministry of Economic Affairs, Netherlands, McKinsey & Co., 2004, p. 12.
33. See, for instance, Gordon (2004), cited earlier.
34. Walter A. Friedman, *Birth of a Salesman: The Transformation of Selling in America* (Cambridge: Harvard University Press, 2004), p. 4.
35. Ibid., p. 7

rooted in craftwork traditions," did not exhibit an interest in mass selling campaigns. In addition, "Organized selling in America flourished for cultural reasons." For instance, the United States had "more fluid class boundaries" than Europe, and salesmanship "seemed to offer a path to personal success [to] Americans [who] read know-how-to-sell books and turned Bruce Barton's *The Man Nobody Knows* (1925), which portrayed Jesus Christ as a successful sales and advertising executive, into a bestseller."[36]

As mentioned earlier, purchases of IT by mainstream users (and not just by early adopters) in the service sector are exceptionally high in the U.S., possibly because those users derive more value from their IT investments than their counterparts in many countries abroad. In part, this may be the result of U.S. policies (such as fewer restrictions on big-box retailing) that permit the effective use of IT. But the exceptional capacity of U.S. managers also apparently plays an important role. A study published in 2005 suggests that the managerial capacity of U.S.-based service companies to derive value from their IT investments was especially notable when those companies operated in countries where the environment for using IT might be less favorable. The study compared establishments based in the U.K. that were owned by U.S. multinationals and non-U.S. multinationals with domestic (i.e., U.K.-based) companies, and found that establishments owned by U.S. multinationals invested about 40% more per employee in IT than the average for the industry; non-U.S. multinationals invested about 20% more than the industry average, while domestic companies invested about 15 % *less*. U.S. multinationals also apparently got more for their IT buck, achieving "significantly higher productivity of IT capital." This effect accounted for "almost all the difference" between the overall productivity of resources used by "U.S. owned and all other establishments." The study also found that the "IT edge" of U.S. multinationals was "confined to the same 'IT-intensive' industries that largely accounted for U.S. productivity growth acceleration since the mid 1990s."[37]

The researchers further argue that U.S. multinationals can use IT more effectively because of their greater "devolution"—that is, they operate "with flatter hierarchies with more control passed down to lower level employees."[38]

But I find it unlikely that decentralization is the whole story. Even as a conceptual matter, many IT systems cannot be adopted and implemented by decentralized employees. The decision to use a company-wide ERP system has to be made centrally—and its implementation also requires individual members of the organization to follow common rules and procedures.[39] In fact, some interviewees told me that one problem with selling enterprise systems to large European companies was that they operated as a collection of independent fiefdoms that would not easily agree on any corporate-wide purchase.

But my observations—both as a former management consultant and now as a field-based researcher—also lead me to believe that some "big decisions" apart, U.S. companies do give individual employees more responsibility and opportunity to exercise personal initiative than many European or Japanese companies. This ought to provide the benefit of giving decision rights to individuals with the necessary "specific knowledge," as well as of motivating employees to do their best—even if they don't expect to work in the organization for the long haul.

In other words, it isn't just that U.S. businesses are more decentralized. Notwithstanding the self-image of "rugged individualism," my impression is that people who live in the United States, or work for U.S. organizations, do submit more wholeheartedly to authority and rules than, say, Italians or Indians. And this is not to suggest that individuals in the U.S. are more compliant than their overseas counterparts—but rather that they are less cynical and more willing to identify with the good of the organizations. In my view, this is attributable in large part to the greater willingness of U.S. organizations to treat their members more as individuals than as interchangeable automatons—and to specify rules, curiously enough, that provide opportunities for individual initiative. To use a phrase popularized by Peters and Waterman, U.S. businesses have figured out the right balance of "loose-tight" controls. For example, a CEO may dictate the choice of an ERP system and may even closely monitor its implementation, but also leave ample scope for employees to exercise individual initiative and creativity.

On the higher-education front, according to most sources that I have reviewed, the U.S, is at or near the top of advanced countries in college enrollment (or the percentage of the adult population with college degrees). According to UNESCO, the gross enrollment ratios in tertiary education (i.e., the percentage of the college-age population that actually enrolls) in the U.S. was 72.6% (in 2000)—well above the 56.4% average for all developed countries. Similarly, according to OECD data, the United States had (by one definition) the highest percentage of the population aged 25 to 64 with a tertiary education.

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36. Ibid., p. 5

37. Nick Bloom, Rafella Sadun, and John Van Reenen. 2005. "It Ain't What You Do It's the Way That You Do I.T.--Testing Explanations of Productivity Growth Using U.S. Affiliates," Working paper, Centre for Economic Performance, London School of Economics, September. http://www.statistics.gov.uk/articles/nojournal/sadun_bvr25.pdf.

38. Ibid., p. 19.

39. R. Plant and Leslie P. Willcocks, "Critical Success Factors in International ERP Implementations: A Case Research Approach," London School of Economics and Political Science Working Paper, May 2006, citing the work of Markus et al (2003), argue that a decentralized global organizational structure can undermine the whole concept of ERO as appropriate for hat organization. See M.L. Markus, S. Axline, D. Petrie, and C. Tanis, "Learning from Adopters' Experiences with ERP: Problems Encountered and Successes Achieved," In *Second Wave Enterprise Resource Planning Systems: Implementing for Effectiveness*, ed. Graeme Shanks, Peter B. Seddon, and Leslie P. Willcocks (Cambridge: Cambridge University Press, 2003).

U.S. universities charge higher tuitions than those of any other country, but this may have helped them develop relatively robust financing structures. For instance, according to the *Economist*, by mobilizing private resources, the United States can spend twice as much on higher education (as a proportion of its GDP) as Germany. German universities (nearly all of which are state run) stopped charging tuition in October 1970, "in the name of access for all." Unfortunately, "ever-rising student numbers" stoked by free tuition "then met ever-shrinking budgets, so the reforms backfired. Today, the number of college drop-outs is among the highest in the rich world, making tertiary education an elite activity: only 22% of young Germans obtain a degree, compared with 31% in Britain and 39% in America. German universities come low in world rankings, so good students often go abroad."[40]

U.S. colleges, according to some observers, also seem more able to cultivate learning habits and attitudes that enhance their graduates' capacity to contribute to innovative activity. As the president of an Ivy League university put it: "In the U.S., you become a participant in education, not a victim of education, not a passenger. My experience in studying in Mexico, in France and in Germany is that it's highly passive. You can go into a classroom and sit there and not have to do anything or say anything. You certainly never do one thing that's very important in the United States: you never challenge the professors, the thought leaders."[41] According to the *Economist*, the Japanese educational system was designed 60 years ago to train children for "long, uncomplaining hours on production lines." Now the economy has "changed out of all recognition," but the educational system has retained its "emphasis on facts and figures and drilling of mental arithmetic."[42]

Concluding Comments

In previous chapters, we saw that useful innovations combine many different kinds—and levels—of know-how. Here we examined some of the elements of the modern U.S. system that have supported its exceptional capacity for developing and deploying useful innovations:

- a high level of inclusiveness and participation;
- diversity of organizational forms;
- venturesome beliefs that embrace new technologies and goods, sometimes at the expense of thrift;
- a premium on growth;
- the capacity to systematically manage the development marketing and use of new technologies; and
- tertiary education that promotes the skills and attitudes necessary to develop and acquire new knowledge.

Although I do not discuss how the elements interact, they surely reinforce each other. High enrollment in colleges promotes wide participation in the innovation system, which then improves economic opportunities for college graduates. Attractive prospects in turn encourage many to incur the high costs of a college education. Similarly, professional sales techniques help users deploy new products effectively, which then nurture a predisposition to buy new products. The predisposition in turn encourages innovators to develop new products—and to invest in sales and marketing. In other words, modern innovation is sustained by a system of interconnected elements rather than through the simple addition of causal factors.

The system is elusive in that we cannot fully understand how all the elements interact or what their ultimate sources are. My list of elements is no doubt incomplete; and even with the elements listed above, I cannot provide a sensible scheme for their measurement or quantification. Nevertheless, in thinking about how public policies might nurture or advance innovation, we want to keep in mind these elusive and systemic underpinnings of our general prosperity.

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40. "Jacob's Ladder—German Higher Education," *The Economist*, December 16, 2006.

41. Response to author's question at Campuses Initiative event at the Kauffman Foundation.

42. "The Wrong Answer," *The Economist*, December 19, 2006.

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