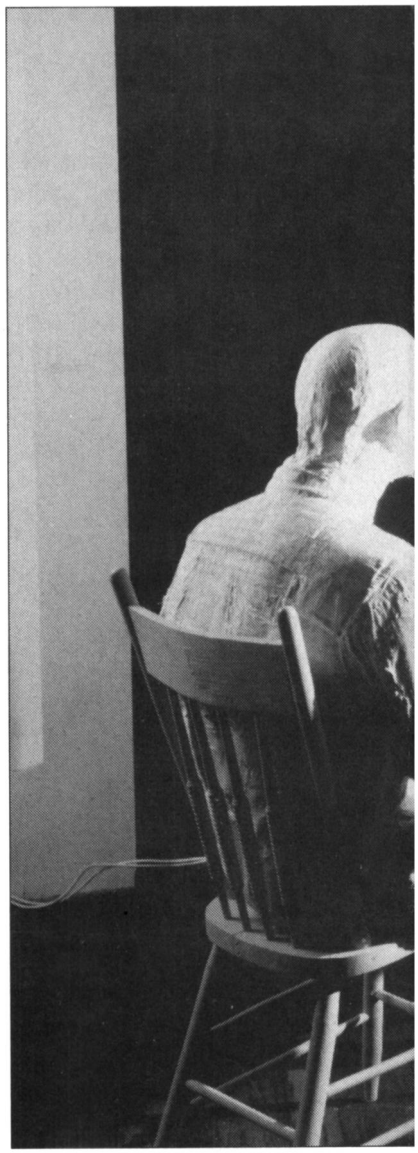
THE RISE OF THE KNOWLEDGE SOCIETY

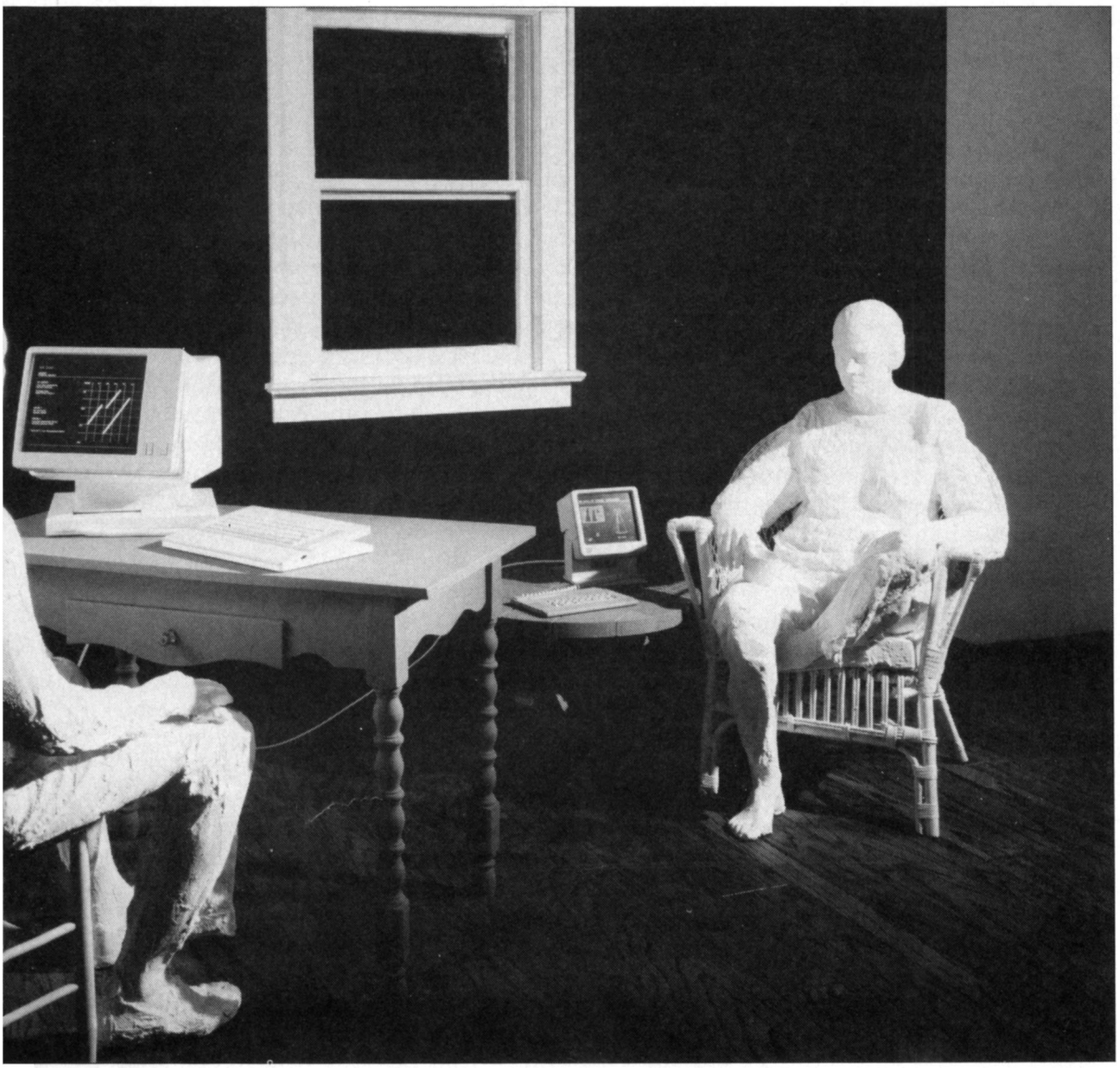
BY PETER F. DRUCKER



Since ancient times, new knowledge and new inventions have periodically remade human societies. Today, however, knowledge is assuming greater importance than ever before. Now more essential to the wealth of nations than either capital or labor, Peter Drucker argues here, it has already created a "postcapitalist" society and promises further transformations on a global scale.

In only 150 years, between about 1750 and 1900, capitalism and technology conquered the globe and created a world civilization. Neither capitalism nor technical innovations were new; both had been common, recurrent phenomena throughout the ages in both the West and the East. What was new was the speed of their diffusion and their global reach across cultures, classes, and geography. And it was this speed and scope that converted technical advances into the Industrial Revolution and capitalism into Capitalism. Instead of being one element in society, as all earlier expressions of capitalism had been, Capitalism—with a capital C—became society. Instead of being confined, as always before, to a narrow locality, Capitalism prevailed throughout all of Western and Northern Europe by 1850. Within another 50 years it spread throughout the entire inhabited world.

This transformation was driven by a radical change in the meaning of knowledge. In both the West and Asia knowledge had al-



George Segal's *Machine of the Year* (1983)

ways been seen as applying to *being*. Almost overnight, it came to be applied to *doing*. It became a resource and a utility. Knowledge had always been a private good. Almost overnight it became a public good.

For 100 years—in the first phase—knowledge was applied to *tools, processes,* and *products*. This created the Industrial Revolution. But it also created what Marx called "alienation" and new classes and class war, and with them communism. In its second phase, beginning around 1880 and culminating around World War II, knowledge in its new meaning came to be applied to work. This ushered in the Productivity Revolution, which in 75 years converted the proletariat into a middle-class bourgeoisie with near-upper-class income. The Productivity Revolution thus defeated class war and communism. The last phase began after World War II. Knowledge is being applied to *knowledge* itself. This is the Management Revolution. Knowledge is now fast becoming the *one* factor of production, sidelining both capital and labor. It may

be premature (and certainly would be presumptuous) to call ours a "knowledge society." So far we have only a knowledge economy. But our society today is surely "postcapitalist."

From earliest times, new tools, new processes, new materials, new crops, new techniques—what we now call "technology"—diffused swiftly throughout the Old World. Few modern inventions, for instance, spread as rapidly as a 13th-century one: eyeglasses. Derived around 1270 from the optical experiments of an English Franciscan friar, Roger Bacon, reading glasses for the elderly were in use at the papal court at Avignon by 1290, at the sultan's court in Cairo by 1300, and at the court of the Mongol emperor of China no later than 1310. Only the sewing machine and the telephone, fastest-spreading of all 19th-century inventions, moved as quickly.

But earlier technological change almost without exception remained confined to one craft or one application. It took another 200 years, until the early 16th century, before Bacon's invention acquired a second application: to correct nearsightedness. Similarly, the redesign of the windmill around A.D. 800, which converted it from the toy it had been in antiquity into a true machine, was not applied to ships for more than 300 years. Ships were still oared; if wind was used at all to propel them it was as an auxiliary and only if the breeze blew in the right direction.

The inventions of the Industrial Revolution, however, were immediately applied across the board, and across all conceivable crafts and industries. They were immediately seen as technology. James Watt's redesign of the steam engine between 1765 and 1776 made it into a cost-effective provider of power. Watt himself throughout his own productive life focused on only one use of his engine: to pump water out of mines—the use for which the steam engine had first been designed by Thomas Newcomen in the early years of the 18th century. But one of England's leading iron masters immediately saw that the redesigned steam engine could also be used to blow air into a blast furnace, and so he put in a bid for the second engine Watt built. Furthermore, Watt's partner, Matthew Boulton, promptly promoted the steam engine as a provider of power for all kinds of industrial processes, especially, of course, for what was then the largest of all manufacturing industries, textiles. Thirty-five years later, an American, Robert Fulton, floated the first steamboat on New York's Hudson River. Twenty years later the steam engine was put on wheels and the locomotive was born. And by 1840—at the latest by 1850—the steam engine had transformed every single manufacturing process, from glassmaking to printing. It had transformed long-distance transportation on land and sea, and it was beginning to transform farming. By then, too, it had penetrated almost the entire world—with Tibet, Nepal, and the interior of tropical Africa the only exceptions.

As in the 19th century, most people today still believe that the Industrial Revolution was the first time a change in the "mode of production" (to use Karl Marx's term) changed social structure and created new classes, the capitalist and the proletarian. It was not. Between A.D. 700 and 1100 two new classes emerged in Europe as a result of technological change: the feudal aristocracy and urban craftsmen. The knight was created by the invention of the stirrup, an innovation coming out of Central Asia around the year A.D. 700; the craftsman by the redesign of water wheel and windmill into true

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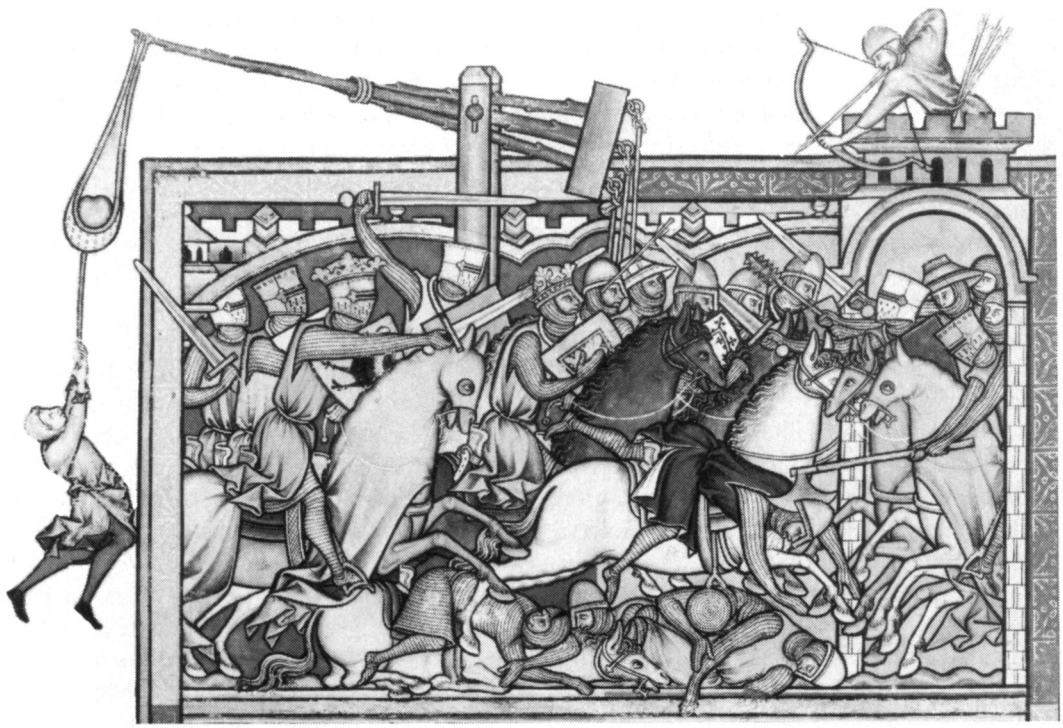


The age of the feudal knight, an invincible fighter supported on horseback by stirrups, was already succumbing to technological and social change at the time of this 13th-century French painting.

machines that, for the first time, used inanimate forces rather than muscle as motive power.

The stirrup made it possible to fight on horseback. Without it a rider wielding a lance, sword, or heavy bow would have been thrown off his horse by the force described in Newton's Third Law: "To every action there is always opposed an equal reaction." For several hundred years the knight was an invincible fighting machine. But this machine had to be supported by a "military-agricultural complex"—something quite new in history. Germans until this century called it a *rittergut*, a knight's estate endowed with legal status and with economic and political privileges, and populated by at least 50 peasant families to produce the food needed to support the fighting machine: the knight, his squire, his three horses, and his 12 to 15 grooms. The stirrup, in other words, created feudalism.

The craftsmen of antiquity had been slaves. The craftsmen of the first "machine age," the craftsmen of Europe's Middle Ages, became the urban ruling class, the "burghers" who created Europe's unique city, and both the Gothic period and the Renaissance.

The technical innovations—stirrup, water wheel, and windmill—traveled throughout the entire Old World, and fast. But the social transformations involved in this earlier industrial revolution remained largely contained within Europe. Only in Japan around A.D. 1100 did there arise proud and independent craftsmen who enjoyed high esteem and, until 1600, considerable power. But while the Japanese adopted the stirrup for riding, they continued to fight on foot. The rulers in rural Japan were the commanders of foot soldiers—the *daimyo*. They levied taxes on the peasantry but possessed no feudal estates. In China, in India, and in

the world of Islam, the new technologies had no social impact whatever. Craftsmen in China remained serfs without social status. The military did not become landowners but remained, as in Europe's antiquity, professional mercenaries. Even in Europe, the social changes generated by this early industrial revolution took almost 400 years to take full effect.

By contrast, the social transformation of society brought about by Capitalism and the Industrial Revolution took fewer than 100 years in Western Europe. In 1750 capitalists and proletarians were still marginal groups. In fact, proletarians in the 19th-century meaning of the term—that is, factory workers—hardly existed at all. By 1850 capitalists and proletarians were the dynamic classes of Western Europe. They rapidly became the dominant classes wherever capitalism and modern technology penetrated. In Japan the transformation took fewer than 30 years, from the Meiji Restoration in 1867 to the war with China in 1894. It took not much longer in Shanghai and Hong Kong, Calcutta and Bombay, or in the tsar's Russia. Capitalism and the Industrial Revolution—because of their speed and their scope—created a world civilization.

Unlike those "terrible simplifiers," Hegel, Marx, and other 19th-century ideologues, we know that major historical events rarely have just one cause and just one explanation. They typically result from the convergence of a good many separate and independent developments. Many disparate trends—most of them probably quite unconnected with one another—went into making capitalism into Capitalism and technical advance into the Industrial Revolution. The best-known theory—that Capitalism was the child of the "Protestant Ethic"—expounded in the opening years of this century by the German sociologist Max Weber, has been largely discredited. There is simply not enough evidence for it. There is only a little more evidence to support Karl Marx's earlier thesis that the steam engine, the new prime mover, required such enormous capital investment that craftsmen could no longer finance their "means of production" and thus had to cede control to the capitalist. There is one critical element, however, without which capitalism and technical advance could not possibly have turned into a worldwide social pandemic. It is the radical change in the meaning of knowledge that occurred in Europe around the year 1700.

There are as many theories about what we can know and how we know it as there have been metaphysicians, from Plato in antiquity to Ludwig Wittgenstein and Karl Popper in our own century. But since Plato's time there have been only two theories in the West—and since roughly the same time, two theories in Asia—regarding the meaning and function of knowledge. According to Plato, Socrates held that the only function of knowledge is self-knowledge, that is the intellectual, moral, and spiritual growth of the person. Socrates' ablest opponent, the brilliant and learned Protagoras, held, however, that the purpose of knowledge is to make the holder effective by enabling him to know what to say and how to say it. For Protagoras knowledge meant logic, grammar, and rhetoric—later to become the trivium, the core of learning in the Middle Ages and still very much what we mean by a "liberal education" or what the Germans mean by *allgemeine Bildung* (general education). In Asia there were essentially the same two theories of knowledge. Knowledge for the Confucian was knowing what to say and how to say it, the way to advancement and earthly success. Knowledge for the Taoist and the Zen monk was self-knowledge, and it was the road to enlightenment and wisdom. But while the two sides thus sharply disagreed about what knowledge means, they were in total agreement about what it did not mean. It did not mean *ability to do*. It did not mean utility. Utility was not knowledge; it was skill—the Greek word for which is *techné*.

Unlike their Eastern contemporaries, the

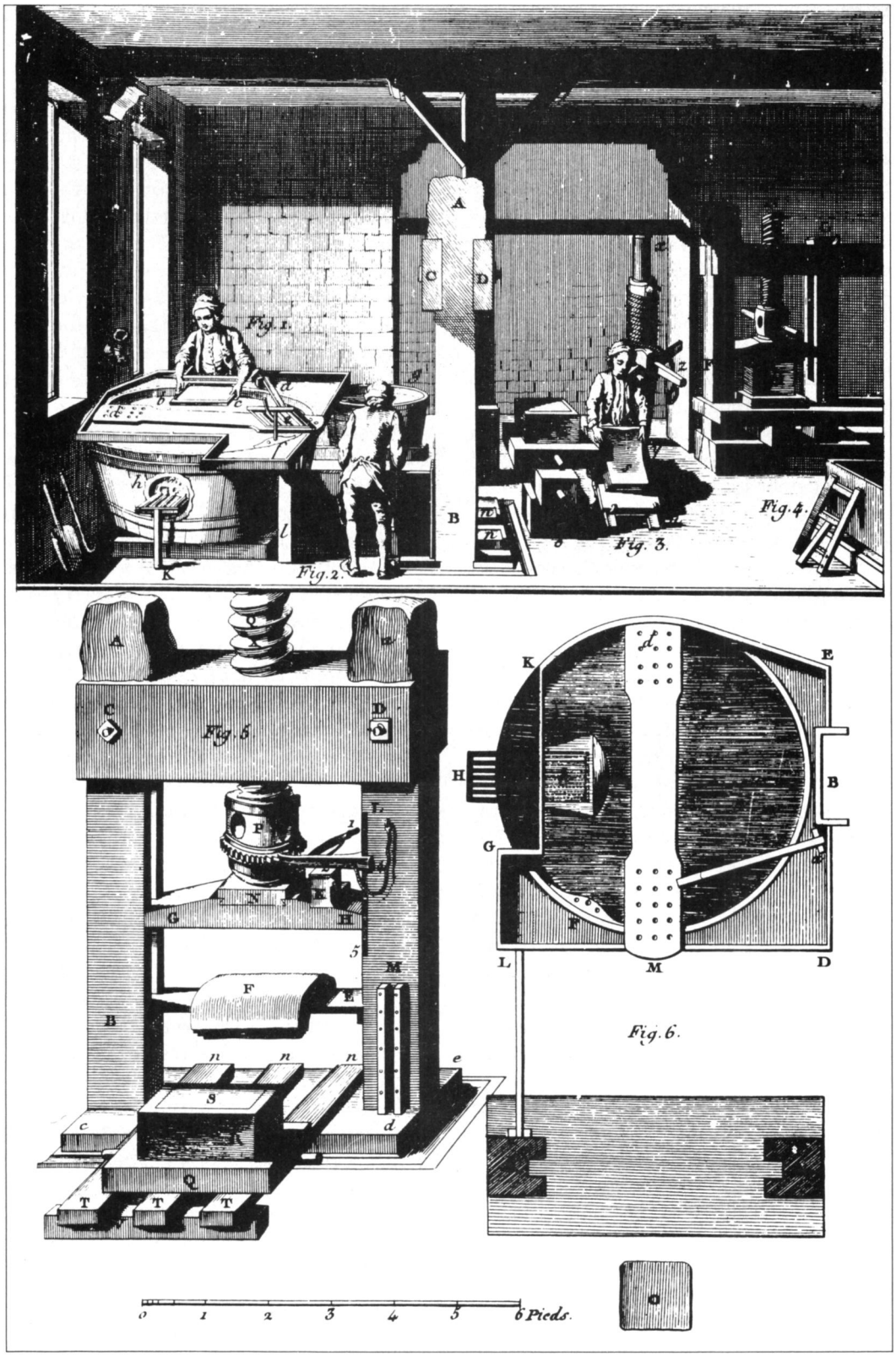
Chinese Confucians, with their infinite contempt for anything but book learning, both Socrates and Protagoras respected *techné*. But even to Socrates and Protagoras, *techné*, however commendable, was not knowledge. It was confined to one specific application and involved no general principles. What the shipmaster knew about navigating from Greece to Sicily could not be applied to anything else. Furthermore, the only way to learn a *techné* was through apprenticeship and experience. A *techné* could not be explained in words, whether spoken or written. It could only be demonstrated by one who had mastered it. As late as 1700 or even later, the English did not speak of "crafts." They spoke of "mysteries"—not only because the possessor of a craft skill was sworn to secrecy but also because a craft by definition was inaccessible to anyone who had not been apprenticed to a master and taught by example.

Then, beginning after 1700—and within the incredibly short span of 50 years—technology was invented. The very word is a manifesto in that it combines *techné*, that is the mystery of a craft skill, with *logy*, organized, systematic, purposeful knowledge. The first engineering school, the French École des Pontes et Chaussées, was founded in 1747, followed around 1770 in Germany by the first school of agriculture, and in 1776 by the first school of mining. In 1794 the first technical university, France's École Polytechnique, was founded and with it was born the profession of engineering. Shortly thereafter, between 1820 and 1850, medical education and medical practice were reorganized as a systematic technology.

As part of a parallel development in Britain, the meaning of patents shifted between 1750 and 1800. Once monopolies to enrich royal favorites, patents now were granted to encourage the application of knowledge to tools, products, and processes, and to reward inventors, provided they published their inventions. This not only triggered a century of feverish mechanical invention in Britain; it finished craft mystery and secretiveness.

The great document of this dramatic shift from skill to technology—one of the more important books of all time—was the *Encyclopédie* (1751–72), edited by Denis Diderot and Jean d'Alembert. This monumental work attempted to bring together in organized and systematic form the knowledge of all crafts, and in such a way that the nonapprentice could learn to be a "technologist." It was by no means accidental that articles in the *Encyclopédie* that describe individual crafts such as spinning or weaving were not written by craftsmen. They were written by "information specialists": people trained as analysts, as mathematicians, as logicians. Both Voltaire and Rousseau were contributors. The underlying thesis of the *Encyclopédie* was that effective results in the material universe—in tools, processes, and products—are produced by systematic analysis, and by systematic, purposeful application of knowledge. But the *Encyclopédie* also preached that principles that produced results in one craft would produce results in any other. That was anathema, however, to both the traditional man of knowledge and the traditional craftsman.

None of the technical schools of the 18th century aimed at producing new knowledge—nor did the *Encyclopédie*. None even talked of the application of science to tools, processes, and products, that is, to technology. This idea had to wait until around 1840, when Justus Liebig, a German chemist, applied science to invent artificial fertilizers and a way to preserve animal protein, in the form of meat extract. What the early technical schools and the *Encyclopédie* did, however, was perhaps more important. They brought together, codified, and published the *techné*, the craft mystery, as it had been developed over millennia. They converted experience into knowledge, apprenticeship into textbook, secrecy into methodology, doing into applied knowledge. These are the essentials of what we have come to call the Industrial Revolution, in other words, the transformation by technol-



Diderot's Encyclopédie *included descriptions of some 250 crafts. This illustration is one of more than a dozen accompanying a lengthy technical article on paper- and book-making.*

ogy of society and civilization worldwide.

It is this change in the meaning of knowledge that then made modern Capitalism inevitable and dominant. Above all, the speed of technical change created a demand for capital far beyond anything the craftsman could possibly supply. The new technology also required the concentration of production: thus the shift to the factory. Knowledge could not be applied in thousands of small individual workshops and in the cottage industries of the rural village. The new technology also required large quantities of energy, whether water power or steam power, which also encouraged concentration. Although they were important, these energy needs were secondary. The central point was that production almost overnight moved from being craft-based to being technology-based. As a result the capitalist moved into the center of economy and society.

As late as 1750, large-scale enterprise was governmental rather than private. The earliest and for many centuries the greatest of all manufacturing enterprises in the Old World was the famous arsenal owned and run by the government of Venice. And the 18th-century "manufactories" such as the porcelain works of Meissen and Sèvres were still government-owned. But by 1830 large-scale private capitalist enterprise dominated in the West. By the time Karl Marx died in 1883, private capitalist enterprise had penetrated everywhere except to such remote corners of the world as Tibet and the Empty Quarter of Arabia.

Adam Smith's *Wealth of Nations* appeared in the same year—1776—in which James Watt patented the perfected steam engine. Yet the *Wealth of Nations* pays practically no attention to machines or factories or industrial production. The production it describes is still craft-based. Even 40 years later, after the Napoleonic Wars, factories and machines were not yet seen as central even by acute social observers. They play practically no role in the economics of David Ricardo. Even more surprising, neither factory workers nor bankers can be found in the novels of Jane Austen, England's most perceptive social critic. Her society (as has often been said) is thoroughly bourgeois. But it is still totally preindustrial, a society of squires and tenants, parsons and naval officers, lawyers, craftsmen, and shopkeepers. Only in faraway America did Alexander Hamilton see very early that machine-based manufacturing was fast becoming the central economic activity. But few even among his followers paid much attention to his 1791 *Report on Manufactures* until long after his death.

By the 1830s, however, Honoré de Balzac was turning out best-selling novel after best-selling novel depicting a capitalist France whose society was dominated by bankers and the stock exchange. And 15 years later, capitalism, the factory system, and the machine, were central in the mature works of Charles Dickens, as were the new classes, the capitalists and the proletarians. In *Bleak House* (1852), the new society and its tensions form the subplot in the contrast between two able brothers, both sons of the squire's housekeeper. One becomes a great industrialist in the North who plans to get himself elected to Parliament to fight the landowners and break their power. The other chooses to remain a loyal retainer of the broken, defeated, ineffectual, precapitalist "gentleman." And Dickens's *Hard Times* (1854) is the first and by far the most powerful industrial novel, the story of a bitter strike in a cotton mill and of class war at its starkest.

The social tensions and conflicts of the new order were created by the unheard-of speed with which society was transformed. We now know that there is no truth in the nearly universal belief that factory workers in the early 19th century were worse off and treated more harshly then they had been as landless laborers in the preindustrial countryside. They were badly off, no doubt, and harshly treated. But they flocked to the factory precisely because they were still better off

there than they were at the bottom of a static, tyrannical, and starving rural society. The new factory workers experienced a much better "quality of life." In the factory town infant mortality immediately went down and life expectancy rose, thus triggering the enormous population growth of industrializing Europe. Today—in fact, since World War II—we have the example of the Third World countries. Brazilians and Peruvians stream into the *favelas* and barrios of Rio de Janeiro and Lima. However hard, life there is better than in the impoverished *Noreste* of Brazil or on Peru's altiplano. As an Indian saying goes, "The poorest beggar in Bombay still eats better than the farm hand in the village."

While industrialization from the beginning meant material improvement rather than Marx's famous "immiseration," the pace of change was so breathtaking as to be deeply traumatic. The new class, the "proletarians," became "alienated," to use Marx's term. Their alienation, Marx predicted, would make inevitable their exploitation. They were becoming totally dependent for their livelihood on access to the "means of production," which were owned and controlled by the capitalist. This, Marx predicted, would increasingly concentrate ownership in fewer and bigger hands and increasingly impoverish a powerless proletariat—until the day when the system would collapse of its own weight, with the few remaining capitalists being overthrown by proletarians who "had nothing to lose but their chains."

Most of Marx's contemporaries shared his view of capitalism even if they did not necessarily share his prediction of the outcome. Even anti-Marxists accepted Marx's analysis of the "inherent contradictions of capitalism." Some, such as J. P. Morgan, the American banker, were confident that the military would keep the proletarian rabble in check. Liberals of all stripes believed that somehow there could be reform and amelioration. But practically every thinking person of the late 19th century shared with Marx the conviction that capitalist society was a society of inevitable class conflict—and in fact by 1910 most "thinking people," at least in Europe (but also in Japan), were inclining toward socialism. The greatest of 19th-century conservatives, Benjamin Disraeli, saw capitalist society very much as Marx did. So did his conservative counterpart on the Continent, Otto von Bismarck, and it motivated him, after 1880, to enact the social legislation that ultimately produced the 20th-century welfare state.

By 1950 a good many observers already knew that Marxism had failed both morally and economically. (I had said so already in 1939, in my book, *The End of Economic Man.*) But Marxism was still the one coherent ideology for most of the world. And for most of the world it looked invincible. What finally overcame the "inevitable contradictions of capitalism," the "alienation" and "immiseration" of the proletarians and with it the "proletarian" condition altogether? The answer is the *Productivity Revolution.*

When knowledge changed its meaning 250 years ago, it began to be applied to tools, processes, and products. This is still what "technology" means to most people and what is being taught in engineering schools. But two years before Marx's death the Productivity Revolution began. In 1881, Frederick Winslow Taylor, then a foreman in a steel plant, first applied knowledge to the study of *work*, the analysis of work, and the engineering of work.

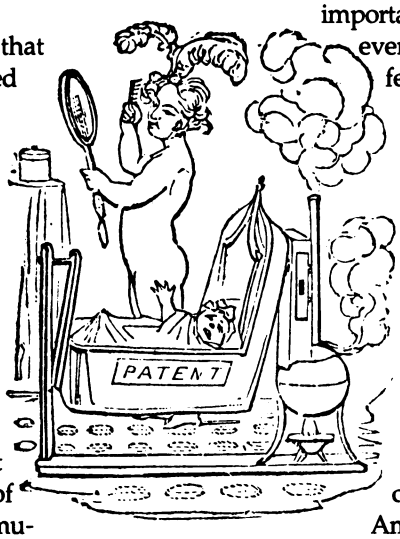
In the West the dignity of work has received lip service for a long time. The second oldest Greek text, following the Homeric epics by only 100 years or so, is a poem by Hesiod (eighth century B.C.), entitled *Works and Days*, which sings of the work of the farmer. One of the finest Roman poems is Virgil's *Georgics*, a cycle of songs about the farmer's labor written in the first century B.C. Although there is no such concern with work in Asia's literary traditions, the emperor of China once a year touched a plow to celebrate rice planting. But neither in the West nor in

Asia did work receive more than token gestures. Neither Hesiod nor Virgil actually looked at what a farmer *does*. Nor did anybody else throughout most of recorded history. Work was beneath the attention of the educated, the well-to-do, and the powerful. Work was what slaves did. "Everybody knew" that the only way a worker could produce more was by working longer hours or by working harder. Marx too shared this belief, as did every other 19th-century economist or engineer.

It was by pure accident that Taylor, a well-to-do, educated man, became a worker. Poor eyesight forced him to abandon plans to enter Harvard, where he had been accepted, and to take instead a job as an apprentice machinist. Being highly gifted, Taylor very soon rose to be one of the bosses. His metalworking inventions made him a rich man very early. What got Taylor started on the study of work was his shock at the mutual and growing hatred between capitalists and workers, which had come to dominate the late 19th century. Taylor, in other words, saw what Marx saw and what Disraeli and Bismarck saw. But he also recognized something else: The conflict was unnecessary. He set out to make workers productive so that they would earn decent money.

Taylor's goal was not to improve efficiency. It was not to create profits for the owners. To his death he maintained that the major beneficiary of rising productivity had to be the worker, not the owner. His main concern was the creation of a society in which owners and workers, capitalists and proletarians, had a common interest in productivity and could build a relationship of harmony based on the application of knowledge to work. His lesson has been best understood by Japan's post-World War II employers and unions.

Few thinkers in history have had greater impact than Taylor. And few have been so willfully misunderstood and so assiduously misquoted. In part, Taylor has suffered because history has proven him right and the intellectuals wrong. In part, Taylor is ignored because contempt for work still lingers, above all among the intellectuals. Surely shoveling sand—the subject of Taylor's most famous analysis—is not something an "educated person" would appreciate, let alone consider important. In much larger part, however, Taylor's reputation has suffered precisely because he applied knowledge to the study of work. This was anathema to the labor unions of his day, and they mounted against Taylor one of the more vicious campaigns of character assassination in American history. Taylor's crime, in the eyes of the unions, was his assertion that there is no "skilled work." In manual operations there is only "work." All work can be analyzed the same way. Any worker who is willing to do the work the way analysis shows it should be done, is a "first-class man," deserving a "first-class wage"—that is, as much as, or more than, the skilled worker got with his long years of apprenticeship.



The steam engine's influence was felt in many different realms—including the popular imagination.

The unions that were most respected and powerful in Taylor's America were the unions in the government-owned arsenals and shipyards in which, prior to World War I, virtually all peacetime U.S. defense production occurred. These unions were craft monopolies, and membership in them was largely restricted to sons or relatives of members. They required an apprenticeship of five to seven years but had no systematic training or work study. The unions allowed nothing to be writ-

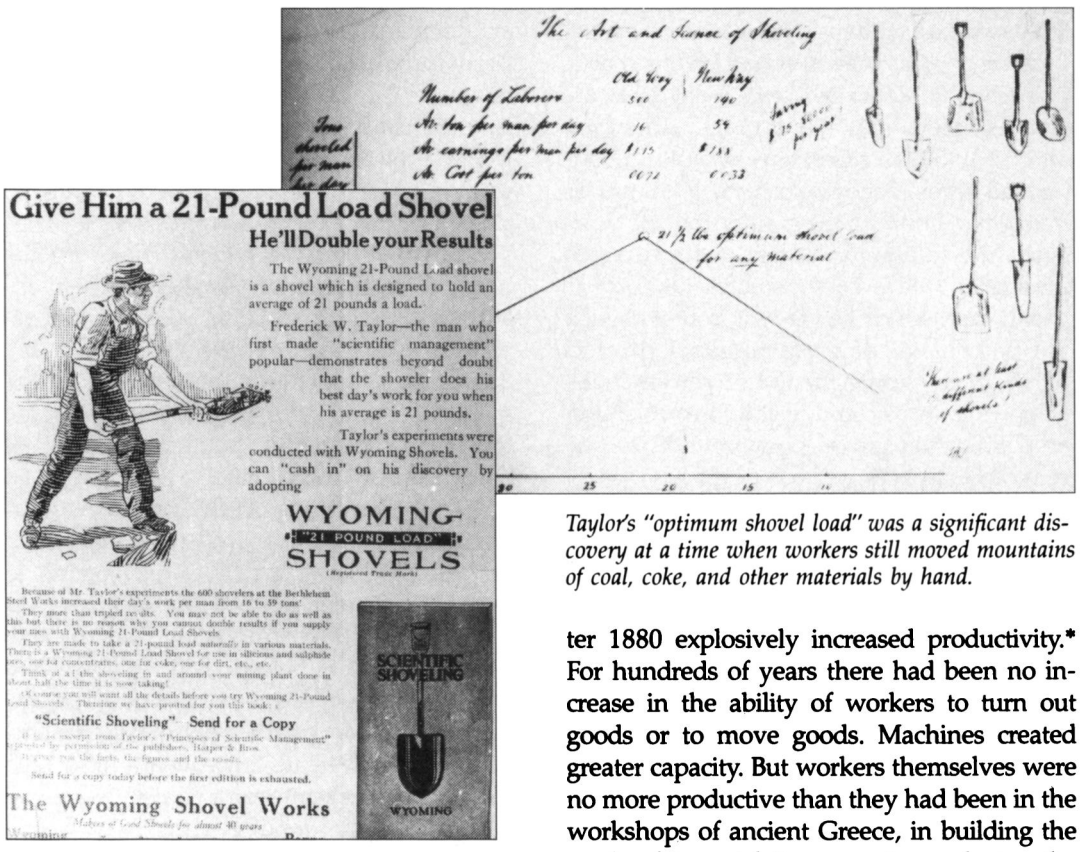
ten down. There were not even blueprints or any other drawings of the work to be done. Union members were sworn to secrecy and forbidden to discuss their work with nonmembers. Taylor's assertion that work could be studied, analyzed, and divided into a series of simple repetitive motions, each of which had to be done in its one right way, in its own best time, and with its own right tools, was indeed a frontal attack on such encrusted guild practices. And so the unions vilified him. They even succeeded in persuading Congress to ban Taylor's "task study" method in government arsenals and shipyards, a ban that remained in force until after World War II.

Taylor's dealings with owners were as bad as those with unions, a fact that further hurt his cause. While he had little use for unions, he was contemptuous of owners. His favorite epithet for them was "hogs." And then there was his insistence that the workers rather than the owners should get the lion's share of the increased revenue that the application of his theory of "Scientific Management" would produce. Adding insult to injury, his "Fourth Principle" demanded that work study be done in consultation, if not in partnership, with the worker. Finally, Taylor held that authority in the plant should be based not on ownership but solely on superior knowledge. He demanded, in other words, what we now call "professional management"—and that was anathema to 19th-century capitalists. They bitterly attacked him as a troublemaker and a socialist. (Some of his closet disciples and associates, especially Carl Barth, his right-hand man, were indeed avowed leftists and strongly anticapitalist.)

Taylor's axiom that all manual work, skilled or unskilled, could be analyzed and organized by the application of knowledge seemed preposterous to his contemporaries. The ancient belief that there was a mystique to craft skill continued to be accepted for many years after Taylor made his case. This belief encouraged Hitler in 1941 to welcome war with the United States. For the United States to field an effective force in Europe would require a large fleet to transport troops, and America at that time had almost no merchant marine or destroyers to protect it. Modern war, Hitler further argued, required precision optics in large quantities for bombsights and other devices, and there were no skilled optical workers in America.

Hitler was absolutely right. The United States did not have much of a merchant marine, and its destroyers were few and ludicrously obsolete. It also had almost no optical industry. But by applying Taylor's "task study," American industry, which played a far more important role in war production than the old government arsenals, learned how to train totally unskilled workers, many of them former sharecroppers raised in a preindustrial environment, and convert them in 60 or 90 days into first-rate welders and shipbuilders. The United States trained within a few months the same kind of people to turn out precision optics superior in quality to what the Germans produced, and did this, furthermore, on an assembly line.

Taylor's greatest impact was in showing the importance of training. Only a century before Taylor, Adam Smith had taken for granted that it took at least 50 years of experience (and more likely a full century) for a country or a region to acquire the necessary skills to turn out high-quality products. His examples were the production of musical instruments in Bohemia and Saxony and of silk fabrics in Scotland. Seventy years later, around 1840, August Borsig—one of the first people outside England to build a steam locomotive—invented what is still the German system of apprenticeship, combining practical plant experience under a master with theoretical grounding in school. This system remains the foundation of Germany's industrial productivity. But even Borsig's apprenticeship took three to five years. Then, first during World War I, but especially during World War II, the United States systematically applied



Taylor's "optimum shovel load" was a significant discovery at a time when workers still moved mountains of coal, coke, and other materials by hand.

Taylor's approach, training "first-class men" (and women) to perform simplified tasks in a few months' time. This, more than any other factor, explains why the United States was able to defeat Japan and Germany.

All earlier economic powers in modern history—England, the United States, Germany—emerged through leadership in new technology. The new post–World War II economic powers—first Japan, then South Korea, Taiwan, Hong Kong, and Singapore—all owe their rise to an appreciation of Taylor's teachings about training. It enabled them to endow a still largely preindustrial and therefore still low-wage work force with world-class productivity in practically no time. In the post–World War II decades Taylor-based training became the one truly effective engine of economic development.

The application of knowledge to work after 1880 explosively increased productivity.* For hundreds of years there had been no increase in the ability of workers to turn out goods or to move goods. Machines created greater capacity. But workers themselves were no more productive than they had been in the workshops of ancient Greece, in building the roads of imperial Rome, or in producing the highly prized woolen cloth that gave Renaissance Florence its wealth. But within a few years after Taylor began to apply knowledge to work, productivity began to rise at a rate of 3.5 to four percent annually, which meant that productivity doubled every 18 years or so. Ever since Taylor's principles took hold at the turn of the century, productivity has increased some 50-fold in all advanced countries. On this unprecedented expansion rest all the increases in both standard of living and quality of life in developed countries.

Half of this additional productivity has been used to increase purchasing power—creating a higher standard of living. But people have used between one-third and one-half to increase their leisure time. As late as

*The term *productivity* was unknown in Taylor's time. In fact, it was unknown until World War II, when it first began to be used in the United States. As late as 1950 the most authoritative English dictionary, the *Concise Oxford*, still did not define the term as it is used today.

1910, workers in developed countries still labored as long as they ever had before, that is, at least 3,000 hours per year. Today even the Japanese work only 2,000 hours, Americans around 1,850, and Germans at most 1,600—and all three nations produce 50 times as much per hour as they produced 80 years ago. Other substantial shares of the increased productivity have been taken in the form of health care, which has grown from a negligible percentage of gross national product (GNP) to between eight and 12 percent in developed countries, and in the form of education, which has grown from around two percent of GNP to 10 percent or more.

Most of this increase—as Taylor predicted—has been taken by the workers, that is, by Marx's proletarians. Henry Ford brought out the first cheap automobile, the Model T, in 1908. It was cheap, however, only by comparison with all other automobiles on the market, which in terms of average incomes cost as much as a two-engine private plane costs today. At $825, the Model T cost what an American industrial worker earned in three to four years—80 cents was then a good day's wage (and, of course, there were no benefits). Today, a unionized automobile worker in the United States, Japan, or Germany, working only 40 hours a week, earns $50,000 in wages and benefits—$45,000 after taxes—which is roughly six times what a cheap new car costs today.

By 1930 Taylor's Scientific Management—despite resistance from unions and intellectuals—had swept the developed world. As a result Marx's proletarian became a bourgeois. The blue-collar manufacturing worker rather than the capitalist became the true beneficiary of Capitalism and the Industrial Revolution. This explains the total failure of Marxism in the highly developed countries for which Marx had predicted revolution by 1900. It explains why, after 1918, there was no proletarian revolution, even in the defeated countries of Central Europe where there was misery, hunger, and unemployment. It explains why the Great Depression did not lead to a communist revolution, as Stalin and practically all Marxists had confidently expected. By the 1930s, Marx's proletarians had not yet become affluent. But they had already become middle class. They had become productive.

Darwin, Marx, and Freud make up the trinity often cited as the "makers of the modern world." Marx would be taken out and replaced by Taylor if there were any justice. But that Taylor is not given his due is a minor matter. It *is* a serious matter, however, that too few people realize that it is the application of knowledge to work that created developed economies by setting off the productivity explosion of the last hundred years. Technologists give credit to machines, economists to capital investment. But both elements were as plentiful in the first hundred years of the capitalist age, that is before 1880, as they were afterward. But there was absolutely no increase in worker productivity during the first hundred years—and consequently also little increase in workers' real incomes or any reduction in their working hours. What made the second hundred years so critically different can be explained only as the result of *the application of knowledge to work.*

The Productivity Revolution, however, has come to an end. When Taylor started propounding his principles, nine out of every 10 working people did manual work, making or moving things, whether in manufacturing, farming, mining, or transportation. The productivity of people engaged in making and moving things is still going up at the historical rate of 3.5 to four percent annually—and in American and French agriculture, even faster. Forty years ago people who engaged in work to make or to move things were still a majority in all developed countries. By 1990 this group had shrunk to one-fifth of the work force. By 2010 it will constitute no more than one-tenth. Increasing the productivity of manual workers in manufacturing, in farming, in mining, in transportation, can no longer create wealth by itself. The Productivity Revolu-

tion has become a victim of its own success. From now on what matters is the productivity of nonmanual workers. And that requires *applying knowledge to knowledge.*

When I decided in 1926 not to go to college after finishing secondary school, my father was quite distressed. Ours had long been a family of lawyers and doctors. Yet my father did not call me a dropout. He did not try to change my mind. And he did not even predict that I would never amount to anything.

I was a responsible adult wanting to work as an adult. (That I then also got a doctorate on the side had more to do with my trying to annoy my father than with any belief on my part that it would make any difference in my life and career.) Thirty years later, when my son reached age 18, I practically forced him to go to college. Like his father, he wanted to be an adult among adults. Like his father, he felt that in 12 years of sitting in school he had learned little, and that his chances of learning much by spending four more years in school were not particularly great. And yet by 1958, 31 years after I had moved from being a high-school graduate to being a trainee in an export firm, the college degree had become a necessity. It had become the passport to virtually all careers. Not to go to college in 1958 was "dropping out" for an American boy who had grown up in a well-to-do family and who had done well in school. My father did not have the slightest difficulty finding a trainee job for me in a reputable merchant house. Thirty years later such firms would not have accepted a high-school graduate as a trainee. All of them would have said, "Go to college for four years—and then you probably should go on to graduate school."

In my father's generation—he was born in 1876—going to college was either for the sons of the wealthy or for a very small number of poor but exceptionally brilliant youngsters (such as himself). Of all the American business successes of the 19th century, only one went to college: J. P. Morgan, who went to Goettingen to study mathematics but dropped out after one year. Few others even attended high school, let alone graduated from it. By my time, going to college was already desirable. It gave social status. But it was by no means necessary, nor much of a help in one's life and career. When I made my first study of a major business corporation, General Motors (published as *Concept of the Corporation* in 1946), the GM public-relations department tried very hard to conceal the fact that a good many of the company's top executives had gone to college. The proper thing then was to start as a machinist and work one's way up. As late as 1960, the quickest route to a middle-class income—in the United States, Great Britain, and Germany (though already no longer in Japan)—was to go to work at age 16 in one of the unionized mass-production industries. There one earned a middle-class income after a few months—the result of the productivity explosion. These opportunities are practically gone. Now there is virtually no access to a good income without a formal degree attesting to the acquisition of knowledge that can be obtained only systematically and in a school.

The change in the meaning of knowledge that began 250 years ago has transformed society and economy. Formal knowledge is seen as both the key personal resource and the key economic resource. *Knowledge is the only meaningful resource today.* The traditional "factors of production"—land (i.e. natural resources), labor, and capital—have not disappeared, but they have become secondary. They can be obtained, and obtained easily, provided there is knowledge. And knowledge in this new meaning is knowledge as a utility, knowledge as the means to obtain social and economic results.

These developments, whether desirable or not, are responses to an irreversible change: *Knowledge is now being applied to knowledge.* This is the third and perhaps the ultimate step in the transformation of knowledge. Supply-

AN INTERVIEW WITH PETER DRUCKER

WQ: *American schools now seem incapable of educating students even in the traditional curriculum. How can they hope to prepare youngsters for the new era you describe?*

Drucker: It isn't true that American schools are incapable of educating students. The parochial schools, both Catholic and Protestant, do a reasonable job by being totally old-fashioned, that is, by running the way they did during the 1950s. This is exactly what the Japanese are doing, too. In fact, the various Christian schools, Catholic and Protestant, are almost indistinguishable—except for the cross on the wall and the absence of "examination hell"—from Japanese schools. And a good many experimental schools, such as those in Harlem's District Four in New York City, do a good job.

There is an old saying of mountaineers and hikers: If you have lost your way, don't try to be clever. Go back to where you last knew where you were. I am an old "progressive educator"—I taught at two ultraprogressive colleges, Sarah Lawrence and Bennington, during the 1940s—but it's clear to me that we have lost our way since the 1950s. Other countries—Japan, Germany, France—stayed where they were, and their schools still work. We have to go back, I have become increasingly convinced. That's why I believe that we have no choice but to go ahead with voucher plans that allow parents to put their children in schools of their choice. At least the kids will acquire core skills and—the most important things—standards and self-confidence.

Above all there are three things children need to obtain very early: the ability to read, which is still the foundation skill; self-confidence, which means success in one area; and the ability to learn in other areas. None of these do America's public schools pay much attention to today.

WQ: *You emphasize the need to educate people broadly in what you call the "knowledges," or various technical disciplines. Which ones?*

Drucker: I have an old answer that I used to give to students 50 years ago (and which Montaigne had, though he formulated it differently): Be a first-rate expert in one area and at least a journeyman in a second and totally unrelated one. This way you'll *understand.* If you know only one area you can't understand; and if you try to cover more than two you'll be a dilettante.

This kind of exposure does not have to come in school. One of the more successful people I know today, for instance, is a physician who at the same time has learned enough to manage successfully a fair-size medical clinic. Another is the head of a medium-size company who came up through the financial route but has learned enough biology to work closely with his scientists.

Or look at what volunteers get when they join groups at one of the pastoral churches. The groups cut across all social layers and people work together in, say, the church's drug-abuse program. While they are volunteers, they are not dilettantes. Counseling is professional work. The volunteers gain respect for one another and also for a very different kind of work.

WQ: *Although the Japanese colossus seems somewhat diminished today, Japan will remain one of America's major competitors in the future. What are the advantages and disadvantages of the two countries in the new economy you describe?*

Drucker: Never underrate the Japanese. That said, they may be in for many years of transition. The competitors to watch out for now may no longer be primarily the Japanese but the Chinese and other economic newcomers.

The Japanese advantage is clearly shrinking—the Japanese are wedded to a "bigger is better and the biggest is best" approach. Our main competitive advantage in the knowledge economy is that the young people increasingly get training with the big companies but then quit—something you still cannot easily do in Japan—and go to work for me-

dium-size or small businesses. As a result, these businesses have the talent they need to succeed. And it is becoming increasingly clear that the future no longer belongs to the giants. They are too slow, too bureaucratic, and too focused on what worked yesterday.

Our competitive disadvantage is rooted in the failure so far to work out the implications of the shift of corporate ownership from individuals to institutional investors and as a result the absence of any paradigm for corporate governance—something which I have written about at considerable length in the past, most recently in my book *Managing for the Future* (1992). This failure largely explains the short-term preoccupations of America's large companies.

WQ: *In Frederick W. Taylor's time the key conflict was between "capital" and "labor." Is there a comparable conflict today?*

Drucker: The significant division in postcapitalist society is between knowledge workers and nonknowledge, service workers, between, for instance, lawyers, advertising copywriters, and teachers, on the one hand, and salespeople, clerks, and window washers, on the other. But it isn't a conflict, and I hope it never will become one. The two kinds of workers are moving in different directions. There will be tension between the two groups unless a way is found for the service workers to rapidly increase their productivity and their income potential.

The situation today is very different from any the world has seen before. The nature of social mobility has changed. The idea that there was no upward mobility in earlier society is a kind of Marxist nonsense. In fact, mobility was probably greater in 18th- and 19th-century Europe than it has ever been in this country. But if you moved out of your class, you moved out. You cut your bonds. That's what happens in the black community today. A colleague of mine, whose parents were sharecroppers and who is now a full professor and a very distinguished one, has totally cut his bonds with his background. Totally. That was common in the past. The saying was that if a bright boy from a blue-collar family got a scholarship, his father would say, "I've lost my son. I'm very proud of him, but I've lost him." That's not true in most of our society today. Now in the same family you might have a fellow who becomes a doctor while his brother or sister works at a check-out counter in a store, yet they remain a family. And that is why the analogy with conflicts and class war is probably the wrong analogy. But the division between knowledge workers and service workers is a source of tension.

WQ: *How does your vision of the knowledge society differ from that of Daniel Bell, who argued in* The Coming of Post-Industrial Society *(1973) that such a society, unable to provide a transcendent ethic for its people, was bound to experience a profound cultural crisis?*

Drucker: Daniel Bell and I—I in 1969, he four years later—started at very different points but came out at pretty much the same place. Even earlier, in my 1959 book *Landmarks of Tomorrow*, I tried to sketch out the kind of philosophy and ethic Bell was asking for. I called the chapter, overoptimistically, "The New Philosophy Comes to Life." It hasn't. And because I cannot answer the question I am profoundly interested in the rapidly growing pastoral churches in this country, which the new affluent two-earner families are coming to in great numbers in a search for community, ethics, and responsibility.

Altogether our society will have to be based on *individual responsibility*. There are some movements in that direction. We now expect the person to take responsibility for keeping himself or herself healthy. We now expect—or are moving toward expecting—that parents take responsibility for the education of their children, which is what the voucher movement is all about. We now increasingly expect individuals—and especially people with a lot of schooling—to take responsibility for their careers, since obviously the corporate personnel department is unable and unwilling to do so (despite all the talk about "organization development" and "management development"). But these are still only signs.

There is a great deal of talk today about "empowerment"—a term I have never used and never will. It does not do any good simply to take power from the top and move it to the bottom. Power always corrupts unless it is first earned through responsibility.

ing knowledge to find out how existing knowledge can best be applied to produce results is, in effect, what we mean by management. But knowledge is now also being applied systematically and purposefully to define what new knowledge is needed, whether it is feasible, and what has to be done to make knowledge effective. It is being applied, in other words, to systematic innovation.

This third change in the dynamics of knowledge can be called the Management Revolution. Like its two predecessors—knowledge applied to tools, processes, and products, and knowledge applied to work—the Management Revolution has swept the earth. It took 100 years, from the middle of the 18th century to the middle of the 19th century, for the Industrial Revolution to become dominant and worldwide. It took some 70 years, from 1880 to the end of World War II, for the Productivity Revolution to do so. It has taken fewer than 50 years—from 1945 to 1990—for the Management Revolution to prevail.

When they hear the word "management," most people still hear "business management." Management did first emerge in its present form in large-scale business organizations. When I first began to study management some 50 years ago, I too concentrated on business management. But we soon learned that management is needed in all modern organizations, whether they are businesses or not. In fact, we soon learned that it is needed even more in organizations that are not businesses, whether not-for-profit (what I call "the Social Sector") or government agencies. They need management the most precisely because they lack the discipline of the bottom line. That management is not confined to business was recognized first in the United States. But it is now becoming accepted in all developed countries. We now know that management is a generic function of all organizations, whatever their specific mission. It is the generic organ of the knowledge society.

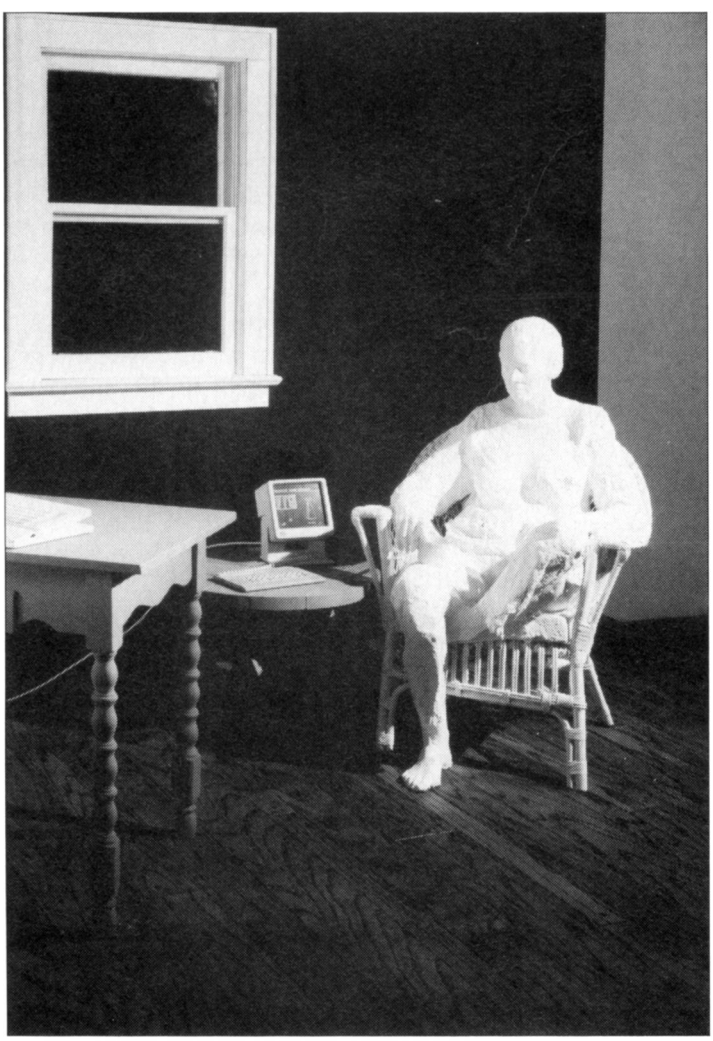
Management has been around for a very long time. I am often asked whom I consider the best or the greatest executive. My answer is always "the man who conceived, designed, and built the first Egyptian pyramid more than 4,000 years ago—and it still stands." But management as a specific kind of work was not seen until after World War I—and then by a handful of people only. Management as a discipline emerged only after World War II. As late as 1950, when the World Bank began to lend money for economic development, the word "management" was not even in its vocabulary. In fact, while management was *invented* thousands of years ago, it was not *discovered* until after World War II.

One reason for its discovery was the experience of World War II and especially the performance of American industry. But perhaps equally important to the general acceptance of management has been the performance of Japan since 1950. Japan was not an underdeveloped country immediately after World War II, but its industry and economy were almost totally destroyed and it had practically no domestic technology. The nation's main resource was its willingness to adopt and to adapt the forms of management that the Americans had developed during World War II (especially training). By the 1970s it had become the world's second leading economic power and a technology leader.

When the Korean War ended in 1953 South Korea was even more devastated than Japan had been eight years earlier. And it had never been anything but a backward country; indeed, the Japanese had systematically suppressed Korean enterprise and Korean higher education during their 35 years of occupation. But by using the colleges and universities of the United States to educate its able young people and by importing and applying management, South Korea became a highly developed country within 25 years.

With this powerful expansion of management came a growing understanding of what management really is. When I began to study

management, during and immediately after World War II, a manager was defined as "someone who is responsible for the work of subordinates." A manager in other words was a "boss," and management was rank and power. This is probably still the definition many people have in mind when they speak of managers and management. But by the early 1950s the definition had already changed to "a manager is responsible for the performance of people." Now we know that this is also too narrow a definition. The right definition is *"a manager is responsible for the application and performance of knowledge."* Implicit in this definition is that we now see knowledge as the essential resource. Land, labor, and capital are chiefly important as restraints. Without them even knowledge cannot produce. Without them even management cannot perform. Where there is effective management, that is, application of knowledge to knowledge, we can always obtain the other resources. The fact that knowledge has become *the* resource, rather than *a* resource, is what makes our society "postcapitalist." It changes, and fundamentally, the structure of society. It creates new social dynamics. It creates new economic dynamics. It creates new politics.



Underlying all three phases in the shift to knowledge—the Industrial Revolution, the Productivity Revolution, the Management Revolution—is a profound change in the meaning of knowledge. We have moved from *knowledge* to *knowledges.*

Traditionally, knowledge was general. What we now consider knowledge is of necessity highly specialized. We never before spoke of a man or woman "of knowledge." We spoke of an "educated person." Educated persons were generalists. They knew enough to talk or write about a good many things, enough to understand a good many things. But they did not know enough to do any one thing. Knowledge today must prove itself in action. What we now mean by knowledge is information effective in action, information focused on results. Results are outside the person, in society and the economy, or in the advancement of knowledge itself. To accomplish anything, this knowledge has to be highly specialized. This is the very

reason why the tradition—beginning with the ancients but still persisting in what we call "liberal education"—relegated it to the status of *techné* or craft. It could neither be learned nor taught. Nor did it imply any general principle whatever. It was specific and specialized. It was experience rather than learning, training rather than schooling. But today we do not speak of these specialized knowledges as "crafts." We speak of "disciplines." This is as great a change in intellectual history as any ever recorded.

A discipline converts a craft into a methodology—such as engineering, the scientific method, the quantitative method, or the physician's differential diagnosis. Each of these methodologies converts ad hoc experience into a system. Each converts anecdote into information. Each converts skill into something that can be taught and learned. The shift from knowledge to knowledges has given knowledge the power to create a new society. But this society has to be structured on the basis of knowledge being specialized and of "knowledge people" being specialists. This gives them their power. But it also raises basic questions—of values, of vision, of beliefs, in other words, of all the things that hold society together and give meaning to life. It also raises a big—and new—question: What constitutes the educated person in the knowledge society?

Tomorrow's educated person will have to be prepared to live in a global world. It will be a Westernized world. But educated people will also live in an increasingly tribalized world. They must be able to be citizens of the world—in their vision, their horizons, their information—but they will also have to draw nourishment from their local roots and, in turn, enrich and nourish their own local culture.

Most, if not all, educated people will practice their knowledge as members of an organization. The educated person will therefore have to prepare to live and work simultaneously in two cultures, that of the intellectual, the specialist who focuses on words and ideas, and that of the manager, who focuses on people and work. Intellectuals need their organization as a tool; it enables them to practice their *techné*, their specialized knowledge. Managers see knowledge as a means to the end of organizational performance. Both are right. They are poles rather than contradictions. Indeed, they need each other. The intellectual's world, unless counterbalanced by the manager, becomes one in which everybody "does his own thing" but nobody does anything. The manager's world becomes bureaucratic and stultifying without the offsetting influence of the intellectual. Many people in the postcapitalist society will actually live and work in these two cultures at the same time. And many more could and should be exposed to both by rotation early in their career—by having the young computer technician, for example, serve as a project manager and team leader. All educated persons in the postcapitalist society will have to be prepared to understand both cultures.

For the educated person of the 19th century *techné* were not knowledge. They were already taught in the university. They had become "professional disciplines." Their practitioners were "professionals" rather than "tradesmen" or "artisans." But they were not part of the liberal arts or of the *allgemeine Bildung* and thus not part of knowledge. Now that the *techné* have become *knowledges*, they have to be integrated into knowledge. The classics, whatever that term may mean, may still be the core of the educated person's knowledge. But the *techné*, too, have to be incorporated into the educated person's learning. That the liberal arts they enjoyed so much in their college years do not do that, cannot do that—in fact refuse even to try—is the reason why many young people repudiate them a few years out of college. They feel let down, indeed, betrayed. They have good reason to feel that way. Liberal arts and *allgemeine Bildung* that do not integrate the knowledges into a "universe of knowl-

edge" are neither liberal nor *bildung* (education). They fall down on the first task: to create mutual understanding—that "universe of discourse" without which there can be no civilization. Instead of uniting, such liberal arts fragment.

We neither need nor will get polymaths who are at home in many knowledges. We will probably become even more specialized. But what we do need—and what will define the educated person in the Knowledge Society—is the ability to understand the knowledges, from law to computer science. What is each about? What is it trying to do? What are its central concerns? What are its central theories? What major insights has it produced? What are its important areas of ignorance, its problems, its challenges? To make knowledges into knowledge requires that the holders of the knowledges, the specialists, take responsibility for making both themselves and their knowledge area understood. The media, whether magazines, movies, or television, can help. But they cannot do the job. Nor can any other kind of popularization. The knowledges must be understood as what they are: serious, rigorous, demanding. And such understanding can be acquired only if the leaders in each of the knowledges—beginning with the learned professors in their tenured university chairs—take responsibility for making their own knowledge understood and are willing to do the hard work this requires.

Capitalism had been dominant for over a century when Karl Marx in the first volume of *Das Kapital* (1867) identified it as a distinct social order. The term *capitalism* was not coined until 30 years later, well after Marx's death. It would therefore not only be presumptuous in the extreme to attempt to write *The Knowledge* today; it would be ludicrously premature. All that can be attempted is to describe society and polity as we begin the transition from the Age of Capitalism (which, of course, was also the Age of Socialism). But we can hope that 100 years hence a book of this kind, if not a book entitled *The Knowledge*, can and will be written. For that would mean that we have successfully weathered the transition upon which we have embarked. It would be as foolish today to predict the Knowledge Society as it would have been to predict in 1776—the year of the American Revolution, of Adam Smith's *Wealth of Nations*, and of James Watt's steam engine—the society of which Marx wrote 100 years later, and as it was foolish of Marx to predict "with scientific infallibility" 20th-century society.

But one thing is predictable: The greatest change will be in the form and content of knowledge, in its meaning and its responsibility, and in what it means to be an educated person.