

## Thinking Back, Looking Ahead

## VISIONS OF THE FUTURE

Market society did not appear overnight; it took hundreds of years for market society to take hold as a dominant form of organizing economic society. Moreover, the great engine of market society—machinery and the mass production it would allow—only appears at the end of this period of “emergence,” indicating that technological change itself had preconditions in the social realm, as we will see in our next chapter. In this chapter, our focus has been on the process of the emergence and appearance of new forms of social organization. This is more difficult to understand than an era in which a clear set of social relations has already been well established.

Part of the difficulty of understanding this period is that much of the pro-

cess of creation also involved some destruction, like religious beliefs in the sinfulness of making money. Amidst this disarray and breaking up of existing social structures, it was very difficult to see the emergence of a new coherent entity, a “market society” with all the implications of harmony that such a phrase implies. Therefore, historical change is more difficult to grasp than more or less stationary “periods.” Not until the Industrial Revolution does change become a norm, with all the disturbances we can image. Do you think that the increasing presence of automated production processes might pose a similar challenge in our time? This question takes us to our next chapter.



## CHAPTER

## The Industrial Revolution

In our survey of economic history, we have concentrated almost entirely on two main currents of economic activity: agriculture and commerce. However, from earliest days there was a third essential source of economic wealth—industry—which we deliberately let slip by unnoticed. In contrast to agriculture and commerce, industrial manufacture did not leave a major imprint on economic society itself. As a peasant, serf, merchant, or guildsman, the actors in the economic drama directly typified the basic activities of the times, but this would not have been true of someone in industry. Such a person as a “factory worker”—indeed, the very idea of an *industrial* “proletarian”—was absent from the long years before the late seventeenth century. Only with the advent of Adam Smith’s pin factory does this concept begin to enter the scene.

The “industrial capitalist” was also lacking. Most of the moneymakers of the past gained their fortunes by trading, or transporting, or lending—not by making. It is amusing—more than amusing; instructive—to mark the best ways of getting rich enumerated by Leon Battista Alberti, a fifteenth-century architect, musician, and courtier. They are (1) wholesale trade; (2) seeking for treasure trove; (3) ingratiating oneself with a rich man to become his heir; (4) usury; and (5) the rental of pastures, horses, and the like. A seventeenth-century commentator adds to this royal service, soldiering, and alchemy. Manufacturing is conspicuously absent from both lists.<sup>1</sup> It, too, enters the economic world only about the time of Smith.

In ancient Greece, Demosthenes had an armor and a cabinet “factory”; from long before his time, in ancient Egypt, we even have the attendance record of workers in “factories” for the production of cloth. Yet it is clear that this form of production was far less important in shaping the economic texture of the times than either agriculture or commerce. For one thing, the typical scale of manufacture was small. Note that the very word *manufacture* (from the Latin *manus*, “hand,” and *facere*, “to make”) implies a system of hand, rather than machine, technology. Demosthenes’ enterprises, for example, employed no more than 50 men. It is true that from time to time we do come across quite large manufacturing operations; already in the second century A.D., a Roman brickworks employed 46 foremen; by the time we reach the seventeenth century, enterprises with several hundred workers are not unheard of. However, such operations were the exception rather than the rule. In 1660, for instance, a steelsmith in France needed no more than 3 tons of pig iron a year for his output of swords or sickle blades or artistic cutlery. Similarly, most guild operations, as we have seen, were small. As late as 1843, a Prussian census showed only 67 working people for every 100 masters.<sup>2</sup> In the past—as today in the East and Near East—most “industry” was carried on in the backs

<sup>1</sup>Werner Sombart, *The Quintessence of Capitalism* (New York: Dutton, 1915), pp. 34–35.

of small shops or the dim cellars of houses, in sheds behind bazaars, or in the scattered homes of workers to whom materials would be supplied by an organizing "capitalist."

## A GREAT TURNING POINT

### Pace of Technical Change

In addition to its small scale of industry, another aspect of the times delayed industrial manufacture from making known its social presence. This was the absence of any sustained interest in the development of an *industrial technology*. Throughout antiquity and the Middle Ages, little of society's creative energy was directed toward a systematic improvement of manufacturing techniques. It is indicative of the lack of interest attached to productive technology that so simple and important an invention as the horse collar had to await the Middle Ages for discovery; the Egyptians, Greeks, and Romans, who were capable of a magnificent technology of architecture, were simply not concerned with the techniques of everyday production itself.<sup>3</sup> Even well into the Renaissance and Reformation, the idea of industrial technology hardly attracted serious thought. With the principal exception of Leonardo da Vinci, whose fecund mind played with inventions of the most varied kind, the serious thinkers of Europe, until well into the seventeenth century, were both ignorant of and uninterested in the technology of basic production.

There was good reason for this prevailing indifference: In the societies of the pre-market world, the necessary economic base for any large-scale industrial manufacture was totally lacking. In economies sustained by the labor of peasants, slaves, and serfs, economies in which the stream of money was small and the current of economic life—accidents of war and nature aside—relatively changeless from year to year, who could dream of a process in which avalanches of goods would be turned out? The very idea of industrial production on the large scale was inconceivable in such an unmonetized, static setting.

For all these reasons, the pace of industrialization was slow. It is a question whether Europe in the year 1200 was significantly more technologically advanced than it had been in the year 200 B.C. The widespread use of waterpower in industry did not appear until the fifteenth century, and it would be still another century before windmills provided a common means for tapping the energy of nature. The mechanical clock dates from the thirteenth century, but not for 200 years would significant improvements be made in instruments for navigation, surveying, or measuring. Movable type, that indispensable forerunner of mass communication, did not appear until 1450.

In short, despite important pockets of highly organized production, notably in the thirteenth-century Flanders cloth industry and in Northern Italian towns, not until the late sixteenth century can we discern the first signs of a general groundswell of industrial technology. Even in that time it would have been impossible to foresee that one day industry would be the dominant form of productive organization. Indeed, as late as the eighteenth century, when manufacturing had already begun to reach respectable

*Civilization* (New York: Harper, Torchbooks, 1960), p. 131; R. H. Tawney, *Equality*, 4th ed. (London: Macmillan, 1952), p. 59.

proportions as a form of social endeavor, it was not generally thought of as inherently possessing any but secondary importance. Agriculture, of course, was the visible foundation of the nation itself. Trading was regarded as useful insofar as it brought a nation gold. At best, industry was seen as a handmaiden of the others, providing the trader with the goods to export, or serving the farmer as a secondary market for the products of the earth.<sup>4</sup>

What finally conspired to bring manufacturing into a position of overwhelming prominence?

It was a complex concatenation of events that brought about the eruption we call the Industrial Revolution. As with the Commercial Revolution and the Mercantile era, which preceded it and formed its indispensable preparation, it is impossible in a few pages to do justice to the many currents that contributed to that final outburst of industrial technology. However, if we cannot trace the process in detail, we can at least gain an idea of its impetus and of the main forces behind it if we turn now to England around 1750. Here, for the first time, industrial manufacture as a major form of economic activity began to work its immense social transformations.

### England in 1750

Why did the Industrial Revolution originally take place in England and not on the Continent? Why did the pin factory attract Smith's attention? To answer these questions, we must look at the background factors that distinguished England from most other European nations in the eighteenth century.

The first of these factors was simply that England was relatively wealthy. In fact, a century of successful exploration, slave trading, piracy, war, and commerce had made her the richest nation in the world. Even more important, her riches had accrued not solely to a few nobles, but also to a large upper-middle stratum of commercial *bourgeoisie*. England was thus one of the first nations to develop, albeit on a tiny scale, a prime requisite of an industrial economy: a "mass" consumer market. As a result, a rising pressure of demand inspired a search for new techniques. Very typically, the Society for the Encouragement of Arts and Manufacturers (itself a significant child of the age) offered a prize for a machine that would spin six threads of cotton at one time, thus enabling the spinner to keep up with the technologically more advanced weaver. It was this that led, at least in part, to Arkwright's spinning jenny, of which we shall hear more shortly.

Second, England was the scene of the most successful and thoroughgoing transformation of feudal into commercial society. The process of enclosures was a significant clue to a historic change that sharply marked England from the Continent. In England, the aristocracy had early made its peace with (and more than that, found its profits in) commerce. Although sharp conflicts of interest remained between the "old" landed power and the "new" monied power, by 1700, the ruling orders in England had decisively opted for adaptation rather than resistance to the demands of the market economy.<sup>5</sup>

<sup>4</sup>In the mid-eighteenth century, when the French doctor François Quesnay propounded one of the first systematic explanations of economic production and distribution (called *Physiocracy*), only the farmer was regarded as a producer of net worth; the manufacturer, although his utility was not ignored, was nonetheless relegated to the "sterile" (i.e., non-wealth-producing) classes.

Third, England was the locus of a unique enthusiasm for science and engineering. The famous Royal Society, of which Newton was an early president, was founded in 1660 and was the immediate source of much intellectual excitement. Indeed, a popular interest in gadgets, machines, and devices of all sorts soon became a mild national obsession: *Gentlemen's Magazine*, a fashionable periodical of the time, announced in 1729 that it would henceforth keep its readers "abreast of every invention"—a task that the mounting flow of inventions soon rendered quite impossible. No less important was the enthusiasm of the British landed aristocracy for scientific farming: English landlords displayed an interest in matters of crop rotation and fertilizer that their French counterparts would have found quite beneath their dignity.

Then there were a host of other background causes, some as fortuitous as the immense resources of coal and iron ore on which the British sat; others were as purposeful as the development of a national patent system that deliberately sought to stimulate and protect the act of invention itself.<sup>6</sup> As the revolution came into being, it fed upon itself. The new techniques (especially in textiles) simply destroyed their handicraft competition around the world and thus enormously increased their own markets. What finally brought all these factors into operation was the energy of a group of New Men who made of the latent opportunities of history a vehicle for their own rise to fame and fortune.

### Rise of the New Men

One such, for instance, was John Wilkinson. The son of an old-fashioned, small-scale iron producer, Wilkinson was a man possessed by the technological possibilities of his business. He invented a dozen things: a rolling mill and a steam lathe, a process for the manufacture of iron pipes, and a design for machining accurate cylinders. Typically, he decided that the old-fashioned leather bellows used in the making of iron itself were not efficient, so he determined to make iron ones. "Everybody laughed at me," he later wrote. "I did it and applied the steam engine to blow them and they all cried: 'Who could have thought of it?'"

He followed his success in production with a passion for application; everything must be made of iron: pipes, bridges, even ships. After a ship made of iron plates had been successfully launched, he wrote a friend: "It answers all my expectations, and has convinced the unbelievers, who were nine hundred and ninety-nine in a thousand. It will be a nine-days wonder, and afterwards, a Columbus' egg."<sup>7</sup>

But Wilkinson was only one of many. The most famous was, of course, James Watt—well known to Adam Smith—who, together with Matthew Boulton, formed the first

<sup>6</sup>Phyllis Deane, in *The First Industrial Revolution* (paperback ed., Cambridge: Cambridge University Press, 1965), ascribes the onset of industrialism in England to a somewhat different set of causes: a rise in population, better food-producing techniques, a boom in foreign trade, and vast improvement in transportation. There is no doubt that these were also indispensable elements in the process. I mention Deane's book so that a student will not think that there is only one "right" way of accounting for very complex historical transformations. For another excellent account of the process, one might turn to the fascinating book by David Landes, *Prometheus Unbound* (Cambridge: Cambridge University Press, 1969); for still another interesting account, see Joel Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress* (New York: Oxford University Press, 1990).

company for the manufacture of steam engines. Watt was the son of an architect, shipbuilder, and maker of nautical instruments. At 13 he was already making models of machines, and by young manhood he was an accomplished artisan. He planned to settle in Glasgow, but the guild of hammermen objected to his making mathematical instruments—the last remnants of feudalism thus coming into an ironic personal conflict with the man who, more than any other, would create *the* invention that would destroy guild organization. At any rate, Watt found a haven at the university and there, in 1764, had his attention turned to an early and very unsatisfactory steam engine invented by Newcomen. In his careful and systematic way, Watt experimented with steam pressures, cylinder designs, and valves, until by 1796 he had developed a truly radical and (by the standards of those days) extraordinarily powerful and efficient engine. Interestingly, Watt could never have done so well with his engines had not Wilkinson perfected a manner of making good piston-cylinder fits. Previously, cylinders and pistons were made of wood and rapidly wore out. Typically, too, it was Wilkinson who bought the first steam engine to be used for purposes other than pumping: It worked the famous iron bellows.

There was needed, however, more than Watt's skill. The new engines had to be produced and sold, and the factory that made them had to be financed and organized. Watt at first formed a partnership with John Roebuck, another iron magnate, but it shortly failed. Thereafter, luck came his way. Matthew Boulton, already a wealthy and highly successful manufacturer of buttons and buckles, took up Roebuck's contract with Watt, and the greatest combination of technical skill and business acumen of the day was born.

Even then the firm did not prosper immediately. Expenses of development were high, and the new firm was not out of debt for 12 years. Yet from the beginning, interest was high. By 1781, Boulton was able to claim that the people of London, Birmingham, and Manchester were all "steam mill mad"; by 1786, when two steam engines were harnessed to 50 pairs of millstones in the largest flour mill in the world, all London came to see the marvel.

The steam engine was the greatest single invention, but by no means the sole mainstay, of the Industrial Revolution. Hardly less important were a group of textile inventions, of which the most famous was Arkwright's jenny, or water frame, as it was called to distinguish it from other hand-operated spinning jennies.<sup>8</sup>

Arkwright's career is, in itself, interesting. A barber, he plied his trade near the weaving districts of Manchester and so heard the crying need for a machine that would enable the cottage spinners to keep up with the technically more advanced weavers. Good fortune threw him into contact with a clockmaker named John Kay, whom he hired to perfect a machine that Kay had already begun with another employer-inventor. What happened thereafter is obscure: Kay left the business accused of theft and embezzlement, and Arkwright appeared as the "sole inventor" of a spinning jenny in 1769.

He now found two rich hosiers, Samuel Need and Jedediah Strutt, who agreed to set up business with him to produce water frames, and in 1771, the firm built its own spinning mill. It was an overnight success; by 1779, it had several thousand spindles,

<sup>8</sup>Essentially, what the water frame did was enable cotton thread of much greater strength to be produced. As a result, for the first time it was possible to use cotton thread instead of linen thread for the warp (the vertical threads that take most of the strain in weaving) as well as for the weft. Not until Arkwright's invention was "cotton cloth" made wholly of cotton. The new cloth was incomparably superior to the old and instantly

more than 300 workers, and ran night and day. Within not many years, Arkwright had built an immense fortune for himself and founded an even more immense textile industry for England. "O reader," wrote Carlyle, looking back on his career, "what a historical phenomenon is that bag-cheeked, pot-bellied, much enduring, much inventing barber! . . . It was this man that had to give England the power of cotton."<sup>9</sup>

### The Industrial Entrepreneur

It is interesting, as we watch the careers of these New Men, to draw a few generalizations concerning them. This was an entirely new class of economically important persons. Peter Onions, who was one of the inventors of the puddling process, was an obscure foreman; Arkwright was a barber; Benjamin Huntsman, the steel pioneer, was originally a maker of clocks; Henry Maudslay, who invented the automatic screw machine, was a bright young mechanic at the Woolwich Arsenal. None of the great industrial pioneers came of noble lineage; with few exceptions, such as Matthew Boulton, none even possessed money capital. In agriculture, the new revolutionary methods of scientific farming enjoyed aristocratic patronage and leadership, especially from the famous Sir Jethro Tull and Lord Townshend; but in industry, the lead went to men of humble origin and descent.

This required a social system flexible enough to permit the rise of such obscure "adventurers." It is not until we see the catalytic effect of unleashing and harnessing the energies of talented men in the lower and middle ranks of the social order that we begin to appreciate the immense liberating effect of the preceding economic and political revolutions. In the medieval hierarchy, the meteoric careers of such New Men would have been unthinkable. In addition, the New Men were the product of the unique economic preparation of England itself. They were, of course, the beneficiaries of the rising demand and the technical inquisitiveness of the times. Beyond that, many of the small manufacturers were themselves former small proprietors who had been bought out during the late period of the enclosure movement and who determined to use their tiny capital in the promising area of manufacture.

### The New Rich

Many of these New Men made great sums of money. A few, like Boulton and Watt, were modest in their wants. Despite an iron-clad patent, they charged for their engines only the basic cost of the machine and installation plus one-third the saving in fuel the customer got. Some, like Josiah Wedgwood, founder of the great china works, actually refused on principle to take out patents, but most of them did not display such fine sensibilities. Arkwright retired a multimillionaire, living in ostentatious splendor: Huntsman, Wilkinson, and Samuel Walker (who began life as a nailsmith and stole the secret of cast steel) all went on to roll up huge fortunes.<sup>10</sup> Indeed, Wilkinson's iron business became a minor industrial state with credit stronger than many German and Italian principalities. It even coined its own money, and its copper and silver tokens (with a profile and legend of John Wilkinson, Ironmaster) were much in use between 1787 and 1808.

<sup>9</sup>Mantoux, *The Industrial Revolution in the Eighteenth Century*, p. 225.

<sup>10</sup>In contrast to the manufacturers, the inventors did not usually fare successfully. Many of them, who did not have Watt's good fortune in finding a Boulton, died poor and neglected, fruitlessly suing for stolen inventions.

Besides being avaricious, the manufacturers have been described by the economic historian Paul Mantoux as

tyrannical, hard, sometimes cruel: their passions and greeds were those of upstarts. They had the reputation of being heavy drinkers and of having little regard for the honour of their female employees. They were proud of their newly acquired wealth and lived in great style with footmen, carriages and gorgeous town and country houses.<sup>11</sup>

It is not surprising, then, that Adam Smith, although recognizing their usefulness, looked with distrust on the "mean rapacity, the monopolizing spirit" of merchants and manufacturers, warning that "they neither are, nor ought to be, the rulers of mankind."<sup>12</sup>

Pleasant or unpleasant, these men's personal characteristics fade beside one overriding quality: These were all interested in expansion, in growth, in investment for investment's sake. All of them were identified with technological progress, and none of them disdained contact with the physical process of production. An employee of Maudslay once remarked, "It was a pleasure to see him handle a tool of any kind, but he was *quite splendid* with an 18-inch file."<sup>13</sup> Watt was tireless in experimenting with his machines; Wedgwood stomped about his factory on his wooden leg, scrawling "This won't do for Jos. Wedgwood" wherever he saw evidence of careless work. Richard Arkwright was a bundle of ceaseless energy in promoting his interests as he jounced about England over execrable roads in a post chaise driven by four horses, pursuing his correspondence as he traveled.

"With us," wrote a French visitor to a calico works in 1788, "a man rich enough to set up and run a factory like this would not care to remain in a position which he would deem unworthy of his wealth."<sup>14</sup> This was an attitude entirely foreign to the rising English industrial capitalist. His work was its own dignity and reward; the wealth it brought was quite aside. Boswell, on being shown Watt and Boulton's great engine works at Soho, declared that he never forgot Boulton's expression, as the latter declared, "I sell here, sir, what all the world desires to have—Power."<sup>15</sup>

The New Men were first and last *entrepreneurs*—organizers. They brought with them a new energy, as restless as it proved to be inexhaustible. In an economic, if not a political, sense, they deserve the epithet "revolutionaries," for the change they ushered in was nothing short of total, sweeping, and irreversible.

### Industrial and Social Repercussions

The first and most striking element of that change was a sharp rise in the output of the newly industrialized industries. The import of raw cotton for spinning weighed 1 million pounds in 1701; 3 million pounds in 1750; 5 million in 1781. That was a respectable rate of increase, but then came the sudden burst in textile technology. By 1784, the figure was over 11 million pounds; by 1789, it was three times greater yet, and still it grew: to 43 million pounds in 1799; 56 million in 1800; 60 million in 1802.<sup>16</sup> So was it with much else

<sup>11</sup>Mantoux, *The Industrial Revolution in the Eighteenth Century*, p. 397.

<sup>12</sup>Adam Smith, *The Wealth of Nations* (New York: Modern Library, 1937), p. 460.

<sup>13</sup>Lewis Mumford, *Technics and Civilization* (New York: Harcourt, 1934), p. 210.

<sup>14</sup>Mantoux, *The Industrial Revolution in the Eighteenth Century*, p. 404.

<sup>15</sup>H. R. Fox Bourne, *English Merchants* (London: 1866), p. 119.

where the new technology penetrated. The output of coal increased tenfold in 40 years; that of pig iron leaped from 68,000 tons in 1788 to 1,347,000 tons in 1839.<sup>17</sup>

The first impact of the Industrial Revolution was an immense quickening of the pace of production in the new industrial sector of the economy, an effect we find repeated in every nation that goes through an "industrial revolution." In France, for example, the impact of industrial techniques did not make its influence felt until about 1815; between that date and 1845, the French output of pig iron grew fivefold; her coal production, sevenfold; her rate of importation, tenfold.<sup>18</sup>

The Industrial Revolution itself did not immediately exert a comparable leverage on the *overall* increase of output. The industrial sector was small; the phenomenal rates of increase in those industries where its leverage was first and most fruitfully applied were by no means mirrored in every industry. What is of crucial importance, however, is that the Industrial Revolution ushered in the technology by which large-scale, sustained growth was eventually to take place. This is a process into which we must look more carefully at the end of this chapter.

### Rise of the Factory

But first we must pay heed to another immediate and visible result of the Industrial Revolution in England. We can describe it as the transformation of an essentially commercial and agricultural society into one in which industrial manufacture became the dominant mode of organizing economic life. The Industrial Revolution was characterized by the rise of the factory to the center of social as well as economic life. After 1850, the factory was not only the key economic institution of England, it was also the economic institution that shaped its politics, its social problems, and the character of its daily life just as decisively as the manor or the guild had done a few centuries earlier.

It is difficult for us today to realize the pace or the quality of change that this rise of factory work created. Until the mid-eighteenth century, Glasgow, Newcastle, and the Rhondda Valley were mostly wasteland or farmland, and Manchester in 1727 was described by Daniel Defoe as "a mere village." Forty years later, there were 100 integrated mills and a whole cluster of machine plants, forges, leather and chemical works in the area. A modern industrial city had been created.

By the 1780s, the shape of the new environment was visible. A French mineralogist visiting England in 1784 wrote:

[The] creaking, the piercing noise of the pulleys, the continuous sound of hammering, the ceaseless energy of the men keeping all this machinery in motion, presented a sight as interesting as it was new. . . . The night is so filled with fire and light that when from a distance we see, here a glowing mass of coal, there darting flames leaping from the blast furnaces, when we hear the heavy hammers striking the echoing anvils and the shrill whistling of the air pumps, we do not know whether we are looking at a volcano in eruption or have been miraculously transported to Vulcan's cave. . . .<sup>19</sup>

<sup>17</sup>J. L. and B. Hammond, *The Rise of Modern Industry* (New York: Harcourt, 1937), p. 160.

<sup>18</sup>A. Dunham, *The Industrial Revolution in France, 1815-48* (New York: Exposition Press, 1955), p. 432.

The factory provided not merely a new landscape but a new and uncongenial social habitat. In our day, we have become so used to urban industrial life that we forget what a wrench is the transition from farm to city. For peasants, this transfer requires a drastic adjustment. No longer do they work at their own pace, but at the pace of a machine. No longer are slack seasons determined by the weather, but by the state of the market. No longer is the land, however miserable its crop, an eternal source of sustenance close at hand, but only the packed and sterile earth of the industrial site.

It is little wonder that the English laborer, still more used to rural than urban ways, feared and hated the advent of the machine. Throughout the early years of the Industrial Revolution, workers literally attacked the invading army of machinery, burning and wrecking factories. During the late eighteenth century, for instance, when the first textile mills were built, whole hamlets rose in revolt rather than work in the mills. Headed by a mythical General Ludd, the Luddites constituted a fierce but fruitless opposition to industrialism. In 1813, in a mass trial that ended in many hangings and transportations, the movement came to an end.<sup>20</sup>

### Conditions of Labor

Distasteful as was the advent of the factory itself, even more distasteful were the conditions within it. Child labor, for instance, was commonplace and sometimes began at age 4; hours of work were generally dawn to dusk; abuses of every kind were all too frequent. A Committee of Parliament, appointed in 1832 to look into conditions, gives this testimony from a factory overseer.

- Q. At what time in the morning, in the brisk time, did these girls go to the mills?  
 A. In the brisk time, for about six weeks, they have gone at three o'clock in the morning and ended at ten or nearly half past at night.
- Q. What intervals were allowed for rest and refreshment during those nineteen hours of labour?  
 A. Breakfast a quarter of an hour, and dinner half an hour, and drinking a quarter of an hour.
- Q. Was any of that time taken up in cleaning the machinery?  
 A. They generally had to do what they call dry down; sometimes this took the whole time at breakfast or drinking.
- Q. Had you not great difficulty in awakening your children to the excessive labour?  
 A. Yes, in the early time we had to take them up asleep and shake them.
- Q. Had any of them any accident in consequences of this labour?  
 A. Yes, my eldest daughter . . . the cog caught her forefinger nail and screwed it off below the knuckle.
- Q. Has she lost that finger?  
 A. It is cut off at the second joint.
- Q. Were her wages paid during that time?  
 A. As soon as the accident happened the wages were totally stopped.<sup>21</sup>

<sup>20</sup>Even in our day, however, we use the word *Luddite* to describe an attempt to "fight back" at the threat of machinery.



It was a grim age. The long hours of work, the general dirt and clangor of the factories, the lack of even the most elementary safety precautions, all combined to give early industrial capitalism a reputation from which, in the minds of many people of the world, it has never recovered. Worse yet were the slums to which the majority of workers returned after their travail. Life expectancy at birth in Manchester was 17 years—a figure that reflected a child mortality rate of over 50 percent. This is not so surprising when we read this government commissioner's report of 1839 on one such workers' quarter in Glasgow called "the wynds."

The wynds . . . house a fluctuating population of between 15,000 and 30,000 persons. The district is composed of many narrow streets and square courts and in the middle of each court there is a dunghill. Although the outward appearance of these places was revolting, I was nevertheless quite unprepared for the filth and misery that were to be found inside. In some bedrooms we visited at night we found a whole mass of humanity stretched on the floor. There were often 15 to 20 men and women huddled together, some being clothed and others naked. There was hardly any furniture there and the only thing which gave these holes the appearance of a dwelling was fire burning on the hearth. Thieving and prostitution are the main sources of income of these people.<sup>22</sup>

### Early Capitalism and Social Justice

Without question, the times were marked by tremendous social suffering. But it is well, in looking back on the birth years of industrial capitalism, to bear several facts in mind:

#### 1. It Is Doubtful if the Poverty Represented a Deterioration in Life for the Masses in General.

In at least some sections of England, industrialism brought immediate benefits. Wedgwood (an exceptionally good employer, it is true) used to tell his employees to ask their parents for a description of the country as *they* first knew it and to compare their present state. So, too, the 12-hour day in Arkwright's mills was a 2-hour *improvement* over previous Manchester standards. Furthermore, the existing poverty was not by any means new. As we know from Hogarth's etchings, long before the Industrial Revolution, "Gin Lane" already sported its pitiful types. As one reformer of the mid-nineteenth century wrote, those whose sensibilities were revolted by the sight of suffering factory children thought "how much more delightful would have been the gambol of free limbs on the hillside; the sight of the green mead with its spangles of buttercups and daisies; the song of the bird and the humming of the bee . . . [but] we have seen children perishing from sheer hunger in the mud hovel or in the ditch by the wayside."<sup>23</sup>

<sup>22</sup>Quoted in F. Engels, *The Condition of the Working Class in England* (New York: Macmillan, 1958), p. 46.

#### 2. Much of the Harsh Criticism to Which Early Industrial Capitalism Was Subjected Was Derived Not So Much from Its Economic as from Its Political Accompaniments.

Coincident with the rise of capitalism, and indeed contributory to it, was a deep-seated change in the vantage point of political criticism. New ideas of democracy, of social justice, of the "rights" of the individual charged the times with a critical temper of mind before which *any* economic system would have suffered censure.

To be sure, the political movements by which capitalism was carried to its heights were not working-class movements, but middle-class, bourgeois movements; the rising manufacturers in England and France had little social conscience beyond a concern for their own rights and privileges. However, the movement of political liberalism that they set in motion had a momentum beyond the narrow limits for which it was intended. By the first quarter of the nineteenth century, the condition of the working classes, now so exposed to public view in the new factory-slum environment, had begun to curry public sympathy.

Thus, one of the unexpected consequences of the Industrial Revolution was a sharp reorientation of political ideas. In the creation of an industrial working class and an industrial environment, the revolution bequeathed a new economic framework to politics.<sup>24</sup> Karl Marx and Friedrich Engels were to write in 1848 that "all history" was the history of class struggle, but never did that struggle emerge so nakedly into the open as after the industrial environment had been brought into being.

Equally important was that the rise of political liberalism not only aroused feelings of hostility toward the prevailing order, but initiated the slow process of amelioration. From the outset, a reform movement coincided with capitalism. In 1802, pauper apprentices were legally limited to a 12-hour day and barred from night work. In 1819, the employment of children under nine was prohibited in cotton mills; in 1833, a 48- to 69-hour week was decreed for workers under 18 (who comprised about 75 percent of all cotton-mill workers), and a system of government inspection of factories was inaugurated; in 1842, children under 10 were barred from the coal mines; in 1847, a 10-hour daily limit (later raised to 10½) was set for children and women.

The nature of the reforms is itself eloquent testimony to the conditions of the times, and the fact that the reforms were bitterly opposed and often observed in the breach is testimony to the prevailing spirit. Yet capitalism, unlike feudalism, was from the beginning subject to the corrective force of democracy. Using the material of the 1830s, Karl Marx drew a mordant picture of the capitalist process in all its economic squalor, but he overlooked (or shrugged off) this countervailing force whose power was steadily to grow.

#### 3. The Most Important Effect of the Industrial Revolution We Have Left for Last: Its Long-Term Leverage on Economic Well-Being.

The ultimate impact of the Industrial Revolution was to usher in a rise of living standards on a mass scale unlike anything that the world had ever known.

This did not happen overnight. In 1840, according to the calculations of Arnold Toynbee, Sr., the wage of an ordinary laborer came to 8 shillings a week, which was

<sup>24</sup>For a stirring account of the birth of a self-conscious working-class movement, see E. P. Thompson, *The Making of the Working Class* (New York: Oxford University Press, 1963).

6 shillings less than he needed to buy the bare necessities of life.<sup>25</sup> He made up the deficit by sending his children or his wife, or both, to work in the mills. If, as we have noted, some sections of the working class gained from the early impact of industrialization, others suffered a decline from the standard of living enjoyed in 1795 or thereabouts. A Committee of Parliament in the 1830s, for example, discovered that a hand weaver at that earlier date could have bought more than three times as many provisions with his wages as at the later date. Although not every trade suffered equally, the first flush of the Industrial Revolution brought its hardships to bear full force, though its benefits were not as immediately noticeable.

By 1870, however, the long-run effects of the Industrial Revolution were beginning to make themselves felt. The price of necessities had by then risen to 15 shillings, but weekly earnings had crept up to meet and even exceed that sum. Hours were shorter, too. At the Jarrow Shipyards and the New Castle Chemical Works, the workweek had fallen from 61 to 54 hours; even in the notoriously long-working textile mills, the stint was down to “only” 57 hours. It was still a far cry from an abundant society, much less an “affluent” one, but the corner had been turned.

## THE INDUSTRIAL REVOLUTION IN THE PERSPECTIVE OF THEORY

We have reviewed very briefly the salient historic features of the rise of industrial capitalism. Now we must reflect on the great economic and social changes we have witnessed and ask a pertinent economic question: How did the process of industrialization raise material well-being? To answer the question, we must turn to economic theory to elucidate systematically the insights we have already gained from Smith's *Wealth of Nations*.

Let us begin by asking what is necessary for a rise in the economic well-being of a society. The answer is not difficult. If we are to enjoy a greater material well-being, generally speaking, we must produce more. This is particularly true when we begin at the stage of scarcely-better-than-subsistence that characterized so much of Europe before the Industrial Revolution. For such a society to raise the standard of living of its masses, the first necessity is unquestionably higher production. Despite all the inequities of distribution that attended the society of serf and lord, capitalist and child-employee, underlying the meanness of the times was one overriding reality: the sheer inadequacy of output. There was simply not enough to go around, and if less lopsided distributive arrangements might have lessened the moral indignity of the times, they would not have contributed much to a massive improvement in basic economic well-being. Even assuming that the wage of the city laborer and the income of the peasant could have been doubled had the rich been deprived of their share—and this is a wildly extravagant assumption—still, the prime characteristic of rural and urban life would have been its poverty.

We must add only one important qualification to this emphasis on increased output as the prerequisite of economic improvement. Overall living standards will not improve if a country's population is growing even faster than its increased output. The production of goods and services must rise faster than population if individual well-being is to improve.

How does a society raise its per capita output?

We cannot fully analyze this problem here, but our glimpse into the pin factory and our study of the Industrial Revolution in England enable us to understand a great deal about the problem. For clearly, *the key to higher output lies in enhancing the human energies of the community with the leverage of industrial capital*. Our analytic understanding of the growth must begin by looking further into this extraordinary power that capital possesses.

## Capital and Productivity

We have frequently used the word *capital*, but we have not yet defined it. We can see that, in a fundamental sense, capital consists of anything that can enhance a person's power to perform economically useful work. An unshaped stone is capital to the cave-man who can use it as a hunting implement. A hoe is capital to a peasant; a road system is capital to the inhabitants of a modern industrial society. Knowledge is capital, too—indeed, perhaps the most precious part of society's stock of capital.

When economists talk of capital, however, they usually confine their meaning to *capital goods*—the stock of tools, equipment, machines, and buildings that society produces in order to expedite the production process.<sup>26</sup> All these capital goods have one common effect on the productive process: They all operate to make human labor more productive. They make it possible for a worker to produce more goods in an hour (or a week, or a year) than he or she could produce without the aid of that capital. Capital is therefore a method of raising per capita productivity, which is an individual person's output in a given span of time; it is the lesson of the pin factory extended to all branches of output. For example, in a 40-hour week, a typical modern worker using power-driven mechanical equipment can physically outproduce at least a half dozen persons working 70 hours a week with the simpler tools available at the beginning of this century. To put it differently, in one day, a modern worker will turn out more output than his or her counterpart of 1900 did in a full week—not because the modern worker works harder, but because he or she commands thousands of dollars' worth of capital equipment rather than the few hundred dollars' worth available to a worker in 1900.<sup>27</sup>

Why does capital make labor so much more productive?

The most important reason is that capital goods enable people to use principles and devices such as the lever and the wheel, heat and cold, and combustion and expansion in ways that the unaided body cannot. *Capital goods give people mechanical and physico-chemical powers of literally transhuman dimensions*. They enormously magnify muscular strength; they refine powers of control; they embody intelligence; they endow men and women with endurance and resilience far beyond those of flesh and bone. In using capital, human beings utilize the natural world as a supplement to their own feeble capacities.

<sup>26</sup>There is also another meaning to the word *capital*. This is the social relationship that binds the wage-worker and the capitalist, the owner of the capital goods (the factory) where the worker seeks employment. Capital as a social relationship establishes the prerogatives of both capitalist and worker in their mutual dealings. First proposed by Marx, it is perhaps the most important meaning of the word if we seek to define *capitalism* as a distinct period of social history. In this book, we stay with the conventional economic usage, however, and speak of capital in terms of capital goods.

<sup>27</sup>We need an important qualifier here. Very few commodities remain unchanged over a century-long span. We have searched for items—nails? pins? bricks?—that have been unchanged since 1900. We found none.

### Capital and Specialization

Another reason for the augmentation of production lies in the fact that capital facilitates the specialization of human labor. Once again, Smith's example serves us well. A team of people working together, each one tending to one job alone in which he or she is expert, can usually far outproduce the same number of people, each of whom does a variety of jobs. The prime example is, of course, the auto production line, in which a thousand workers cooperate to produce an immensely larger output of cars than could be achieved if each one built a car alone. Auto assembly lines, of course, use prodigious quantities of capital in the overhead conveyor belts, the inventories of parts on hand, the huge factory with its power system, and so on. Although not all specialization of labor depends on capital, capital is usually necessary for the large-scale industrial operations in which specialization becomes most effective.

In our next chapter, we return to these important matters in the context of the development of modern industry. While we are still discussing the basic question of the rise of industry itself, there is a fundamental problem to consider: This is the question of how capital is made in the first place, of how a society generates the capital equipment it needs in order to grow.

### Capital and Saving

The question brings us for the first time to a relationship that we will encounter many times in our study of economics, both from a perspective of history and from a later vantage point of theory. The relationship is between the creation of those physical artifacts that we call capital and the inescapable prior act that we call *saving*.

When we think of saving, we ordinarily picture it in financial terms; that is, as a decision not to spend part of our money income. Behind this financial act, however, lies a "real" act that we must now clearly understand: When we save money, we also abstain from using a certain quantity of goods and services we might have bought. To be sure, our money savings represent a claim on goods and services, a claim that we may later exercise. Until we do, however, we have freed resources that would otherwise have been used to satisfy our immediate wants. When Smith's pin manufacturer "accumulated," he deliberately denied himself the higher standard of living that he could have enjoyed by spending his profits on riotous living. From these freed resources—the unused labor and capital that might have produced silks and coaches—society builds its capital, or, in more technical language, carries out the act of investment. Note that *investment* in economics means devoting labor and other inputs to the creation of capital goods. It does not mean putting money into stocks and bonds, although that may lead to, or assist, the capital-building process. Economists call the process of making money investments *financial* investment, to distinguish it from real investment in capital goods.

### Saving and Investment

The acts of saving and investment are inextricably linked: Saving is the releasing of resources from consumption; investment is the employment of these resources in making capital. Indeed, from society's point of view, saving and investment are only two sides of the same coin. Why do we then separate them in economic discourse? The reason is that different people may perform the saving and investing functions, especially in mod-

as those who gather up those resources for investment purposes. Nonetheless, we can see that every act of capital building, no matter who performs it, requires that resources be devoted to that purpose.

This does not mean that investment necessarily entails a diminution of consumption. A rich society does not feel its normal, recurrent saving as a "pinch" on its spending, and Smith's manufacturers were not known for their modest ways. More important, a society with unemployed factors can put its idle resources to work building capital without diminishing its expenditure on consumption. It is still saving, insofar as it is not using these newly employed resources to make consumption goods. However—and this is a crucial point—when a society is fully employed, for instance in the midst of war, it can only spend more for capital if it curtails its consumption. Put differently, at full employment, consumption spending and capital spending are competitive; when there is unemployment, both consumption and capital spending can increase.

We can now see that the rate at which an economy can invest—that is, the size of the yearly addition it can make to its stock of capital goods—depends on its capacity to save. If its living standards are already close to the margin of existence, it will not be able to transfer much labor from consumption effort to capital-building effort. However badly it may wish for more tools, however productive those tools would prove to be, it cannot invest beyond the point at which its remaining consumption activity would no longer be adequate to maintain subsistence. At the other extreme, if a society is well-to-do, it may be able to abstain from a great deal of current consumption effort to provide for the future. Accordingly, its growth will be fast. *Whether growth is fast or slow, it is a hard economic reality that the amount of investment can never exceed the amount of resources and effort that are unused for other purposes, mainly consumption.*

### Growth in Early Capitalism

This seems to imply that the process of economic growth must perforce be very slow in a poor economy, and so it is. In England, as we have already seen, nearly three-quarters of a century elapsed before the new process of industrialization brought about an increase in productivity sufficiently large to be felt as a general improvement in the lot of the worker. In the underdeveloped nations, as we shall see in Chapter 13, the prospect is equally or even more sluggish. At its best, growth is a gradual and cumulative rather than an instant phenomenon; where the initial level of savings is low because of poverty, the rate of advance is correspondingly slower.

Perhaps we can better appreciate this overall determinant of the pace of growth if we examine the actual social circumstances under which saving arose in early nineteenth-century England.

Who did the saving? Who abstained from consumption? Well-to-do agriculturalists and manufacturers (for all their ostentatious ways) were certainly important savers who plowed substantial sums into more new capital investments. Yet the savers were not just the manufacturers or the gentry but also another class—the industrial workers. Here, in the low level of industrial wages, a great sacrifice was made—not voluntarily, by any manner of means, but made just the same. From the resources the workers could have consumed was built the industrial foundation for the future.

We can also see something that is perhaps even more significant. This is the fact that England had to hold down the level of its working-class consumption in order to free



“holding down” was accomplished largely by the forces of the marketplace—with a liberal assist, to be sure, from the capitalists and from a government quick to oppose the demands of labor in the interests of its upper classes. But social inequities aside, the hard fact remains that had industrial wages risen very much, a vast demand for consumer goods would have turned the direction of the English economy away from capital building, toward the satisfaction of current wants. This would certainly have redounded to the immediate welfare of the English worker (although the increase in per capita consumption would have been small). At the same time, however, it would have postponed the day when society’s overall productive powers were capable of generating an aggregate output of very large size.

This bitter choice must be confronted by every industrializing society, capitalist or socialist, democratic or totalitarian. To assuage the needs of today or to build for tomorrow is *the* decision a developing society must make.

### Incentives for Growth

There remains but one last question. We have gained some insight into the mechanics of growth, but we have not yet answered the question: How are these mechanics brought about? How does society arrange the reallocation of its factors of production to bring about the creation of the capital it needs?

This query brings us again to a consideration of our original division of economic societies into three types: traditional, command, and market. It also leads to some very important conclusions.

The first of these is obvious: Tradition-bound societies are not apt to grow. In such societies, there is no direct social means of inducing the needed reallocation of factors. Worse yet, there are often strong social and religious barriers that create obstacles to the needed shifts in employment.

The situation is very different, however, when we turn to command societies. We have seen a striking use of command as the industrializing agency in modern times. In at least one country at one time, the Soviet Union, command was the principal mechanism for a dramatic transition from peasantry to industrialization, and in many other collectivist economies, command has been used, with varying results, to bring into effect such a transition. China is the big case in point today, with command being used to create a dynamic market sector.

Command was also one of the principal ways by which Europe began its industrialization. In the state-directed establishment of shipyards and armories, the construction of royal palaces and estates, tapestry works and chinaware factories, a very important organizing impetus was given to the creation of an industrial sector in the Mercantile era. True, in those days, command was never so ruthlessly applied nor so widely directed as with the communist states. But however much milder the dosage, the medicine was in essence the same: The *initial* transfer of labor from the traditional pursuits of the land to the new tasks of the factory depended on a commanding authority that ordered the new pattern into being. A few years ago Barbara Ward wrote in *India and the West*: “A developing society must at some point begin to save, even though it is still poor. This is the tough early stage of growth which Marx encountered in Victorian England and unfortunately took to be permanent. It is a difficult phase in any economy—so difficult that most societies got through it by *force majeure*. . . . No one asked

The Soviet workers who came to Sverdlovsk and Magnitogorsk from the primitive steppes had no say in the scale or the condition of their work. Nor have the Chinese in their communes today.”<sup>28</sup>

### The Market as a Capital-Building Mechanism

Command was by no means the main agency for the final industrialization of the West. Rather, the organizing force that put people to work in making capital equipment was the market.

How did the market bring about this remarkable transformation? It achieved its purposes by the lure of monetary rewards. It was the hope of profits that lured manufacturers into turning out more capital goods. It was the attraction of better wages (or sometimes of *any* wages) that directed workers into the new plants. It was the signal of rising prices that encouraged, and falling prices that discouraged, the production of this or that particular capital good. Here is Smith’s market mechanism, joined to his growth model.

What, we may next ask, opened the prospect of profits large enough to induce entrepreneurs to risk their savings in new capital goods? The answer brings us full circle to the focal point of this chapter, for it is to be found primarily in the body of technological advance constituting the core of the Industrial Revolution. It was the pin-making machinery that opened the possibility of a profitable and expanding pin industry.

Not that every new invention brought with it a fortune for its pioneering promoters, or that every new product found a market waiting for it. The path of technical advance is littered with inventions born too soon and with enterprises founded with great hopes and closed down 6 months later. Looking back over the vast process of capital accumulation that, beginning in the late eighteenth century, lifted first England and then America into the long flight of industrial development, there is little doubt that the impelling force was the succession of inventions and innovations that successfully opened new aspects of nature to human control. Steam power, the cheap and efficient spinning and weaving of cloth, the first mass production of iron and, later, steel—these were the great breakthroughs of industrial science that opened the way for the massive accumulation of capital. When the great inventions had marked the channel of advance, secondary improvements and subsidiary inventions took on an important supporting role. To the entrepreneur with a cost-cutting innovation went the prize of a market advantage in costs and correspondingly higher profit. More than that, when one pioneer in a field had gained a technical advantage, competition quickly forced everyone else in the field to catch up as quickly as they could. Most of the cost-cutting innovations involved adding machinery to the production process—and this in turn boosted the formation of capital.

Capitalism as a whole proved an unparalleled machine for the accumulation of capital. In its development, we find the first economic system in history in which economic growth became an integral part of daily life. As Marx and Engels were to write in the *Communist Manifesto*: “The bourgeoisie, during its scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together.” The compliment, all the more meaningful coming from the two archenemies of its social order, was true.

## Key Concepts and Key Words

- |                              |  |
|------------------------------|--|
| <b>Industrial Revolution</b> | <p>1. The Industrial Revolution was a <i>great turning period</i> in history, during which manufacturing and industrial activity became primary forms of social production.</p> <p>2. The Industrial Revolution began in England in the mid- to late-eighteenth century (although its roots are far deeper). There are numerous reasons why it occurred there and then:</p> <ul style="list-style-type: none"> <li>• England was a <i>wealthy trading nation</i> with a well-developed middle class.</li> <li>• England's <i>aristocracy</i> was <i>much more commerce-minded</i> than the aristocracies of the Continent.</li> <li>• England was the home of a widespread vogue of <i>scientific investigation</i> and of "gentlemen farmers" interested in agricultural innovation.</li> <li>• England's relatively <i>open social structure</i> permitted the rise of New Men, such as Watt and Wilkinson, who brought to manufacturing a burst of new social energies.</li> <li>• Many other causes could be cited as well. The Industrial Revolution was a <i>many-sided, complex chain of events</i>.</li> </ul> |
| <b>Output</b>                | <p>3. The Industrial Revolution brought with it changes of the greatest importance in society.</p> <ul style="list-style-type: none"> <li>• It ushered in a slow but cumulative <i>rise in output</i> that was eventually to lift the industrial world out of an age-old poverty.</li> <li>• It brought the <i>factory</i> (and the <i>industrial slum</i>) as a new environment for work and life.</li> <li>• It gave rise to new kinds of <i>social abuses</i>, but it also greatly sharpened the general <i>awareness of economic conditions</i>.</li> </ul>  |
| <b>Capital building</b>      | <p>4. The Industrial Revolution was essentially a <i>capital-building process</i> (machines, buildings, canals, railways), as a result of which the productivity of labor was greatly increased.</p>   |
| <b>Productivity</b>          | <p>5. <i>Capital generally enhances productivity</i> because it gives people far greater physical and technical capabilities than they enjoy with unaided labor alone. It also enables people to combine and <i>specialize</i> their labor, as in modern factory production lines.</p>   |
| <b>Saving</b>                | <p>6. <i>Capital building requires saving</i>. Capital can be built only if society has the use of resources normally used for filling its consumption needs. Saving releases these resources; investing puts them to use.</p>   |
| <b>Investment</b>            | <p>7. Society cannot devote more resources or energies to capital building than those it releases from other uses (or those it has available as unemployed resources). By and large, <i>saving regulates the pace at which investment can proceed</i>. Poor societies, in which it is difficult to give up consumption, accordingly have great problems in amassing enough resources for investment.</p>   |
| <b>Consumption</b>           | <p>8. The saving necessary for investment can come from agriculture, manufacturing enterprises, and many other sources. In poor nations, it must also often be wrung from workers or peasants, by denying them the use of all the nation's economic potential to fill their consumption needs.</p> <p>9. <i>Saving in poor nations is usually an involuntary process</i>. Capital building in many developing nations today, particularly those under authoritarian regimes, is attempted by the agency of command, not very successfully, on the whole. In the Industrial Revolution, it was accomplished in part by command, but mainly by the market system. The remarkable inventions of the Industrial Revolution served as sources of profits that resulted in great accumulations of capital.</p>   |

## Questions

1. It is interesting to note that technical improvements in agriculture or manufacturing have generally been slow to arise in countries that have relied on slave labor. Can you think of a reason why this might be so?
2. What forces do you think would be necessary to bring a new "industrial revolution" to the underdeveloped world today? Is an industrial revolution there apt to resemble the one that took place in England in the eighteenth century?
3. Industrialization in England was marked by a sharp growth of bitter political feeling on the part of the new factory proletariat. Do you think this must be an accompaniment of industrialization everywhere, or was it a particular product of early capitalism?
4. How does capital help human productivity? Discuss this in relation to the following kinds of labor: farm labor, office help, teaching, government administration.
5. When General Motors devotes \$1 billion to new investment (e.g., building new factories, warehouses, offices), who does the saving that is required? Stockholders? Workers? The public? Buyers of cars?
6. It is estimated that the value of our private capital structures and equipment in the United States in 1992 was some \$18 trillion. Assume that half of it were wiped out in some catastrophe. What would happen to U.S. productivity? To average U.S. well-being? How could the damage be repaired?
7. Does all investment require saving? Why?
8. Is capital building in the United States today directed by the market alone? Does the government accumulate capital? Does public capital improve productivity as well as private capital?
9. Is building a school an "investment"? Is building a hospital? A sports stadium? A housing project? A research lab? What do you think distinguishes investment, in general, from consumption?

## Thinking Back, Looking Ahead

## THE EMBEDDEDNESS OF ECONOMICS


The fact-packed pages behind us lead to a question central to economics that is curiously hard to answer. It is whether there is an inner core to that complicated thing we call “economic history”—the “story,” if you will, that lies behind the title of our book.

Is technology the theme of that larger story? It certainly seems to be just such a core in the period we have just studied. If so, however, what was the shaping force of economic history during the thousands of years before that dynamic technology was born? Kinship obligations were surely the organizing force of hunting and gathering societies, and relations of command and obedience were the core of the social formations that followed them. What have kinship, or command and obedience, to do, though, with economics as we know it? Does economics always rest on some fundamental sociological, or psychological, or political aspect of society? Is there no *economic* organizing force, as such? Does that mean that to be an economic historian we need to know a great deal about engineering and social and political relationships? Or, looking ahead to the world of market systems, does it mean that economists have to be experts on the psychol-

ogy of buyers and sellers of all kinds, not least of stocks and bonds? If so, what is left for economics to add?

Here is our answer: We see economics as a unique field of social inquiry that helps us understand why human history has gone in the directions of the past and in whatever directions it may move in the imaginable future.

That certainly does not make us one-track thinkers who see production and distribution, or markets, or even the powerful dynamics of capitalism behind everything, important as these forces have been and are likely to continue to be. There can be more than one way to describe the nature and impact of capitalism on politics or national cultures or the human imagination. Looking forward in economics is no more cut and dried than we hope looking backward has been.

We ask you to read the following chapters with a sharpened awareness of our interest in the ways in which economics may help us see both the past and the future more clearly. By now, you must have determined the degree to which economics has helped you understand the past. Beginning with Chapter 5, you should be looking for ways in which economics may—or may not—be useful in shedding light on the future. 

# CHAPTER

## The Impact of Industrial Technology

**W**ith this chapter, we enter a new period of economic history. Until now, we have largely dealt with the past, giving only an occasional glance to later echoes of the problems we encountered. Our focus now turns toward the present. We have reached the stage of economic history whose nearest boundary is our own time. Simultaneously, our point of geographic focus shifts. As economic history enters the mid-nineteenth century, the dynamic center of events begins to shift toward the United States. Not only do we now begin to enter the modern world, but the economic trends in which we will be interested take us directly into our own society.

What is the theme of this chapter? Essentially, it continues a motif we began with the Industrial Revolution—the impact of technology on economic society. Looking back, we can see that the burst of inventions that marked the revolution was not in any sense the completion of a historic event. Rather, it was merely the inception of a change process that would continually accelerate to the present time.

We can distinguish three or even four stages of this continuous process. The first industrial revolution was largely concentrated in new textile machinery, improved methods of coal production and iron manufacture, revolutionary agricultural techniques, and steam power. It was succeeded in the mid-nineteenth century by a second industrial revolution: a clustering of industrial inventions centering on steel, railroad and steamship transportation, agricultural machinery, and chemicals. By the early twentieth century, there was a third wave of inventions: electrical power, automobiles, and the gasoline engine. In our own time, there is a fourth: the revolution of electronics, air travel, and nuclear energy. Some people speak of today’s computerization of the world as constituting a fifth such revolution, perhaps the most important of all.

It is difficult, perhaps impossible, to exaggerate the impact of this continuing advance. Now moving rapidly, now slowly; now on a broad front, now on a narrow salient; now in the most practical of inventions, again in the purest of theoretical discoveries, the cumulative application of science and technology to the productive process was *the* great change of the nineteenth and twentieth centuries. The initial Industrial Revolution was therefore in retrospect a kind of discontinuous leap in human history, a leap as important as that which had lifted the first pastoral settlements above the earlier hunting communities. We have already noted that in the factory the new technology brought a new working place for people, but its impact was vastly greater than that alone. The enormously heightened powers of transportation and communication, the far more effective means of wresting a crop from the soil, the hugely enhanced ability to apply power for lifting, hauling, shaping, binding, cutting—all this conspired to bring about a literal remaking of the human environment, and by no means an entirely benign one.