

1 England and the Birth of the Revolution

The birthplace of the industrial revolution was eighteenth-century England, blessed with people, natural resources, inventions, and money, all of which were needed for industrialization. Actually, none of these factors was unique to England; among other European nations, France and Holland also possessed these elements. Nonetheless, it was England where the brew of these ingredients first gave rise to the industrial revolution.

England's Expanding Population

The industrial revolution required both workers and consumers, both of which were supplied by England's rapidly expand-

ing population. Prior to the eighteenth century, population growth in England had been slow. In 1700, England had less than 7 million people, and its population was growing so slowly that English statistician Gregory King predicted the total would not reach 11 million until the year 2300. In fact, however, beginning a half-century after King, the population began expanding rapidly. By the first decades of the nineteenth century, England's population reached the 11 million mark, only a little over a hundred years, not six hundred, after King's prediction.

Although the number of births rose during the eighteenth century, the more dramatic change was in the death rate, which dropped sharply. In 1700, London and its surrounding areas, for example,



A view of the busy Thames River in London shows a bustling city and crowded skyline. England's population boomed throughout the eighteenth century.

recorded a half-million more deaths than births; by 1800, deaths only outnumbered births by twenty thousand.

In part, the death rate dropped because more babies were surviving childbirth, due to better training of midwives and the formation of maternity hospitals. Additionally, both children and adults were dying less frequently of disease. The major epidemics, which had ravaged the country throughout earlier centuries, disappeared after 1700. For instance, beginning in the fourteenth century, the bubonic plague, or Black Death, periodically decimated the English population. However, after an outbreak of the plague

Workers collect the dead in 1665 during the last outbreak of bubonic plague in London. The decline of the plague and other diseases reduced England's death rate.



in the 1660s, the disease vanished from England. Other major diseases followed a similar pattern. Syphilis, a major killer in the sixteenth century, although still present in eighteenth-century England, was no longer of epidemic proportions.

The reason for the end of these epidemics remains obscure. Certainly, sanitation was as poor as it had been for centuries, with sewage and garbage routinely dumped into the streets. However, at least one deadly disease, smallpox, was brought under control through human efforts when inoculations against it began in the 1760s.

More and Better Food

Another major reason for the drop in the death rate was that more food was available. Indeed, food production increased over 60 percent during the eighteenth century, about twice the rate between 1500 and 1700.

Much of this increase came from the introduction of new crops. During the 1700s, English farmers began raising potatoes, which proved to be cheap and nourishing food. Other new crops indirectly benefited humans as improved animal feed: Animals fed corn, buckwheat, carrots, and cabbage produced larger quantities of better-tasting meat and milk.

“Turnip” Townshend

The most important new animal food was the turnip, introduced by Viscount Charles Townshend in the first half of the eigh-



Viscount Charles Townshend proposed using turnips to sustain farm animals and clover to utilize crop fields more efficiently.

teenth century. The viscount was such a passionate promoter of the vegetable that he became the butt of many jokes and earned the nickname “Turnip” Townshend. In the end, however, many realized the value of this food.

Up to Townshend’s time, farm animals had to be slaughtered at the onset of cold weather because there was nothing to feed them during the winter months. Townshend found that turnips could be stored all winter and that farm animals thrived on them. Writer James Burke observes that “if milking cows were fed turnips . . . , they could give milk all winter. Turnips were also used to fatten bullocks [cattle] through the colder months.”⁵

Townshend was also a vocal advocate of clover, a cover crop that replaced nitrogen in soil depleted by food crops, which eliminated the need for farmers to leave

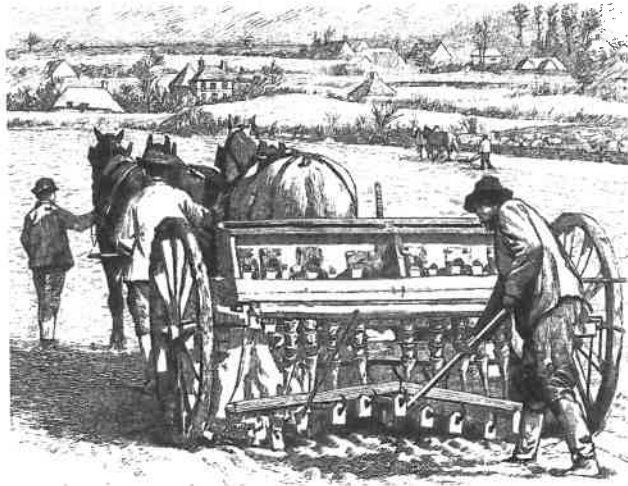
some of their fields unplanted, or fallow, every third year. Instead of leaving fields fallow for nitrogen to build up naturally, Townshend urged the use of clover, which both replenished the soil and provided good food for cattle and sheep.

Seed Drills and Selective Breeding

Equally important to English agriculture was the development of new ways of raising crops and animals. About the same time that Townshend was experimenting with turnips and clover, an English farmer, Jethro Tull, introduced a new way of planting seed. In the past, farmers had scattered

Jethro Tull’s innovative method of planting seeds deeply in the ground forever changed farming.





Horse-drawn seed drills created greater crop yields than the earlier method of scattering seeds on top of the ground.

seed over the surface of a plowed field. Much of this seed was eaten by birds or did not take root.

Tull instead proposed planting each seed deeply into the ground and then hoeing around it. The result was a heavy crop yield because more seeds survived and flourished. Tull increased the efficiency of this process by doing the planting with horse-drawn seed drills and hoes.

Another Englishman, Robert Bakewell, improved sheep, a major source of meat in the British Isles, by crossbreeding the best specimens he could find. The result was sheep that provided twice the meat of other breeds. Additionally, the meat tasted better. Such selective breeding practices were soon applied to other animals, particularly cattle.

This agrarian revolution, as it has been called, was every bit as important as the industrial revolution. The availability of good food, combined with improved infant survival and the disappearance of epidemics, helped more young live to adulthood

and allowed adults to live longer. This meant that, by the middle of the eighteenth century, more people were having more children, and the population grew quickly thereafter.

Impact of the Population Explosion

The multiplying English population had a complex relationship with the growth and development of the industrial revolution. Economic historian Phyllis Deane writes:

Without the population growth . . . , the British industrial revolution would have been retarded for lack of labor. . . . Without the rising demand [for goods] . . . , which reflected . . . the growth of population, there would have been less incentive for British producers [manufacturers] to expand

... , and hence ... some of the dynamism which powered the industrial revolution would have been lost.⁶

The growing numbers of people created an expanding market for all kinds of goods: clothes, shoes, bricks, razors, knives, scissors, kitchenware, and pins, just to name a few. English industry met this demand first by finding ways to speed up the manufacture of the desired wares and second by building more factories to turn out more goods.

The growth of industry meant that more workers were needed; thus the population that gave rise to increased business also provided the labor force to generate that increase. At the core of this workforce were former farmers. The new farming methods of Tull and Bakewell required large farms, herds, and investments, making farming affordable only to the wealthiest of landowners. Those who could not, the scholar Eric Pawson observes, "moved into those parts of the economy where ... regular wages were to be earned—into industry."⁷

Iron and Coal

One of those industries, among eighteenth-century England's most important, was the manufacturing of iron. As historian Charles Beard notes:

The importance of iron in the development of industry ... can scarcely be over-estimated. Its qualities of durability, malleability [ability to be worked], and strength, and the manifold [many] uses to which it can be adapted, make iron an indispensable factor in the evolution of mechanical production.⁸

England was rich in iron ore, but like all ore, it had to be smelted; that is, melted or fused with fire to separate the metal from rock and other substances making up the ore. Prior to the eighteenth century, English iron foundries, like those all over Europe, used charcoal to smelt iron. Charcoal is made from wood, but by 1700 much of England's great forest was gone and so was its charcoal supply. Iron manufacture in England declined so sharply that the country began importing the metal.

England had a possible charcoal substitute in its large deposits of coal. However, the coal contained other substances, such as sulfur, that made smelted iron brittle. Then, in 1708 the Darby family of Coalbrookdale started smelting iron using coke, coal that had been processed to make a cleaner product. Coke-smelted iron was of the highest quality.

With plenty of coal to make coke, English iron production soared, and iron became a major export rather than import. It also became an increasingly important and common building material. In 1779 iron manufacturers John Wilkinson and Abraham Darby II built the first iron bridge, which spanned the River Severn. Eight years later, Wilkinson constructed the first iron ship. Of even more importance were tools and factory machinery made of iron, which replaced less reliable and less durable wooden models.

The Flying Shuttle

Another great English industry was textiles. For centuries, English workers had turned raw wool, and more recently cotton,