

England emerged as the technological leader of the Industrial Revolution and as the target of most efforts at industrial espionage. Strides in industrial technology, however, were not confined to the British Isles. All European states were in some ways involved in the production and transfer of technological and scientific information, and the British government supported appropriation of protected technologies of its rivals while at the same time it erected legal barriers against the outflow of technology. As continental observers marveled at the British innovations, British firms continued to seek various continental industrial techniques and to attract skilled laborers. It was quite common for English professionals to go abroad, learn a trade, and upon their return file for patent monopoly in England. For example, the Smithfield chemist Humphrey Jackson went in the 1750s to Russia to study a new method of brewing, and in March 1760 obtained a patent for the process. When England coveted other nations' industrial techniques, it did not hesitate to employ all the methods it prohibited at home. In an attempt to acquire the French technique of cast plate glass, high-level British officials tried to tempt senior French managers as well as regular workers to come and build an imitative factory in England. Though plagued by economic upheaval and unemployment, the most advanced center of manufacturing in the world continued its policy of attracting footloose skilled workers. In fact, throughout the Industrial Revolution Britain continued to draw heavily on Continental technology.<sup>17</sup>

Industrial espionage by states and individuals only partly accounts for the failure of states to confine the fruits of innovations to their national borders. As early as 1699 the great German mathematician and philosopher, Gottfried Wilhelm Leibniz, argued in his *Memorandum on the Founding of a Learned Society in Germany* that the growth of European scientific enterprise depended on free communication among scientists of different nations. Growing communication among academics, scientists, and intellectuals further

undermined official efforts to control the diffusion of knowledge. Modern distinctions between theoretical knowledge and practical applications do not apply to the eighteenth century. Men of science often dabbled in inventions. The advance in scientific knowledge taught men of letters all over Europe why certain innovations worked. Technological breakthroughs and scientific discoveries were reported in the same journals, making them widely accessible and allowing innovators to build on the discoveries of colleagues all over the continent. Measurements and calculations that underlay the Scientific Revolution of the seventeenth century had frequently an immediate practical application. The popularization of the scientific enterprise in the eighteenth century coincided with increased specialization in production and accelerated the links between utility and science.<sup>18</sup>

In this highly competitive atmosphere, governments, not to be outdone by rivals, invested in the development of scientific and intellectual institutions. Many academies were founded in eighteenth-century England, France, Germany, and Italy. The British government patronized the arts and sciences. In France alone more than a hundred academies were established from 1700 to 1776. Knowledge gained in these endeavors was not kept from rivals and competitors. On the contrary, most European academies published proceedings that were devoted to summarizing and popularizing advances in knowledge. Victory in this competitive culture involved advertising accomplishments—a practice that ran counter to efforts to keep knowledge exclusive to one nation. The London Royal Society of Arts displayed in its public gallery models that had been entered in its periodic contests for the best solutions to particular technological problems. The most important example of the internationalization of knowledge in the eighteenth century was the *Encyclopédie*. An impressive display of the state of knowledge around the middle of the eighteenth century, this collective accomplishment of the French