A 19th-century modernization movement helped launch a 20th-century world power.

The “opening” of modern Japan to the West is commonly understood to have occurred in 1854. Commodore Matthew Perry and eight U.S. Navy warships had sailed to the island nation in 1853 to “encourage” the isolationist Tokugawa shogun government to sign a treaty opening several of its ports to international trade. Initially, foreign influence was not great; however, within two decades, the feudalistic regime that had ruled Japan for more than two centuries fell, primarily because of internal dissatisfaction. The emperor, a teenager named Mutsuhito, was restored as ruler.

This “Meiji Restoration” (meiji means “enlightened peace”) inaugurated what was to be a new era in Japanese history: a 44-year period in which Japan would emerge as a great world power. Determined to modernize the country, the new government looked to the West for inspiration. In this period, the roots of the Japanese technological and industrial transformation developed that would so influence the course of 20th-century history.

The First Success Story

Although the strength of the contemporary Japanese economy derives primarily from post-World War II developments, Japanese achievements in scientific and high-technology research can be traced to industrial practices in the meiji period and the prewar decades. Prewar Japanese chemical industry offered the first business and scientific success story for modern Japan, and served as a premier example for the later, more profitable marriage of 20th-century business and science.

In the early years of the meiji period, no technology-intensive industry existed in Japan. Yet, as both individual and proto-industrial consumers purchased foreign products in increasing numbers, the government decided to invest in certain areas of domestic production to prevent an over-reliance on imports. Sulfuric acid and soda were two such “subsidized” products (used, respectively, in the refining of precious metals and as a bleaching agent), although it was the development of chemical fertilizers that would contribute more to the technological advancement and financial growth of Japanese industry. The land tax reform of 1873 increased the demand for fertilizer, as farmers tried to raise productivity.

In 1886, the Sulphuric Acid Co. of Osaka manufactured the first superphosphate fertilizer from phosphate rock. Tokyo Fertilizer, the future Nissan Chemical Industries, followed suit and eventually would become a dominant firm in early Japanese chemistry. Although the government promoted the use of artificial fertilizers, chemical fertilizers did not become widely popular until the last years of the 19th century. Nevertheless, once farmers began to achieve higher crop yields with the new fertilizers, production—and research—increased precipitously.

Superphosphate manufacturing heralded the beginning of diversification in the young Japanese chemical industry; yet at the same time, there was a national shortage of chemists and engineers. As government and industry began to recognize the need to match Western technological advances, the Japanese system of higher education was forced to adapt. German technical universities and methods of scientific education greatly impressed the Japanese, and they reconfigured the methods of training their scientists to emulate the German model. Japan had very few chemistry graduates in the 1870s, but by the 1920s, it had a temporary glut of chemists—a testament of sorts to the successful transformation of scientific education. Professionalization proceeded apace. Some of those earliest graduates of Tokyo University’s chemistry program founded the first Japanese chemical society, the Tokyo Chemical Association, in 1877.

Entrepreneurial Chemistry

With the success of superphosphate fertilizer production, government and private investors were more than willing to provide funds for further research, development, and manufacture of chemical products. Ammonium sulfate was produced successfully in the early 20th century and was very profitable for Japanese companies. Electro-chemicals, however, were even more profitable and ultimately revolutionary in their implications for Japanese high-technology. In 1901, Fujiyama Tsuneichi, a young scientist working for an electric light company, produced Japan’s first electrochemical, calcium carbide. An entire industry arose quickly around carbide. Initially, sparked by the demand for nitrogenous fertilizers, Japanese manufacturers were soon producing explosives, acetylene, acetic acid vinyls, butanols, esters, and acetates. Fujiyama himself went into business with his friend, the talented engineer Noguchi Jun, and in 1908, they secured the Japanese rights to produce calcium cyanamide (using the technique developed by Germans Adolf Frank...
and Nikodem Caro) and founded Japan Nitrogenous Fertilizer, Inc. (Nitchitsu). The Japanese chemical industry would never be the same.

What was particularly interesting about Nitchitsu’s success in winning the patent rights to the Frank–Caro method was that the new company was not one of the old zaibatsu, the large and powerful “family” corporations that had so long dominated Japanese commerce. Usually centered on a bank and a trading house, the zaibatsu were centralized business groups involved in myriad commercial activities, from shipbuilding to insurance. In time, the zaibatsu also became heavily involved in chemical production, but they were initially more conservative than younger companies like Nitchitsu, Nissan, Nisso, and Mori—all primarily electrochemical in orientation. Because of their aggressive entrepreneurial activities and importation of technology from abroad, these companies were the early leaders in the Japanese chemical industry.

Although they initially trailed the new chemical firms, the zaibatsu learned quickly. For example, the House of Sumitomo had for years operated a copper-smelting facility on the island of Shikoku. In 1913, the family created the Sumitomo Fertilizer Factory to produce sulfuric acid and calcium superphosphate. Fifteen years later, the reorganized Sumitomo Fertilizer Manufacturing Co. went into the production of ammonia, and in 1934, it began to make nitric acid, changing its name to the Sumitomo Chemical Co. Sumitomo would eventually emerge as one of the most comprehensive chemical producers in Japan. Mitsui Chemical underwent a similar, deliberate development process. In the years immediately preceding World War I, Mitsui’s Miike mine coking plant began to produce the first synthetic dyestuffs manufactured in Japan. After a wartime dye shortage boosted business, the old zaibatsu’s operation became profitable in the mid-1920s. By the early 1940s, Mitsui would be the largest dyestuffs manufacturer in the nation. Mitsubishi, did not become involved in chemical production until the early 1930s, when it transformed a coking factory in Kyushu into a dye-making plant for the newly formed Japan Tar (which became Japan Chemical in 1936). For the next decade, Japan Chemical manufactured not only coal chemicals but also explosives, cokes, magnesium, and agricultural chemicals. Near the end of World War II, the company (after acquiring several smaller businesses) became Mitsubishi Chemical, the name by which it is still known.

By the 1930s, the zaibatsu had become important players in the Japanese chemical industry, and the younger companies were so successful that some journalists were referring to them as the “new zaibatsu”. Original chemical research was blooming. The Gosei Kogyo Co. developed independent methanol technology in 1932, and six years later, the Japanese Navy and the South Manchuria Railroad Co. together began high-pressure coal hydrogenation. Much of the new technology came from the electrochemical industry, which was dominated by Nitchitsu but had other significant new zaibatsu participants. Dai Nihon Fertilizer (which would later merge with Nissan) and Showa Fertilizer (later, Showa Denko) were two of the most prominent. In fact, by 1937, Showa trailed only Nitchitsu’s subsidiary Chosen Chisso as the largest producer of ammonium sulfate in Japan.

In concert with the rise of chemical production, the manufacturing of scientific equipment, including chemical instruments, increased significantly during the years before World War II. Kyoto inventor Genzo Shimadzu, Sr., first produced and sold physical and chemical apparatus for educational purposes in the late 19th century, and in the early 20th century, his son, Genzo Jr., reorganized their company, Shimadzu (formed in 1875), as a joint-stock enterprise. Shimadzu manufactured industrial instruments and equipment throughout the 1920s and, in 1934, began the production of spectrographs. Genzo Jr., was honored by the emperor in 1930 as one of the 10 leading inventors in Japan. Another
er significant prewar instrument company, Rigaku, was founded in 1923, and soon became a leader in industrial X-ray technology. By the mid-1930s, Rigaku was routinely manufacturing X-ray generators and cameras. Both companies, along with other instrument makers, would become much more prominent in the postwar era.

**War and Resurgence**

As one might imagine, World War II had a profound impact on Japanese industry. Mobilizing for war, the government demanded explosives, but investment also led to new products that would become increasingly important after 1945. Research into, and development of, plastics, resins, acetates, and petrochemicals were stimulated by the expanding Japanese military machine. At the same time, however, scientific and technical information from the West ceased to enter the country during the years of conflict. Significant chemical manufacturing facilities were destroyed by Allied bombing raids near the end of the war, and operations that had been moved to Korea and northern China were lost with the Japanese military defeat. By 1945, chemical production was down considerably. The manufacture of sulfuric acid was at only 25% of prewar capacity, and calcium carbide was being produced at a slightly better 40%. The industry appeared to face a long climb back to respectability.

Despite its humble position at the war’s end, the prewar chemical industry was essential to Japanese economic growth and technological development. The electrochemical industry in particular was the country’s most technologically sophisticated enterprise before World War II. Using electricity to fix nitrogen from the atmosphere and transform it, in combination with other elements, into fertilizers was a crucial technological achievement for a nation still largely agrarian after the turn of the 20th century. But electrochemistry did not only meet the needs of Japanese agriculture. Because chemical firms were so dependent on technological progress to stay competitive, these new zaibatsu companies inaugurated innovative practices, such as the emphasis on technically trained management, that became commonplace in Japanese high-technology industries. Although the war hurt many of the new zaibatsu, subsidiaries of some early high-tech chemical companies became prominent corporations in postwar Japan (such as Asahi Chemical, out of Nitchitsu). Thus, in some sense, the war did not require a complete break with the scientific-entrepreneurial ways of the past. Perhaps more than any other enterprise, the prewar chemical industry prepared the Japanese business and science communities for their continuing collaboration in the second half of the 20th century.

**Further Reading**


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