Iron and Steel Industries of Manchuria

MUZAFFER ERSELCUK, Purdue University

Although it would seem to the causal observer that little or no connection exists between Manchurian iron and steel and the state of Indiana, still there is a very definite link, the result of the perpetual motion of international trade. It will be remembered that Indiana is one of the larger producers of iron and steel. Naturally any developments in the iron and steel industry even in Manchuria, halfway around the world, will cause unmistakeable repercussions even in Indiana.

Since the Japanese occupation of Manchuria in 1931 striking developments have occurred in the expansion of Manchuria's iron and steel industry in the following phases:

1. Discovery of new deposits of raw materials for the production of iron and steel, especially of coal and iron ore.
2. Development of technology for utilizing low-grade iron deposits.
3. Modernization of the existing equipment and the building of new production facilities.

These were not the result of haphazard developments by private enterprise, but of methodical planning by the Japanese government, which wanted to insure a large supply of iron and steel for the constantly growing needs of industries in Japan proper. Naturally the important role of iron and steel in waging war was also kept well in mind. Japan was not alone in such activity, however; the development of iron ore and coal resources as well as the construction of blast furnaces and steel mills was being pushed at government expense during the decade preceding the Second World War in Russia, Germany, Italy, Poland, Rumania, Turkey, and Yugoslavia.

In 1929 the Manchurian production of iron ore and coal as well as of pig iron was exceedingly small, and no steel ingots or rolled steel were produced. During the first years of the Japanese occupation, there was a considerable increase in production of pig iron and its raw materials, but the large-scale expansion program did not start until 1937, as will be seen from the following figures:[1]

	In metric tons		
	1929	*1937*	*Goal for 1942*
Iron ore	986,000	2,257,000	12,000,000
Pig iron	294,000	739,000	4,860,000
Steel ingots	....	427,000	3,500,000
Rolled steel	....	370,000	2,000,000
Coal	10,024,000	12,540,000	38,000,000

[1] Schumpeter, E. B., et al., 1940. *The Industrialization of Japan and Manchukuo,* p. 388.

Raw Materials

Iron. Most of the known iron deposits in Manchuria are found in the southern and central regions of the country. In the north only small deposits have been discovered to date. The largest part of the Manchurian ores belong to the "Archean" type, which is credited with a possible two billion tons containing just under 35 per cent metallic iron. The ore body is found in an irregular linear zone stretching from the Sea of Japan coast of Northeastern Korea to Lunghsien in Hopeh, passing across Southern Manchuria and going under Liaotung Bay. Although the length of the ore zone is about 400 miles, the mineralized area is narrow.

In addition to the lean ores, in a few places localized pockets of rich ore containing 60 per cent or more metallic iron appear. At least 95 per cent of the ores, however, may be classified as poor, containing only 30-35 per cent metallic iron. On the basis of the most recent available data, the iron reserves of Manchuria may be estimated at over three billion tons, with a metallic content of 1.3 billion tons.

The important reserves are located in two areas, the Anshan-Waitoushan-Miaoerhkou triangle in Fengtien and the Tungpientao zone in Tunghua province. The former has a proved iron reserve of 1,168 million tons of lean ores and ten million tons of rich ores, or about 393 million tons of pure iron. The latter, not yet fully studied, is estimated to have reserves of about 1,500 million tons, with a fair proportion of high-grade ores. Besides these two areas, some iron is found in Central Manchuria, southeast of Hsinking.

On the basis of proved deposits, the production of pig iron at the rate of 5,000,000 tons annually can continue at least for another 200 years.

Coal. Geological investigations since 1932 have pushed estimates of coal reserves in Manchuria from 4,800 million to about 20,000 million tons.[2] Many other rich coal fields are anticipated as results of further surveys, raising the aggregate deposit figure still higher. In regard to thermal power and heat for steel furnaces and rolling mills, the coal supply is more than sufficient; however, only three groups of mines with aggregate known reserves of not more than 500 million tons of coal produce a high-grade metallurgical coking coal—that of Penhsihu in Fengtien, those of Tungpientao in Tunghua, and those of Mishan in Northeastern Manchuria. The total production capacity of these mines is about 2.5 million tons, much less than the requirements of the existing blast furnaces. To make conditions even worse, the Mishan mines, with a production capacity of about a million tons, are 650 miles away from the main blast furnace center of Anshan, and it is more advantageous from the point of transportation economy for the Mishan mines to ship coal to the Seishin blast furnaces in Korea rather than to Anshan. This leaves only about 1.5 million tons of coking coal for Manchurian blast furnaces, which therefore must import coking coal from North China.

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[2] Cressy, G. B., 1944. *Asia's Lands and Peoples,* p. 114.

Technology

Since most of the iron deposits in Manchuria are low-grade in nature, the Japanese scientists paid much attention to the beneficiation of iron ores. Since smelting costs rise rapidly with the higher amount of slag-forming constituents in the ore, and since Manchuria is already short in suitable smelting fuels, the beneficiation of iron ore was absolutely necessary, and it was inevitable that it should become an important part of the iron and steel industry.

Some of the beneficiation processes used in Manchuria were:

1. Anshan-type lean-ore-disposition process
2. Krupp-Renn process
3. Magnetic concentration
4. Flotation
5. High-frequency process.

Manufacturing facilities

Manchuria has four blast furnace centers: Anshan, Penhsihu, Mianohara, and Tungpientao.

Anshan. Plans were made in 1917 to construct a plant comprising eight blast furnaces, with a production capacity of one million tons. In 1919 the first blast furnace was completed and the second began operations a year later. It was soon discovered that the plant had been constructed without a careful examination of available raw materials. Attempts to use the low-grade ores in the vicinity of Anshan was unsuccessful because these ores are high in silicon content. Limestone had to be carried to the furnaces from a distance of 50 miles.

Continuous research solved the problems created by low-grade ores and the Anshan-type lean-ore-disposition method was patented. The concentration factory was completed in 1926.

After the conquest of Manchuria by the Japanese, the capacity of the existing furnaces was increased from 250 tons to 350 and a number of new furnaces were built. As a result, at the time of the Japanese surrender in August, 1945, the total capacity of the Anshan works was 2,781,000 tons of pig iron.

It was originally expected that coal from the huge, world-famous open pit mine at Fushun would be used as fuel, but it was later discovered that coal from Fushun does not produce a satisfactory metallurgical coke, and thus it was necessary to obtain coal from other collieries. Until 1942, Kaiping coals from Hopei were imported and mixed with Fushun coal in order to obtain a suitable coke. To augment the supply of coking coal the Japanese in 1943 completed a railroad across the Mongolian steppes and connected the Tatung coal mines in Suiyuan with Anshan. Incidentally, the same road carries high grade iron from the Lungyen mines in Chahar, which is mixed with enriched and lean ores from Anshan, Kyuchorei, and Waitoushan mines near Anshan and from the mines of the Kyowa Company in Central Manchuria.

The Anshan plants get their limestone from deposits at Kanchingtzu and Huolienchai, and magnesite and dolomite from Niuhsinshan. Fireclay is purchased from the Yentai coal mines.

The pig iron was for the most part converted into steel at Anshan. Some pig iron, as well as a large amount of steel ingots, were exported to Japan for further processing.

Penhsihu. This plant with two 250-ton furnaces was completed during the First World War. In 1939 it was decided to enlarge its capacity. The first new blast furnace was put into operation in December, 1940, and the other was completed in March, 1941, bringing the total capacity to 500,00 tons of pig iron a year.

Penhsihu occupies the most convenient position for the gathering of materials needed in the manufacture of pig iron. Large limestone deposits exist near Penhsihu, the product of which is transported directly to the limestone yard of the plant from the quarry by means of a mile-long aerial cable. The iron ore is shipped from the Miaoerhkow mine about 25 miles to the southwest. The main factor in locating the plants at Penhsihu, however, was the abundance of coking coal reserves, estimated at 190 million tons, which are found in the vicinity of the plants.

Mianohara. In order to utilize the cargo space of the empty railroad cars returning from Penhsihu after delivering their load of iron ore from the Miaoerhkow mines, it was decided to build a smelting plant at Mianohara, near the mines. The coking coal for this plant was to be shipped in from Penhsihu. The first blast furnace was put into operation in October, 1941, and another by the end of 1942. The new plant, which contains steel-making facilities, was to be in full operation by 1943.

The low-phosphorus pig iron produced at Mianohara and Penhsihu constitutes an essential raw material for manufacturing high-grade steel.

Tungpientao. The Tungpientao region has large deposits of coking coal and high-grade ore. The Tungpientao Company, which operates both the coal and iron mines, has two blast furnaces completed during 1942-43. The pig iron produced was exported to Japan.

Other plants. Besides the above-mentioned large units, there are three small plants engaged in the production of pig iron and sponge iron.

Conclusion

Political and military, rather than economic, considerations were responsible for the rapid growth of the iron and steel industry in Manchuria. As long as strategic factors determined the existence of such industries, large subsidies were available to maintain and operate them.

With the collapse of Japan, non-economic considerations have undergone a drastic change and the iron and steel industries of Manchuria as a whole do not have an economic foundation to stand upon. Therefore the question arises of their future.

Assuming that the Russians will not remove the installations and will maintain them in good condition, the new owners of these industries, the Chinese, will face two alternatives.

1. To let the unneeded capacity of the plants lie idle until the day Chinese industrialization will warrant their use.

2. To operate the plants and export the unneeded part of the production until the total production could be utilized in China. It is probable that the Chinese leaders would prefer this alternative. However, this means not only employing foreign technical help in order to manage the plants, but also paying large subsidies, a doubtful condition for the poor Chinese finances.

In conclusion, therefore, one may say that the Manchurian iron and steel industry probably will not furnish any serious competition to that of America in the international markets for some time to come.