

Colonial Development of Modern Industry in Korea, 1910-1939/40*

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Abstract

Under Japanese rule, the Korean economy underwent momentous change, so much so that, from a global perspective, it constituted an exceptional case in the first half of the 20th century. Between 1912 to 1939, traditional primary industry (mostly agriculture) shrank from about 70% to about 40% of GDP, meanwhile, the proportion of mining and manufacturing industries combined in the total economy grew significantly, from about 5% to about 20%. In short, it represented a rapid transition from a primarily agricultural economy to a primarily non-agricultural one. During this transition, the agricultural sector itself underwent change. The policies of the Government-General and the development of the money economy led to improved farming techniques and changes in crop selection. Overall agricultural production increased steadily. In the meantime, industrialization in Korea began with small and medium-sized plants that simply processed raw materials. Then, as early as the 1910s, modern industries arose, particularly ironmaking plants. From the 1920s until 1930s, a private-sector enterprise built a large-scale chemical industrial complex founded on development of power plants. What must be emphasized here is that the colonized people themselves contributed widely to industrialization in Korea. Koreans positively responded to external stimulus and took the initiative in following Japanese models and learning skills in business and industrial technologies, thereby demonstrating entrepreneurship of their own.

Korea lacked modern industry when it was annexed by Japan. How did the Korean economy change under Japanese rule?

Changes in Korea's industrial structure clearly indicate economic transformation. According to recent estimates, agriculture, forestry, and fishery (as calculated by the amount of value added) accounted for approximately 70% of GDP (Gross Domestic Product) in 1912 (Table 1). This percentage declined decade by decade to about 40% in 1939. In less than 30 years, then, traditional primary industry (mostly agriculture) shrank to less than half the total economy in terms of value of products. Conversely, the proportion of mining and manufacturing industries combined in the total economy grew significantly, from about 5% to about 20% during the same period.

In this article I will examine changes in, first, the agricultural sector and, second, the mining and manufacturing sector over the period from annexation in 1910 until 1939/40.

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Table 1 Proportion of Total GDP by Industry (based on nominal prices)

(%)

	Agriculture, forestry and fishery	Mining and manufacturing	Electricity, gas and construction	Services
1912	68.1	4.9	1.9	25.1
1920	61.8	7.4	2.7	28.1
1930	49.0	9.4	6.3	35.3
1939	41.1	18.6	9.1	31.3

Note: Figures show a three-year average centered on the indicated year.

Source: Kim Nak-Nyeon, ed., *Shokuminchi-ki chosen no kokumin keizai keisan* [Economic growth in Korea 1910-1945], 315.

1. Agriculture

Growth of Production

While the agriculture, forestry, and fishery sector shrank in relation to other sectors, its products grew. From 1912 until 1939, agricultural production (in terms of real value added) rose by an average of 1.9% annually (Kim Nak-Nyeon, *op.cit.*, 406, table I-6). During the same period, agricultural products in Japan grew at a much lower rate, 1.0% (Ohkawa *et al.*, *Choki keizai tokei 1: Kokumin shotoku* [Long-term economic statistics 1: National income], 228, table 26).

The coverage of the original statistics issued by the Government-General of Korea in the 1910s was limited. Therefore, estimates of the growth rate of Korean agricultural products from 1910 through 1919 are based on many assumptions that might result in overestimation. Even when we disregard this early period and limit our assessment to the years 1920 to 1939, however, we still find a high average annual growth rate of 1.5%. Such rapid growth is rarely found elsewhere unless a vast area of new land is being cleared or large labor surplus is available.

Rice accounted for the largest proportion of total agricultural output in value. Throughout the period of Japanese rule, rice accounted for more than 40% of it almost every year, with a peak of 54% occurring in 1934.

Rice Production

In the early 1910s, the annual amount of rice produced in Korea stood at around 12 million *koku* (1 *koku* = 180 liters). It subsequently grew rapidly, reaching 27 million *koku* by 1937. Since cultivated land area increased less than 15% during that period, the increase in production is mainly attributable to greater productivity per unit area. By 1937, production per *tan* (about 991.7 square meters) had reached 1.6 *koku*, an increase of over 80% compared with the beginning of the period.

Geographically, the largest gains in productivity accrued in northern Korea. Because of the added factor of expanded cultivated area, rice production in northern Korea grew more sharply.

Improved Varieties of Rice

Before annexation, the Resident-General of Korea in 1906 established the Research Station of Model Agriculture (which later became an Agricultural Experimental Farm) in Suwon, near Hanseong (present-day Seoul), where they initiated research on the selective breeding of rice. Satellite stations and seed nurseries were also established throughout Korea. After annexation, the Government-General selected superior varieties from these facilities, distributed them to farmers free of charge, and provided guidance on cultivation methods for them.

The main varieties selected at the time included *Wase-shinriki* (originally from Kumamoto Prefecture; features high yields even with little fertilizer; also known as *Sou-shinriki*); *Kokuryo-miyako* (originally from Yamaguchi Prefecture; high-quality rice well-suited to manufacture of

sake); and *Tama-nishiki* (originally from Tochigi Prefecture; high-quality rice featuring drought resistance).

At the time of annexation, the dissemination rate of these improved varieties of rice in Korea was virtually nil. Subsequent dissemination occurred quickly, however, exceeding 50% by 1920. In that year, improved varieties accounted for 62% of total output of rice.

It is said that the Government-General went so far as to mobilize police officers to disseminate the improved rice varieties. However, such rapid dissemination could not have been achieved solely through governmental guidance (or “coercion”). At the time, the governmental organization established was neither strong nor systematic enough to implement such a program throughout Korea. Therefore, the rapid dissemination that did occur can only be explained by a positive response on the part of local producers.

Compared with native ones, the improved varieties of rice from Japan afforded Korean farmers higher incomes. In addition to higher yields and more stable crops, the superior quality of the new varieties commanded higher prices in the rice market.

Active Participation of Korean Farmers

Tenant farming was already widespread in Korea before Japan came on the scene. In the 1910s, about 70% of all farming households were either combined owner/tenant farmers or pure tenant farmers, with about half of the arable land area cultivated by tenant farmers. Of all rice paddies, nearly 70% were cultivated by tenant farmers.

Many Korean landowners were reportedly absentee landlords who had no interest in managing their farm and even did not live in local villages. Before annexation, the actual work of running some of the farms fell to Japanese who lived in Korea. They bought Korean land and leased it to tenant farmers to cultivate crops with an emphasis on rice. In the rice belt of southern Korea, there were Japanese individuals and companies who owned anywhere from several hundred to several thousand hectares of rice fields. The largest company of this type was Toyo Takushoku Kabushiki Kaisha (the Oriental Development Company), a national enterprise of the Japanese Empire founded in 1908.

It was only natural that these Japanese landowners would be first to adopt the improved varieties of rice. Their main objective was to maximize their income by exporting the rice they collected as rent from tenants to the home market in Japan.

Even as late as 1920, however, Japanese living in Korea owned only about 10% of the total cultivated rice area in Korea. This fact suggests that Koreans also played a part in widely disseminating improved varieties of rice. Behind the scene was there a rapid growth of the money economy. Korean farmers gained a strong incentive to acquire cash as manufactured goods entered Korea from Japan, taxes and other governmental fees were levied, and commercial fertilizers came on the market. In Korea, rice was by far the most important cash crop. Therefore, it hardly comes as a surprise that once Korean farmers understood the advantages of improved varieties of rice as a means to earn cash, they would spontaneously make the transition to those improved varieties. Whether the impetus came from the landowners or the tenant farmers may have depended on particular circumstances. In either case, Koreans responded to market opportunities newly opened to them.

This response to market opportunities was not limited to Korea. The same phenomenon can be found in many parts of Asia and Africa in the 19th and 20th centuries. In Southeast Asian countries such as Burma (Myanmar), Thailand, and Indochina, rice production burgeoned with the expansion of the export market. In those cases, so-called peasants who were seeking to gain cash transitioned from traditional rice cultivation for self-support to expanded commercial rice production (Myint, *Kaihatsu tojokoku no keizaigaku* [The economics of the developing countries], 38–43).

There were, however, notable differences. These countries had large undeveloped areas, and the increase in rice production depended on the cultivation of newly cleared land. During that time, productivity per unit area declined.

One reason for this decline was that no changes occurred either in the varieties of rice being grown or in cultivation methods. Also, clearing operations started with fertile land with a good water supply and gradually expanded to land with less and less advantageous characteristics (Wickizer *et al.*, *Monsoon Asia no beikoku keizai* [The rice economy of monsoon Asia], 256; Watanabe, *Kaihatsu keizaigaku kenkyu* [Development economics], 37–43).

In short, Korea was a special case because the development of the money economy not only led to increased cash crop production but also triggered a change in cultivation methods (as was also the case in Taiwan under Japanese rule). As a result, Korean farmers showed a more active and innovative response to market opportunities than did farmers in Southeast Asian countries.

Increased Input of Fertilizer and Sanmai Zoshoku Keikaku

Research on improved varieties of rice was pursued continuously. In the late 1930s, *Ginbozu* was the most commonly planted variety in southern Korea. This was a high-yielding variety introduced from the Hokuriku region in northern-centered Japan.

In northern Korea, a variety called *Rikuu no.132* that originated in Akita Prefecture was widely planted. It was not only high-yielding but resistant to cold-weather damage and blight. It is well known that Kenji Miyazawa, who as a famous farmer/poet, provided agricultural guidance in the Tohoku region in northeastern Japan where cold-weather damage was almost an annual event, worked diligently to disseminate this variety, which also was deemed delicious and highly prized in the marketplace (and is the forerunner of *Koshihikari* and *Sasanishiki* varieties today).

Most improved varieties of rice required large amounts of fertilizer, and the consumption of fertilizer in Korea increased significantly under Japanese rule. This included self-supplied fertilizer (green manure, compost, etc.) and commercial fertilizer (fishmeal, oil cake, chemical fertilizer, etc.). Consumption of ammonium sulfate (a type of nitrogenous fertilizer) in particular increased in the 1930s. This development was closely related to the construction of modern fertilizer factories in Korea, as will be discussed below.

Despite these advances, far less fertilizer was consumed by ordinary farmers in Korea than was consumed by farmers in Japan, even in the 1930s.

In 1920, the Government-General initiated Sanmai Zoshoku Keikaku (Rice Production Development Program), with the purported goals of meeting growing demand for rice in Korea, boosting the economies of farming families, and contributing to a solution to food shortage problems in the Japanese Empire.

The program set the ambitious goal of pursuing land improvement policies (improving irrigation, converting land use, and clearing new fields) and improvements in agricultural practices as a whole to increase annual rice production by 9.2 million *koku* (an increase of 60% compared with 1920) within 15 years.

Implementation did not proceed as planned, however, primarily for the following three reasons: rising prices inflated construction costs; interest rates on anticipated loans were higher than expected; and the special corporation slated to serve as the implementing agency was never formed.

The Government-General started over with a revised program implemented in 1926. Like its predecessor it was ambitious, with the goal of increasing annual rice production by 8.2 million *koku* in 14 years. The content of the revised program, however, was more refined, calling for direct government intervention to arrange large amounts of low-interest funding for land improvement and the purchase of fertilizer. Also, the program established two land reform agencies: Chosen Tochi Kairyō Kabushiki Kaisha (Korea Land Improvement Company, a half-

public, half-private entity) and a land improvement division within Toyo Takushoku.

Starting in the 1930s, farmers in Japan who were suffering economically from a serious recession strengthened their opposition to the importation of Korean rice. This made it unavoidably necessary to reduce the goals of the revised program to increase Korean rice production and resulted in the dissolution of the land reform agencies above.

There is much debate concerning the political background, significance, results, and economic impact of Sanmai Zoshoku Keikaku. I will not explore it in detail here. I simply point out that rice production in Korea increased from about 14 million *koku* to 18 million to 19 million *koku* between the years 1920–21 and 1931–32.

Sanmai Zoshoku Keikaku is considered a first large-scale agricultural development plan in the Japanese Empire (Tohata and Ohkawa, *Chosen beikoku keizai ron* [Rice economy in Korea], 12). It was formulated and implemented by the Government-General, indicating that the latter was not simply an administrative organ, but also a large corporate entity that promoted the development of rice production as an industry.

Complementary Policies Pursued by the Government-General

Quality assurance is critically important if a cash crop is to be well-received by the market, and the Government-General made serious efforts in this area as well. In its unimproved state, Korean rice had many defects such as incomplete dryness and contamination by husks, straw, dirt, and *akamai* (a wild, old variety of rice colored red). For this reason, Japanese rice distributors were autonomously conducting grain inspections in open ports even before annexation.

In 1915, the Government-General promulgated regulations that placed rice inspection under provincial authority. In 1917, the regulations were revised so that inspections were paid out of provincial budgets. In 1932, the further step was taken of opening grain inspection centers and making the inspection of rice for export a national operation.

Concerning packaging, the Government-General in 1927 issued *kamasu* (straw bag) inspection regulations designed to improve bag quality and ensure uniformity. In 1932, specifications for standardized straw bags were established.

The Government-General also promoted rice storage operations. Rice sales tended to be concentrated in the fall and winter after harvest, during which time lower prices were unavoidable. Modern storage facilities were necessary both in rice-producing regions and at ports where rice was loaded, both to maintain rice quality and to adjust the selling period.

In 1930, the Government-General announced a plan to construct rice storage facilities in Korea, which formed the basis for the establishment of Chosen Beikoku Soko Kabushiki Kaisha (Korea Rice Storehouse Company). The purpose of the company was to construct and operate “commercial” rice storehouses at ports and “agricultural” rice storehouses in rice-producing regions, as well as providing low-interest financing secured by stored rice. Under the plan, construction of the commercial rice storehouses proceeded rapidly; by 1933, they had a combined capacity of 1.6 million *koku*.

Before harvested rice reaches consumers, it must be husked and polished. This processing was done by private companies; the Government-General was not directly involved in it until the latter stages of World War II. I will explore the issue of rice processing in a later section discussing manufacturing industry.

Stagnation in the Production of Other Food Crops

Under Japanese rule, production of barley, millet, and soybeans, which were main dry-field food crops, stagnated, because of a low dissemination rate of improved varieties and a decline in productivity per unit area.

The Government-General did not show much interest in non-rice crops. It did not formulate

a field improvement plan until 1931, and even then it was much smaller in scale than the plan formulated for rice.

Soybeans were useful to farmers as a cash crop. The native soybeans cultivated in Korea were already of a high quality and were liked in Japan as raw material for *tofu*, *miso*, and soy sauce. They were the preferred market choice even over the well-known soybeans grown in Manchuria.

In the second half of the 1910s, the export of Korean soybeans increased dramatically (from 500,000 *koku* in 1914 to 1.3 million *koku* in 1919). This reflects the influence of World War I, when the soybean market exploded. Exports remained at a high level in subsequent years, to the point where exports represented 20–30% of total Korean soybean output by the 1930s.

If soybeans were a good cash crop, why did production not increase when the money economy developed in Korea?

Regional observation reveals that, while soybean production declined in southern Korea in the 1920s and 1930s, it increased slightly in northern Korea. It is not easy to ascertain the reasons for this relative waxing and waning between regions, but it may be due to farmers in northern Korea responding to market opportunities, thus planting more soybeans. On the contrary, farmers in the south turned to another cash crop, cotton, which promised greater profits than soybeans, as I will discuss below.

One food crop off the general trend above was potatoes, the production of which rose substantially beginning in the 1910s. The center of potato production was in the eastern part of northern Korea. Compared with other crops, potatoes were highly productive per unit area, serving as an important food crop for poor farmers.

Finally, maize production also increased in the 1930s, mainly in the western part of northern Korea. One reason for this, which I will discuss in more detail later, is that a modern cornstarch factory was built in Pyongyang that used maize as a raw material, thereby raising the market price for it.

Dissemination of Upland Cotton and Growth of Sericulture

Cotton was first cultivated as a summer crop on the Korean peninsula in the 14th and 15th centuries, prior to its introduction to Japan. Cotton cultivation grew during the Edo Period (1603–1867) in Japan, but quickly declined after the Meiji Restoration (1868) in the face of cheap imports. The Japanese government formulated policies designed to bolster, if only by a little, the production of raw cotton in regions under its control for use in Japan's rapidly growing cotton textile industry.

In 1905, Menka Saibai Kyokai (the Cotton Cultivation Association) was founded in Tokyo, which established a seed orchard for upland cotton and a ginning mill in Korea. Upland cotton, which originated in South America and was improved in the United States, accounted for most of the raw cotton being cultivated globally at the time. The value of yarn spun from upland cotton was higher than that of yarn made from Korean native cotton.

After annexation, in 1911, the Government-General initiated its first six-year plan for the promotion of cotton production, which focused on replacing native cotton by upland cotton in southern Korea. This plan was extended one year and completed in 1918. By that year, the area of land planted with upland cotton had increased to about 94,000 *chobu* (1*chobu* = 0.992 hectares) close to the 100,000 *chobu* anticipated by the plan. During the same period, the area under native cotton cultivation declined from about 60,000 to about 36,000 *chobu*.

The second ten-year plan for the promotion of cotton production began in 1919. Major goals of this plan were to grow cotton by clearing new land for cultivation and converting existing fields to cotton and to increase yield per unit area by improving cultivation methods, with a focus on upland cotton in southern Korea and also native cotton in the western part of northern Korea. In 1928, the final year of the plan, the cultivated area for upland and native cotton reached

approximately 140,000 and 70,000 *chobu*, respectively.

During the period implementing the plan, however, the price of raw cotton declined, preventing the anticipated targets from being achieved. The price continued to decline after the term of the plan, prompting the Government-General to suspend further efforts to expand cultivated area and concentrate instead on increasing production entirely through improvements in yield per unit area.

After the Manchurian Incident in 1931, a stable supply of raw cotton became even more important for the Japanese Empire. The Government-General accordingly formulated a new plan designed to increase both the amount of cultivated land devoted to cotton and the yield per unit area. In the 1930s, yield per unit area did not improve substantially, but the cultivation of upland cotton did expand, particularly in the western part of northern Korea.

Overall, upland cotton had a higher yield in terms of monetary value per unit area than native cotton. Its yield was even higher than that of the competing crop of soybeans, with some exceptional years. Upland cotton offered Korean farmers the long-term prospect of higher income, which explains why they converted their fields from native cotton and soybeans to upland cotton.

Thus, the development of Korean cotton crop under Japanese rule resulted in more than a six-fold increase in total production by the end of the 1930s as compared with the early 1910s.

Agricultural statistics for Korea show large increases in cultivated area and production amounts for many crops in the 1910s. It is difficult, however, to judge whether these increases actually occurred or whether, in those early years, insufficient surveys created apparent gains. Two crops that showed relatively high production values were *daikon* (horse radish) and *hakusai* (Chinese cabbage). In both cases, however, production leveled off from the 1920s on.

Sericulture grew steadily throughout the period of Japanese rule. After annexation, the Government-General promoted sericulture by spreading improved breeds of silkworm and promoting mulberry cultivation and silkworm breeding techniques. In 1925, it formulated a 15-year plan to increase cocoon production by one million *koku*. Under a series of policies, there was a substantial increase in the number of cocooneries, the area of mulberry orchards, and the total output of cocoons. Farmers were engaged in sericulture as a rare side business for earning cash income.

2. Mining and Manufacturing: A Sudden Rise from an Undeveloped State

Growth Rates and the Policies of the Government-General

From 1911 until 1940, Korean mining and manufacturing industries grew sharply. In terms of real value added, the annual growth rate averaged about 12% for mining and 9% for manufacturing. Expansion was especially rapid in the 1930s, with annual growth rates approaching 20% and 10%, respectively.

It is generally said that the Government-General adopted toward the manufacturing industry in Korea suppressive policies in the 1910s, passive in the 1920s, and active in the 1930s. It is certainly true that, compared with the agricultural sector, the Government-General did not have much interest in industrialization in Korea in the 1910s and 1920s.

However, it cannot be said that the 1910s were an era of suppression. Many researchers mention the Company Ordinance as the main basis for suppressive policies. Promulgated by the Government-General in 1910, it required official permission for a company to be established. According to the “suppressionist,” the purpose of this Ordinance was to prevent the development of commerce and industry in Korea, particularly Korean-owned capital. They stress that many applications to establish companies submitted by Koreans were rejected. But this view is simply the result of a misreading of the data. In fact, a high percentage of applications for company

formation submitted by Koreans were approved.

Rice Husking and Polishing Plants Distinctive to Korea

Small and medium-sized businesses typically start up not as fully formed companies but instead under individual management. The first businesses to form in this manner in Korea were rice husking and polishing plants.

Traditionally, Korean rice farmers did not husk their own rice. They either sold their unhusked rice to huskers or polished their rice directly from the husked state (producing half-polished rice known as *kanpaku*, “Korean white”) and sold it. After husking, the huskers either sold the unpolished brown rice to polishers or polished the rice themselves.

The husking and polishing industry in Korea rose before annexation when Japanese nationals established small-scale plants in rice distribution areas and at ports. Unhusked rice was more expensive to transport, and insufficient dryness of half-polished rice made it prone to rot. This made it important to husk and polish the rice before it was exported, a task that Japanese rice traders took upon themselves.

Koreans emulated the Japanese, entering the field. In 1912, there were 67 husking/polishing plants (with either ten or more employees, or motorized operations) run by Japanese nationals, and 23 run by Koreans in all of Korea. Japanese-owned plants had an average of 30 employees and Korean-owned plants had an average of 11. The plants were mostly of small-scale, but among Japanese-owned plants there were some that employed more than 200 workers.

In Japan, the usual practice was for farmers to husk their own rice using their own equipment and sell the resulting brown rice to retailers. The retailers polished the rice and sold it to consumers. Thus Japan and Korea were different in this regard. The Korean practice of husking and polishing rice in factories was distinctive and contributed to reduced processing costs and more uniform quality of the product, which increased market value of Korean rice. However, because Korean farmers entrusted husking operations to independent plants, they were forced to accept lower prices for the rice they harvested.

Husking and polishing operations grew in tandem with increased rice production and export. In 1932, there were 1,156 husking/polishing plants operating in Korea that employed five or more workers: 373 of them were operated by Japanese nationals, and 783 of them by Koreans. Although the average size of the Korean-owned plants was smaller than that of the Japanese-owned plants, their total number was higher than that of the Japanese-owned plants.

Among Japanese-owned plants, some large plants emerged with a rice polishing capacity that exceeded one million *koku* per year. The largest of these was Chosen Seimai Kabushiki Kaisha (Korea Rice Polishing Company) operated by Heitaro Kato, a native of Yamaguchi Prefecture born in 1881. Kato was called the “king of rice polishing in Korea.” (Kato was also the founder of Kanemi Soko (Kanemi Storehouse), which precipitated a mass poisoning known as the “rice oil disease incident” in Japan in the 1960s.)

In 1935, more than 30,000 workers were employed in rice husking and polishing plants in Korea.

Large-Scale Coal Development Anthracite

In 1907, the Resident-General of Korea established Heijo Kogyosho, a mining office in Pyongyang, for the purpose of development of anthracite. After annexation, the Government-General took over operation of the enterprise and installed more equipment for coal extraction. Because most of anthracite in Pyongyang took the form of coal dust, much of it was transported after extraction to the Briquette Manufactory of the Japanese Navy in Tokuyama, where it was processed into briquettes.

In 1922, management of Heijo Kogyosho was transferred from the Government-General to the Japanese Navy in response to the latter's request to emphasize the mining of Pyongyang anthracite. When the transfer was made, the Navy renamed Heijo Kogyosho as the Pyongyang Mining Division of the Naval Fuel Arsenal. In the 1920s, the Navy relocated part of briquette manufacturing equipment from Tokuyama to Pyongyang, thus increasing the production capacity there.

In 1928, the Pyongyang Mining Division achieved a coal output capacity of 140,000 tons per year, the highest output of any coal mining operation in Korea. In the same year, the Division manufactured 45,000 tons of briquettes, representing nearly half of all briquette production in Korea. During this period, nearly all of the briquettes came to be consumed in Korea to heat homes and power railway boilers.

In 1936, administrative reforms resulted in yet another change in the name of the mining office, Mining Division of the Naval Fuel Arsenal.

At the time, anthracite reserves in Pyongyang were estimated at between 500 and 600 million tons, an amount considered to be virtually limitless. Some might wonder about the link between the ancient capital of Pyongyang and coal production, but in fact the city had the nickname "Coal Capital" because of its location over a vast coal field.

In the private sector, Chosen Muentan Kabushiki Kaisha (Korea Anthracite Company) was founded in 1927, in which Mitsubishi Seitetsu (Mitsubishi Iron and Steel Company) was the main investor. The company always maintained close ties with the Government-General as it mined anthracite in and around Pyongyang and manufactured briquettes.

Some of the highest quality anthracite in Korea was found at Ryuto Kogyosho (a mining office in Ryongdung) in Pyeonganbuk-do in the northwestern part of northern Korea. This mine was developed by Katakura Shokusan (Katakura Industrial), affiliated with Katakura Seishi Boseki (Katakura Silk Reeling and Weaving Company). The unlikely connection between silk and coal can be explained by the suitability of anthracite as a means of heating cocooneries. Thus, anthracite contributed to the development of Korean sericulture. In 1935, Ryuto Kogyosho was producing about 60,000 tons of coal per year.

Anthracite was mined in southern Korea as well. Two mines in particular, located in the eastern part of southern Korea (the southern part of Gangwon-do), were well-known producers: Sanchoku Tanko (a coal mine in Samcheok) and Neietsu Tanko (a coal mine in Yeongwol). The former was operated by Sanchoku Kaihatsu (Sanchoku Development), a subsidiary of Nichiden Kogyo (a power company in Japan) established in 1936; the latter was operated by Chosen Denryoku (Korea Electric Power Company), a member of the Toyo Takushoku group. Coal reserves at Sanchoku Tanko were said to be enormous, totaling several hundred million tons; it was also the only mine in Korea that produced anthracite in non-dust form. For this reason, the coal from Sanchoku Tanko was mainly used in the production of carbide and castings.

Soft (Smoky) Coal

Most soft coal in Korea was low-grade (low-carbonization) lignite, not the kind of high-quality coking coal found in Hokkaido and Kyushu. The soft coal produced in Korea was primarily used to power locomotives, but some was also sold for home heating. Compared with Japanese coal, Korean coal had a high chemical content that resulted in high reactivity with hydrogen. Therefore, it drew attention in the 1930s as a raw material for the manufacture of synthetic oil (liquid fuel made by crushing coal and adding hydrogen).

Production of soft coal in Korea was almost entirely limited to the north. Its development was undertaken by several big companies and sole proprietorships, including Meiji Kogyo (Meiji Mining) and Chosen Yuentan Kabushiki Kaisha (Korea Soft Coal Company).

Meiji Kogyo began developing coal and gold mines in Korea around the time of annexation. It

obtained mining rights in Anju, Pyeongannam-do (in the southwestern part of northern Korea) and began developing a coal mine there in 1912, with reserves estimated at 50 million tons. The Anju coal mine was the first in Korea to pursue mechanization with the introduction of electric drills and drainage pumps manufactured by the German company Siemens in 1928. It produced lignite for home and railway applications.

Another successful mine operated by Meiji Kogyo was the Sariwon coal mine, which was also located in the southwestern part of northern Korea, in Hwanghae-do. The company obtained mining rights in 1914 and opened the mine in 1931. The coal produced there was of nearly the same quality as coking coal, featuring good combustibility, strong thermal power, and clean burning that made it suitable for use in furnaces and boilers.

Chosen Yuentan Kabushiki Kaisha was established in 1939, when small and medium-sized soft coal mines formed a consortium capitalized at ¥15 million through mediation efforts by the Government-General aimed at increasing coal production. The participating companies were: Hokusen Tanko, Toyo Takushoku, Totaku Kogyo, and Aso Kosan, all of which contributed their mines as in-kind investments. Operations centered on the Kogonwon coal mine in Hamgyeongbuk-do in the northeast. This, along with the Sariwon coal mine and the Yuseon coal mine (discussed in more detail below), was one of the main soft coal mines in Korea. In 1935, it had 3,000 employees and produced 30,000 tons of lignite annually. The quality of the coal was high, with a high calorific value of 6,000 to 7,000 calories per gram and low ash and sulfur content, making it a popular choice for railway and home heating use.

Among sole proprietorships, Iwamura Kogyo was particularly successful. It was founded by Choichi Iwamura, a native of Kumamoto Prefecture (1881–1948) who resided in Korea. In 1938, Yamaichi Shoken (Yamaichi Securities) bought a 40% stake to create a stock company capitalized at ¥10 million. Iwamura Kogyo operated several mines in northern Korea, including the Yuseon mine in Hamgyeongbuk-do. The Yuseon mine was one of the best in Korea in terms of both quality and quantity of the coal, which was sold for use in home heating and railway (express locomotives) applications.

Early Development of Iron Mines and Establishment of Steelworks

Dating to the 1910s, iron mine development got an early start in Korea and formed the basis for the construction of several steelworks. Immediately after annexation, the company Mitsubishi Goshi Kaisha (Mitsubishi Joint Company) purchased an iron mine in Kyomipo, Pyeongannam-do (near the Taedong River) in the southwestern part of northern Korea. It subsequently continued to purchase nearby iron mines as well as anthracite coal mines in the same province and planned the construction of a steelworks.

Masatake Terauchi, the Japanese Army general who served as the first Governor-General of Korea, played a leading role in this process. Through the mining bureau of the Government-General, Terauchi helped Mitsubishi conduct mine surveys and smoothed the way for the disposal of large tracts of land owned by the Japanese Army in Kyomipo. He also encouraged development by leasing to the company 400,000 *tsubo* (1 *tsubo* = 3.3 square meters) of property that had been earmarked for railway use, and by waiving tariffs on imported construction supplies.

The construction of the ironworks in Kyomipo (Kenjiho Seitetsujo) began in 1914, but work was substantially delayed by the outbreak of World War I. The facility was finally completed in 1918, and two blast furnaces with an annual production capacity of 50,000 tons each were activated. In the previous year, Mitsubishi had established Mitsubishi Seitetsu (headquartered in Tokyo), which was capitalized at ¥30 million. The operation of Kenjiho Seitetsujo was entrusted to Mitsubishi Seitetsu.

Kenjiho Seitetsujo introduced the most advanced technologies available at the time,

including byproduct recovery furnaces. In 1919, an open-hearth furnace and rolling equipment manufactured by Mitsubishi Shipyards in Nagasaki and Kobe were added to create a fully integrated production system ranging from pig iron to finished steel. A major purpose of production of the steel material was to supply Mitsubishi shipyards with steel plate and large-scale section steel for naval vessels. In 1921, the facility began producing high tensile-strength steel plate for naval applications. In the same year, it raised pig iron production to 83,000 tons, steel production to 51,000 tons, and steel material production to 30,000 tons.

Subsequently, an economic downturn and a reduction in Japanese Navy forces resulted in a considerable decline in the steel market. In response, the company suspended operations at the steelmaking division of Kenjiho Seitetsujo until 1933. Even during that time, however, the production capacity of its pig iron division increased, reaching 150,000 tons in 1931. This was more than that of Kamaishi Seitetsujo in Japan, and slightly more than 20% of the production capacity of the largest steelmaking facility in the Japanese Empire, Yawata Seitetsujo.

In 1934, Nihon Seitetsu (Japan Iron and Steel Company) was created when Mitsubishi Seitetsu joined a large consortium of steel companies. The operation of Kenjiho Seitetsujo was entrusted to the new company at that time. Immediately after Nihon Seitetsu was formed, a plan was formulated to expand the production facilities of all the companies under the consortium's umbrella. The blast furnaces at Kenjiho Seitetsujo were renovated (Furnace No. 1 was removed and replaced by a newly constructed 120,000-ton furnace), and a new coke oven and a byproduct plant were constructed. In 1934–35, open-hearth furnaces Nos. 2 and 3 started their operations.

In the eastern part of northern Korea, the Riwon iron mine began operating in the mid-1910s for the purpose of supplying Yawata Seitetsujo with iron ore. The ore mined at Riwon was of relatively high quality, with an average iron content of 50–55%, and reserves were estimated at several tens of millions of tons. In 1927, the planned extraction amount was 80,000 tons.

The Riwon iron mine had large amounts of fine ore that could not be processed with a blast furnace. To utilize it, Nippon Koshuha Jukogyo (Japan High-Frequency Heavy Industries) was founded in 1935. The new company built a factory in Songjin, not far from Riwon, and began making steel (special steel in particular) from fine ore using its electrical furnace technology.

The Musan iron mine was said to be one of the largest iron mines not only in Korea but all of East Asia, with estimated reserves of 1.5 billion tons. Located deep in the northeastern part of northern Korea, it was hard to access and full development did not begin until the second half of the 1930s.

Large-scale Nonferrous Metal Refinery

During the rule of the Resident-General, Kuhara Kogyo (Kuhara Mining Company) began a geological survey of Korea. Kuhara Kogyo was the precursor of Nippon Kogyo, a leading mining company in Japan before World War II. It is one of the predecessors of today's JXTG Holdings Inc.

Beginning in 1915, Kuhara Kogyo aggressively pursued the development of gold, silver, copper, lead, and zinc mines in northern Korea. It also planned the construction of a refinery for processing gold, silver, and copper ore. The new plant was sited at Chinnampo (on the outskirts of Pyongyang), which was convenient for shipment by sea. Construction began in May 1915 and operations began in October of that year. Initially, the plant had a production capacity of crude copper at 216 tons per month and employed 1,400 workers.

Facilities at the refinery were subsequently expanded, including the completion in 1936 of a 600-foot (183-meter) chimney, the tallest in the world at the time. In locations such as Ashio and Besshi in Japan, smoke from metal refineries had caused serious damage to forests and farms. The tall chimney was intended to prevent the same kinds of problems from occurring in and around Chinnampo.

The Forgotten Munitions Plant

There was a munitions plant in Pyongyang when Korea was under Japanese rule. After World War II, this fact was forgotten not only by the general public but also by most scholars of modern Korean history. Because the plant was under the direct control of the Japanese Army, no records of it were included in materials that would ordinarily be viewed by those scholars, particularly the publications of the Government-General. *The annual administration report of the Government-General of Korea* does not mention the plant at all, and industrial statistics announced by the Government-General do not include the outputs at the plant.

The Pyongyang munitions plant, however, was not a secret facility. Located near the center of Pyongyang, it was familiar to city residents before WWII. Built in 1917, the plant was originally called Chosen Heiki Seizosho and was attached to the Tokyo artillery arsenal. Subsequently, it underwent two transformations before becoming Heijo Heiki Seizosho under the jurisdiction of the Kokura arsenal of the Japanese Army armory in 1936.

The main products of the plant included artillery shells, aircraft bombs, rolling stock, leather goods, hemp-made weapons, and materials for the manufacture of instruments. Nearly 200 workers were employed at the plant in 1923, but this number subsequently increased, reaching about 450 by 1936. In that year, armories in Japan employed thousands (one in Osaka had more than 8,000 workers). Compared with them, the workforce at Heijo Heiki Seizosho was quite small. Also, compared with the standard size of ordinary factories in Japan, the plant was only of medium size, without particular distinction. In the Korean context, however, it was counted as a large factory.

The Growth of Onoda Cement

Immediately after annexation, a primary cement maker in Japan, Onoda Cement, set about establishing operations in Korea to meet anticipated growth in demand for cement for railway, road, harbor, and other construction projects. Limestone, an ingredient in cement, could be found in vast quantities in various regions of Korea, particularly in the north.

Completed in the suburbs of Pyongyang in 1919, the new Onoda Cement plant had cutting-edge equipment for the time, with an annual production capacity of 34,000 tons. In later years Onoda Cement expanded its Pyongyang plant and built two more in the eastern part of northern Korea: the Wonsan plant in 1928 and the Komusan plant in 1936.

In the second half of the 1920s, the combined supply capacity of the Pyongyang and Wonsan plants exceeded Korea's total demand for cement. Onoda Cement therefore restricted production at these plants and set its sights on selling its products in Japan and Manchuria.

The competitors of Onoda Cement, Ube Cement and Asano Cement, countered Onoda's business strategy by constructing large plants in Korea in the second half of the 1930s (Ube in 1936, and Asano in 1937, both in the western part of northern Korea).

The Development of the Silk Industry and the Cotton Spinning and Weaving Industry

Katakura Seishi Boseki was founded in 1920. Its predecessor, Katakura Gumi, made plans to enter the Korean market after the Sino-Japanese War and initiated a survey of Korean sericulture and silk industries. After annexation, Katakura Gumi established forestry divisions in several locations in northern Korea. In 1913, it opened a cocoon purchasing office in the southern Korean town of Daegu, and went on to build a silk-reeling factory there in 1918.

In 1919, the silk company Yamaju Gumi, which was based in Shinshu, Japan, also built a factory in Daegu. In the same year, Jotaro Yamamoto, who began his career at Mitsui Bussan (Mitsui & Co.) (and later served as the president of the South Manchuria Railway Company), teamed up with Ozawa Gumi and other companies in Shinshu to establish Chosen Kiito Kabushiki

Kaisha (Korea Raw Silk Company) which, like the others, set up operations in Daegu. Thus, Daegu became the center of mechanized silk reeling in Korea.

In 1927–28, Katakura Seishi Boseki established more factories in Seoul, Hamhung (in the eastern part of northern Korea), and Jeonju (in the western part of southern Korea) (In Seoul, the company purchased an existing small factory and expanded it). At about the same time, Gunze Seishi, Toyo Seishi, and Zenhoku Seishi (the latter two affiliated with Mitsui Bussan) also built factories in Korea.

Koreans also established silk-reeling companies and built factories. Two of the more prominent Korean-owned companies were Chosen Seishi and Chunan Seishi. The former was founded in 1919 by a nobleman who belonged to the Korean aristocracy prior to the Japanese colonial period; its factory was located in Seoul. The latter was founded in 1926 with a factory located in the central part of southern Korea.

Many other small-scale factories were set up throughout Korea under both Japanese and Korean ownership and management. At the end of 1934, there were 84 mechanized silk-reeling factories operating in Korea with workforce of five or more employees. Forty percent of them, that is, 34 factories, were operated by Koreans and 19 of those were located in Daegu.

In the area of cotton spinning and weaving, Chosen Boshoku Kabushiki Kaisha (Korea Spinning and Weaving Company) was established in 1917 by Utaro Noda (who participated in the founding of Miike Boseki), Kyohei Magoshi (who used to work at Mitsui Bussan), Jotaro Yamamoto, and others. The company set up operations in Pusan and built a large spinning and weaving factory there in 1922.

In 1919, the Kim family, who had vast landholdings in the western part of southern Korea, established Keijo Boshoku Kabushiki Kaisha (Keijo Spinning and Weaving Company). The company bought and operated a small factory that previously belonged to Keijo Orihimo Kaisha, which was set up in 1910. The factory subsequently achieved remarkable growth. Keijo Boshoku also built cotton ginning plants and dyeing plants all over Korea and became one of the preeminent Korean-owned companies. Underlying this growth was generous financial support provided by Chosen Shokusan Ginko (Korea Industrial Bank), a half-public, half-private financial institution founded by the Government-General (Eckert, *Nihon teikoku no moshigo* [Offspring of Empire], 123–140).

In the 1930s, two of Japan's major cotton spinning and weaving companies, Toyobo and Kanebo, built factories in Korea.

One example of a Korean-initiated small to medium-sized business in the cotton weaving field was a factory in Pyongyang that made knitted socks. It was founded by a Korean resident in Pyongyang in 1906, who introduced machinery from Japan. The sock-knitting industry grew sharply in the 1920s and had 33 cotton sock plants operating in Pyongyang by 1934. Nearly all of them were small plants that employed fewer than 50 workers, but three of them grew in scale having 100–200 workers.

Pulp and Paper Industry Led by Oji Seishi

Oji Seishi (Oji Paper Company) became the driving force of the pulp and paper industry in Korea. The ample conifer forests on the banks of the Yalu River enticed Oji Seishi to set up operations in Korea at an early date. In 1917, the company founded a subsidiary called Chosen Seishi, which constructed a pulp mill in the following year in Sinuiju, located on the border between the northwestern part of northern Korea and Manchuria. The mill produced sulfite pulp and ground pulp from raw wood, and supplied its products to paper mills operated by Oji Seishi in Japan.

The Government-General supported Chosen Seishi and preferentially sold government-owned lumber grown and harvested in the Yalu River basin to the company. The Sinuiju pulp mill had a site area of 210,000 *tsubo* and an annual production capacity of 10,000 tons, making it one of

the largest factories in Korea. After experiencing a downturn following World War I, the mill in Sinuiju was further expanded in 1925 and began to produce rolled paper.

Furthermore, Oji Seishi undertook to develop virgin forest in Hamgyeong-do in the eastern part of northern Korea. In 1935, it established a subsidiary called Hokusen Seishi Kagaku Kogyo (Hokusen Paper and Chemical Industry), which constructed a mill in Kilju in the eastern part of northern Korea. This was the first mill in the world to produce rayon pulp (an intermediate material for chemical fiber) using larch wood as raw material.

The Kilju mill had an annual production capacity of 25,000 tons, which was more than that of competitive pulp mills operating in Japan. In 1937, the Kilju mill accounted for 36% of all rayon pulp produced in the Japanese Empire. Rayon textiles were one of Japan's main export products at the time, and the Kilju mill served an important function as an intermediate material processor.

Shitagau Noguchi and the Development of Large-Scale Electric Power and Chemical Plants

After annexation, the Government-General actively conducted surveys on hydroelectric power sources in Korea. The first round of surveys was implemented from 1911 until 1914; the second from 1922 until 1929; and the third was initiated in 1936. Each round resulted in an expansion in the number of hydroelectric power sources amenable to development. Most of them were on the Yalu and Tumen rivers and their tributaries in northern Korea.

In 1926, Shitagau Noguchi (1873–1944) founded Chosen Suiryoku Hatsuden Kabushiki Kaisha (Korea Hydroelectric Power Company) with a capitalization of ¥20 million and began hydraulic development on the Pujon River, a tributary of the Yalu River. Noguchi was originally an engineer from the electrical engineering department of Tokyo Imperial University, but became an entrepreneur in 1908 with the establishment of Nippon Chisso Hiryo (Japan Nitrogen Fertilizer Company), which manufactured chemical fertilizer.

The Pujon River flowed to the north of the Kaema Plateau and converged with the Yalu River. Noguchi planned to change its course through watershed modification to achieve large-scale power generation. The first step was to build a dam to flood valleys and create an artificial lake along the river. The next task was to dig water transmission tunnels through the mountains to drop water from the reservoir into the Japan Sea. Noguchi's inventive idea was to utilize the difference in elevation between the reservoir and the ocean to generate electricity. He further planned to construct power plants in four locations.

The huge scale of electric power development on the Pujon River was unprecedented in the Japanese Empire. To initiate it, it was necessary to construct a railroad for material transport. The first power plant was finally completed in 1929.

Using the same methodology, Noguchi was also engaged in development of power sources on the Changjin and Hochon rivers, two other tributaries of the Yalu River. Construction of power plants on these rivers began in 1933 and 1937, respectively. The scale of both of these projects surpassed that of the Pujon project.

Noguchi's ultimate goal was to build a chemical fertilizer plant in northern Korea that would have access to ample and inexpensive electrical power. He invested ¥10 million to establish Chosen Chisso Hiryo Kabushiki Kaisha (Korea Nitrogen Fertilizer Company) in 1927 (which merged with its parent company, Nippon Chisso Hiryo, in 1941), and began the construction of a plant in Hungnam (in the eastern part of northern Korea), which was completed in 1929.

The Hungnam plant was comprised of facilities engaged in ammonia synthesis, electrolysis, ammonium sulfate manufacture, machinery manufacture, and catalysis. It had an initial production capacity of ammonium sulfate of 400,000 tons annually, which far exceeded that of Nippon Chisso Hiryo's plants in Japan (in Nobeoka and Minamata). Unlike the equipment in the plants in Japan, which had mostly been imported from Europe and North America, all of

the equipment in the Hungnam plant (except the nitrogen separator) had been manufactured by Japanese companies (including Yasukawa Denki, Fuji Denki, Shibaura Seisakusho, Kobe Seikosho, and Hitachi Seisakusho). Thus, the construction of the Hungnam plant provided a strong stimulus for the development of machinery industry in Japan.

Pyrites are essential for the manufacture of sulfuric acid, and these were procured from mines in Japan and throughout Korea. The main source in Japan was the Yanahara mine in Okayama Prefecture; in Korea in the 1930s, pyrites were mainly mined in the northeastern part. To promote the development of pyrites mines in Korea, Noguchi invested ¥1 million to establish Chosen Kogyo Kaihatsu Kabushiki Kaisha (Korea Mining Development Company) in 1929.

After its founding, the Hungnam fertilizer plant continued to expand. In addition to ammonium sulfate, its output was diversified to include ammonium sulfate-phosphate, superphosphate of lime, lime nitrogen, and other products, which it shipped in large quantities within Korea and to Japan.

A World-Class Chemical Industrial Complex

Noguchi constructed another chemical plant, in Pongung, about 4 kilometers away from the Hungnam fertilizer plant. It began processing soybeans in 1936. Construction was completed on a lime nitrogen facility in July of that year, enabling the mass manufacture of caustic soda (sodium hydroxide), ammonium chloride, carbide, lime nitrogen, and other products.

The manufacturing method for caustic soda was perfected at the Nobeoka plant in Japan and involved the electrolysis of salt using the mercury process. The caustic soda was shipped to affiliated chemical plants.

The manufacturing of ammonium chloride was initiated with the intention of making effective use of the chlorine that was produced through the electrolysis of salt. In Korea, ammonium chloride was either sold as fertilizer or purified and sold to manufacturers of batteries. Chlorine was also used as a raw material in the manufacture of hydrochloric acid, bleaching powder, and liquid chlorine. It was rare even in Japan for a single plant to manufacture multiple chemical products simultaneously through the rationalized use of salt.

Limestone, a raw material used to make carbide, was transported by freight cars to the plant from a limestone quarry owned by the company located north of Pongung. When there was a shortage, the rest was procured from Onoda Cement's Wonsan plant.

At the Pongung plant, the large amounts of powdered carbide generated as a byproduct of the carbide manufacturing process were simply thrown away. To avoid such waste, technology was developed that enabled the utilization of powdered carbide, which provided the basis for the construction of branch facilities dedicated to the production of acetylene, acetylene black, and glycol. Acetylene black was sold primarily as a material for making printing ink and rubber filler. The branch facility for glycol added hydrogen to acetylene to produce ethylene, the base material for manufacturing glycol. Other products made from acetylene included butanol and acetone. Glycol, butanol, and acetone are basic chemical products used to make solvents, synthetic resins, pharmaceuticals, and other products.

Noguchi built one related factory after another to create a huge chemical industrial complex in Hungnam. This complex was counted as one of the greatest in the world.

Noguchi also pursued urban development in Hungnam, including the construction of a harbor and housing. This was a unique feature of industrial development in Hungnam: a private-sector entrepreneur was engaged in development of infrastructure and factory construction at the same time.

Noguchi's Other Projects

Noguchi's projects extended beyond Hungnam. In 1932, he built a coal carbonization plant in the

town of Yongan in Hamgyeongbuk-do in the northeastern part of northern Korea. Using lignite available nearby, the plant manufactured gasoline from tar and produced methanol and formalin from water gas. Formalin is a base material used to make explosives and carbolic resin (Bakelite). The plant in Yongan included chemical facilities, machinery manufacturing facilities, and an inhouse thermal power plant. The power plant burned semicoke and supplied power not just to the plant but, through an electric power company (Chosen Denki), to surrounding cities.

In 1935, on the basis of technological development in Yongan, Noguchi founded Chosen Sekitan Kogyo (Korea Coal Industry Company), a new firm capitalized at ¥10 million that engaged in direct coal liquefaction. While operating the plant in Yongan, the company built in 1936 another plant in Aoji, in the extreme northeastern corner of northern Korea, near the borders of Manchuria and the U.S.S.R.

The plant in Aoji featured such cutting-edge equipment as high-efficiency gas generators and Japan's first 5,000 hp gas compressors capable of generating 240 atm of pressure each. All of the important equipment at the plant was manufactured by Japanese companies, including Kobe Seikoshu, Hitachi Seisakusho, and the Kure naval arsenal. For raw material, it used lignite obtained from a nearby company-owned mine. Technological development was avidly pursued by engineers from the naval fuel arsenal in Tokuyama. They were joined by Professor Yoshikiyo Oshima of Tokyo Imperial University, an authority on fuel science. At its peak, the plant had a production capacity of 50,000 tons of liquefied coal per year.

Research and commercialization of liquid fuel made from coal had already been undertaken by the Germans, British, and Americans. In Japan, it was the Navy that first showed an interest, with the Japanese government formulating "the summary plan for the promotion of artificial petroleum" in 1936 and implementing the "national liquid fuel policy" from the following year. In this context Noguchi pursued the commercialization of liquefied coal in Korea.

Noguchi gathered many talented engineers and guided them as they introduced and developed advanced technologies. Funding was initially provided by Mitsubishi Ginko (Mitsubishi Bank), with later financing provided by Nippon Kogyo Ginko (The Industrial Bank of Japan) and two of Korea's main financial institutions: Chosen Ginko and Chosen Shokusan Ginko.

Noguchi was intimately connected to the Government-General, particularly close to Kazushige Ugaki, the sixth Governor-General. Ugaki had a strong interest in Noguchi's enterprises and assisted in their development.

The Overlooked Machine Industry

It is widely said that the machine industry languished in Korea under Japanese rule, but this is not true. It did grow during the colonial period, although not as flamboyantly as the other sectors, particularly the chemical industry (as described above).

Many of the Japanese companies that built metal and chemical plants in Korea added machinery manufacturing facilities where they produced and repaired the machinery they used. Because these machine shops did not take the form of independent companies or factories, they hardly ever appear in the statistics and data of the time. Nevertheless, they played an important role in Korea's industry.

The machine plant in Hungnam was the largest machine manufacturing facility in Korea. It was constructed in 1928, at the same time that the Hungnam fertilizer plant was built. It expanded as the chemical industrial complex in Hungnam developed, and manufactured, renovated, and repaired the chemical machinery needed by the industrial complex. Nearly all of the newly designed machines were manufactured at this plant. It possessed a full complement of equipment comparable to that of an independent machine manufacturing company, including electric furnaces for casting, large hammers for forging, various lathes, and presses for manufacturing cans.

The Railway Bureau of the Government-General also operated machine manufacturing facilities throughout Korea. The largest of these was the Gyeongseong plant, founded in 1905. This plant started out as a small railway repair facility but gradually expanded. In 1927, it started producing steam locomotives. By 1939, it had 854 machine tools and a workforce of 1,700 skilled laborers (of which 595 were Japanese).

Two powerful independent machine manufacturing companies should also be mentioned: Chosen Shoko and Ryuzan Kosaku.

Chosen Shoko Kabushiki Kaisha (Korea Industrial and Commerce Company) was established in 1919 by Seishichiro Nakamura, a Japanese national living in Korea. Born in 1872 in Nagasaki Prefecture, Nakamura founded Nakamura Gumi, a sea transport company. Active in many commercial and industrial fields, including civil engineering, oil, fertilizer, machinery, ironworking, shipbuilding, and transport, Chosen Shoko was known as the “Mitsui Bussan of the Peninsula” and was the predecessor of Sankyu Inc., a modern-day general distribution company based in Kyushu. Its first plant was built in Chinnampo in 1910, and engaged in the manufacture and repair of mining and refining machinery.

Ryuzan Kosaku Kabushiki Kaisha (Ryuzan Manufacturing Company) was an ironworks founded in 1919 by Tsunejiro Tagawa, a native of Shimane Prefecture who was born in 1884. Affiliated with the Railway Bureau, it grew quite large by the 1930s, operating plants in Gyeongseong and Incheon that manufactured locomotives, rolling stock for passenger and freight trains, and various other railway equipment.

Rubber Processing, Fish Oil Manufacture, and Agricultural Product Processing

Starting in the 1920s, rubber processing plants (mainly for rubber boots) flourished in Pyongyang. Nearly all of them were small-scale enterprises owned by Koreans, although several of them developed workforces to 100 people or more. In 1939, there were 13 rubber processing plants in Pyongyang, only one of which was Japanese-owned. Two of them had workforces in excess of 200 people.

The fish oil business prospered with the growth of the sardine fishing industry. In 1923, large schools of migrating sardines suddenly appeared off the eastern coast of Korea. In response, Japanese nationals introduced Japanese-style purse seine fishing using motorized boats, giving birth to a burgeoning sardine fishing industry. In the first half of the 1930s, Japanese companies founded modern fish processing plants near fishing harbors: Chosen Chisso's oil plant in Hungnam and a plant of Chosen Yushi (Korea Oil and Fat Company) in Chongjin. These plants produced large volumes of sardine oil (used in the manufacture of soap, foodstuffs, and pharmaceuticals) and fish meal (for fertilizer).

Meanwhile, many Korean-owned small-scale plants for fish-oil processing sprang up, numbering more than a thousand by the late 1930s. At that time, Korean sardine oil accounted for three-quarters of all sardine oil produced in the Japanese Empire and was an important resource for the oil industry both in Japan and Korea.

Reaching its peak in about 1940, the Korean sardine fishing industry was said to be on a global scale. Subsequently, the sardines stopped migrating near Korea and the industry rapidly declined, bringing an end to the fish-oil processing.

A noteworthy development in the field of agricultural product processing in Korea occurred in 1931, when Nippon Corn Products built a corn processing plant in Pyongyang. The company was a subsidiary of an American company (with some investment by Mitsubishi). Introducing American-style machine technology, it processed corn grown in Korea and Manchuria to make such products as cornstarch and dextrose. The cornstarch was important both as food (mixed with rice, wheat, and barley) and for industrial applications, including newly developed ones such as pigment and gunpowder manufacture. The Pyongyang plant won reputation to be the largest

agricultural processing plant in Asia.

An Overview: Mining Output, Total Number of Plants, Proportion of Heavy and Chemical Industries

From annexation in 1910 until 1935, coal production increased dramatically from 80,000 tons to 2 million tons per year (Table 2). Iron ore production increased from 140,000 tons to 230,000 tons. Production of graphite (used to make desiccants, steelmaking crucibles, and electrodes), barite (the source ore of barium sulfate, a chemical additive), tungsten (for making metal alloys), and various other minerals also increased. The district of Kanggye in Pyeonganbuk-do in the northwestern part of northern Korea was known worldwide as a source of vein graphite.

Other products that do not appear in the same table include rare minerals such as antimony and mica, which were mined in the 1920s. In the 1930s, extraction began at a magnesite mine in Tanchon in Hamgyeongnam-do in the eastern part of northern Korea. It had one of the largest magnesite reserves in the world, estimated at several hundred million tons of high-grade ore.

The total number of industrial plants in Korea increased approximately from 300 to 6,500 between 1912 and 1939 (Table 3). This increase was particularly evident among Korean-owned plants, which first surpassed the number of Japanese-owned plants in 1932. Although most Korean-owned plants were quite modest in size with fewer than 50 employees, some relatively large plants also developed, with 15 plants employing 200 or more workers by 1939. A large part of the Japanese-owned plants were also small and medium-sized, but their average size was larger than that of their Korean-owned counterparts. Japanese-owned plants accounted for 90% of all large-scale plants, far outnumbering those owned by Koreans.

Not only did industry as a whole experience growth, but the proportion of total industrial output accounted for by heavy and chemical industries (machinery, metals, and chemicals) increased largely from only 6% in 1911 to 12% in 1920, 17% in 1930, and 40% in 1939.

Table 2 Outputs of Main Ores

(1,000 tons)

	Gold and silver	Copper	Zinc	Iron (pig iron)	Pyrite	Graphite	Coal	Barite	Fluorite	Tungsten	Quartz	Alunite
1910	10.3	0.4	—	140.4 (—)	—	0.8	78.5	—	—	—	—	—
1915	8.8	0.0	8.1	259.2 (—)	—	0.5	229.1	—	—	—	—	—
1920	21.5	—	3.4	447.2 (85.2)	—	11.2	289.0	—	—	—	28.8	—
1925	17.0	1.0	3.5	351.4 (101.9)	—	14.1	622.3	—	—	—	75.9	—
1930	13.4	5.6	3.8	532.5 (151.4)	—	20.1	884.1	6.1	2.3	0.0	47.3	11.7
1935	58.1	1.6	2.2	228.2 (147.8)	55.6	45.1	1,991.2	11.0	9.7	0.9	38.7	81.5

Source: *Chosen sotokufu tokei nenpo: Showa 6 nen* [Statistical yearbook of the Government-General of Korea: 1931], 182–185; *Chosen sotokufu tokei nenpo: Showa 10 nen* [Statistical yearbook of the Government-General of Korea: 1935], 149–151.

Table 3 Number of Plants by Size and Nationality

No. of Employees (Factory Workers)	1912		1932		1939	
	Japanese-owned	Korean-owned	Japanese-owned	Korean-owned	Japanese-owned	Korean-owned
5-49	159 (77.9)	87 (92.6)	1,887 (92.5)	2,445 (97.7)	2,040 (80.1)	3,731 (95.2)
50-99	27 (13.2)	3 (3.2)	82 (4.0)	40 (1.6)	231 (9.1)	135 (3.4)
100-199	11 (5.4)	2 (2.1)	33 (1.6)	12 (0.5)	150 (5.9)	38 (1.0)
200-	7 (3.4)	2 (2.1)	39 (1.6)	5 (0.2)	125 (4.9)	15 (0.4)
Total	204 (100)	94 (100)	2,041 (100)	2,502 (100)	2,546 (100)	3,919 (100)

Note: Figures for 1912 indicate plants that employed 10 or more people or that utilized motors. Figures for 1932 and 1939 indicate plants with facilities that employed five or more factory workers or plants that employed five or more factory workers at all times. Figures in parentheses indicate the proportion (as a percentage) of the total number of plants accounted for by plants of the indicated size.

Source: Umemura and Mizoguchi, eds., *Kyu Nihon shokuminchi keizai tokei* [Economic statistics of former Japanese colonies], 52.

3. Participation of Koreans in the Remarkable Development

Transition to Non-agricultural Economy

Under Japanese rule, the Korean economy underwent momentous change, so much so that, from a global perspective, it constituted an exceptional case in the first half of the 20th century. In short, it represented a rapid transition from a primarily agricultural economy to a primarily non-agricultural one.

During this transition, the agricultural sector itself underwent change. The policies of the Government-General and the development of the money economy led to improved farming techniques and changes in crop selection. Overall agricultural production increased steadily.

Industrialization in Korea began with small and medium-sized plants that simply processed raw materials. Then, as early as the 1910s, modern industries arose, particularly ironmaking plants. From the 1920s until 1930s, a private-sector enterprise built a large-scale chemical industrial complex founded on development of power plants.

The Government-General pushed construction of infrastructure such as transportation and communication networks and simultaneously supported industrial development in several sectors from the earliest days after annexation. The scope of those activities was expanded in the late 1920s and thereafter.

From the perspective of comparative economic history, such industrialization as seen in Korea never occurred in Western colonies. This contrast between Japanese rule over Korea and Western colonization is particularly evident with regard to the construction of hydroelectric power plants on a scale beyond those in the home country, as well as the giant industrial complex based on them.

What must be emphasized here is that the colonized people themselves contributed widely to industrialization in Korea. It is true that the Government-General and Japanese nationals (both companies and individuals) led the way and official policy coupled with Japanese financing, technology, and know-how played central roles. But at the same time, Koreans positively responded to external stimulus and took the initiative in following Japanese models and learning

skills in business and industrial technologies, thereby demonstrating entrepreneurship of their own. The remarkable development achieved was thus the result of the combined efforts of the colonizer and the colonized.

From this point of view, the shortcomings of the so-called “colonial dependence theory” become apparent. On the basis of Marxian economics, the dependence theory has had a strong impact on researchers and other intellectuals interested in colonial history. It focuses attention on the relationships of dominance/subordination and exploiter/exploited that play out between a colonizing country and its colony. Such a view reduces the colonized to a group of totally powerless people, ignoring the positive contributions they make to economic growth.

Today, Marxism is in decline, but the emotionally charged issues of inflicting/suffering harm and atonement have gained currency, and the deeply rooted dependence theory has been maintained. This perspective, however, cannot ultimately explain the changes in the Korean economy from the 1910s through the 1930s.

The Small Presence of Chinese

Finally, what merits consideration is that Chinese nationals (ethnic Chinese born in Qing China or the Republic of China) made up less than 0.5% of the total population in colonial Korea. This distinguishes Korea from the colonies in Southeast Asia, which all had a relatively large presence of Chinese.

In Southeast Asia, the western colonizers lived in limited districts, especially urban locations, and tended to work either in administration and international trade or on plantations. In these countries, Chinese tended to work as laborers in agriculture or civil engineering projects, or in enterprises operating in such fields as commerce and transportation or small to medium enterprises in food-processing fields like rice polishing, or in marginal administrative positions. In these capacities the Chinese supplemented the economic activity and reign of the Western colonizers. Thus, new economic opportunities were monopolized by the hard-working and adaptive Chinese, and, as a result, the colonized population was unable to free itself from work centered on traditional agriculture.

This phenomenon did not occur in Korea, where the economic activity of Chinese nationals was limited to such small areas as vegetable farming and China-related trade. Had there been a larger Chinese population in Korea, it would probably have been much more difficult for Koreans to participate in new business ventures. Indeed, they may well have been placed below the Chinese in the economic pecking order. The lack of Chinese influence, then, should not be dismissed, as the past literature did, in the issue of industrialization of Korea under Japanese rule.

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