

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

**THE IRON AND STEEL
INDUSTRIES OF EUROPE**

ECONOMIC PAPER 19

METAL ECONOMICS DIVISION

UNITED STATES DEPARTMENT OF THE INTERIOR

HAROLD L. ICKES, Secretary

BUREAU OF MINES

JOHN W. FINCH, Director

Economic Paper 19

THE IRON AND STEEL INDUSTRIES OF EUROPE

By

CHARLES WILL WRIGHT



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1939

After this publication has served your purpose and if you have no further need for it, please return it to the Bureau of Mines, using the official mailing label on the last page

For sale by the Superintendent of Documents, Washington, D. C. - - - Price 20 cents

CONTENTS

	Page
Introductory statement.....	1
Iron ore reserves in Europe.....	2
Production and consumption.....	3
Summary of situation early in 1939.....	4
Nations deficient in iron ores.....	6
General statement.....	6
Germany.....	6
General statement.....	6
Iron-mining districts.....	7
Pyrite.....	8
Scrap iron.....	9
Alloy metals.....	9
Manganese ore.....	9
Other alloy metals.....	10
Coal fields.....	11
Iron and steel plants.....	11
Internal trade.....	11
Foreign trade.....	12
Iron and steel organizations under Reichsgruppe für Industrie.....	13
Italy.....	14
General statement.....	14
Iron-mining districts.....	15
Pyrite.....	16
Scrap iron.....	17
Alloy metals.....	17
Manganese ore.....	17
Other alloy metals.....	18
Coal fields.....	18
Iron and steel plants.....	18
Foreign trade.....	19
Labor and industrial organizations.....	20
Great Britain.....	21
General statement.....	21
Iron-mining districts.....	22
Reserves.....	22
Imports.....	23
Manganese ore.....	23
Coal and coke supply.....	23
Iron and steel plants.....	23
Blast furnaces.....	24
Steel plants.....	24
Improvements in practice.....	25
Principal British iron and steel companies.....	26
Government organizations.....	26
Industrial organizations.....	26
Labor.....	27
Czechoslovakia.....	28
General statement.....	28
Territorial changes.....	29
Iron-mining districts.....	29
Manganese ore.....	30
Iron and steel plants.....	31
Iron and steel companies.....	31
Central sales organizations.....	32
Government control and participation.....	33
Workmen's corporations or unions.....	33

Nations deficient in iron ores—Continued.

	Page
Rumania.....	34
General statement.....	34
Iron-mining districts.....	35
Manganese ore.....	35
Pig iron.....	35
Steel.....	35
Metallurgical coke.....	36
Iron and steel companies.....	36
Foreign trade.....	36
State control of industry.....	36
Labor.....	37
Poland.....	37
General statement.....	37
Territorial acquisition.....	38
Iron-mining districts.....	39
Coal fields.....	40
Iron and steel industry.....	40
Foreign trade.....	41
Government control.....	41
New mining law.....	42
Labor.....	42
Nations with adequate or surplus iron ores.....	42
France.....	42
General statement.....	42
Iron-mining districts.....	44
Lorraine Basin.....	44
Other fields.....	45
Principal iron ore companies.....	45
Foreign trade and domestic consumption.....	46
Scrap iron.....	46
Manganese ore.....	46
Coal fields.....	47
Pig iron.....	47
Steel industry.....	47
Principal iron and steel companies.....	49
Comité des Forges de France.....	49
Sales organization.....	50
Market demand.....	50
Labor.....	50
Sweden.....	51
General statement.....	51
Iron-mining districts and ore reserves.....	52
Alloy metals.....	53
Manganese ore.....	53
Other alloy metals.....	53
Coal supplies.....	53
Iron and steel plants.....	54
Iron and steel companies.....	55
Foreign trade.....	55
Transportation problem.....	56
Sales of iron and steel abroad.....	57
Government control.....	57
Swedish mining law.....	58
Government purchases of raw materials.....	58
Soviet Union.....	58
General statement.....	58
Iron-mining districts.....	59
Ukraine.....	60
Urals.....	60
Alloy metals.....	61
Manganese ore.....	61
Mining districts.....	61
Production.....	62
Chronite.....	63
Tungsten.....	64
Nickel.....	64

Nations with adequate or surplus iron ores—Continued.

Soviet Union—Continued.

	Page
Coal fields.....	65
Iron and steel plants.....	65
Blast furnaces.....	65
Steel plants.....	65
Foreign trade.....	67
Soviet foreign trade monopoly.....	67
Internal administration and organization.....	67
Foreign trade in iron and steel.....	69
Administration, operation, planning, and financing of Soviet industry.....	70
Organization of people's commissariats for heavy, defense, and machine-building industries.....	70
Distribution of products between plants (sales).....	70
Financing of Soviet industry.....	71
Spain.....	72
General statement.....	72
Iron-mining districts.....	73
Ore reserves.....	74
Manganese ore.....	74
Coal fields.....	74
Iron and steel plants.....	74
Struggle for mineral supplies.....	75
Norway.....	76
General statement.....	76
Iron-mining districts and ore reserves.....	77
Alloy metals.....	77
Manganese.....	77
Chromite.....	78
Nickel.....	78
Iron and steel plants.....	79
Yugoslavia.....	79
General statement.....	79
Iron-mining districts.....	80
Alloy metals.....	81
Manganese ore.....	81
Chromite mines.....	81
Allatini Mines, Ltd.....	82
Ljuboten A. C.....	82
Asseo Mining Co., Skoplje.....	82
Mines in central Bosnia.....	83
Iron and steel plants.....	83
Government control.....	83
Labor.....	84
Hungary.....	84
General statement.....	84
Iron-mining districts.....	85
Manganese ore.....	85
Coal and coke supplies.....	85
Iron and steel plants.....	85
Government control.....	85
Ministry of industry.....	86
Bulgaria.....	87
General statement.....	87
Iron-mining districts.....	87
Alloy metals.....	87
Manganese ore.....	87
Chromite.....	87
Iron and steel requirements.....	88
Foreign trade restrictions.....	88
Government control.....	89
Labor.....	89
Greece.....	90
General statement.....	90
Iron-mining districts.....	91

Nations with adequate or surplus iron ores—Continued.	Page
Greece—Continued.	
Alloy metals.....	92
Manganese ore.....	92
Nickel mines.....	92
Chromite mines.....	92
Government control.....	93
Labor.....	94
Conclusions.....	94
Political aspects.....	94
Strategic aspects.....	95
Commercial aspects.....	95
Principal sources of information; acknowledgments.....	96

ILLUSTRATION

Fig.	
1. Iron-mining districts, steel centers, and coal fields of Europe.....	III

THE IRON AND STEEL INDUSTRIES OF EUROPE¹

By CHARLES WILL WRIGHT²

INTRODUCTORY STATEMENT

Factual information on such a broad subject as the iron and steel industries, intended for distribution among a variety of persons, cannot include extensive data on geology and technical processes or terms that a nontechnical reader may not recognize. Moreover, the busy man has no time to bother with much detail; he wants a clear picture of the situation in tabular or graphic form, with a map as needed. The author has attempted to keep these specifications in mind, and if in many places he has included too much descriptive material and used terms familiar only to the engineer or geologist, he asks indulgence.

The more one thinks about the status of iron as a power among metals, greater than that of all other metals combined, the more he realizes why nations must secure control of iron ore resources. No war can be waged without considerable stocks of iron, and countries that have achieved dominion over the principal sources of supply have the best chance to win the conflict, provided that they have the furnaces and fuel to melt the ore into steel for munitions.

Desiring power as well as protection, certain industrial nations in Europe have awarded a position of paramount importance in their economic programs to expansion of the iron industries.

Activity in the development of domestic iron ore resources as well as coal and plants for the production of pig iron and steel is being pushed at government expense in Germany, Italy, and such less powerful nations as Poland, Rumania, and Yugoslavia. These nations feel the need of being more self-sufficient in the production of steel for building and bridge construction and for industrial machines, including automobiles and airplanes, as well as for supplying war machines and munitions, should their imports be suspended. France, Great Britain, and Russia are in a more favorable position as they have access to almost unlimited iron ore supplies, and one of their present objects seems to be augmenting plant capacity in the production of fighting machines and munitions to counteract the growing strength of the Central European powers.

Fortunately a few nations, such as Sweden, Norway, Greece, and possibly Bulgaria, do not have such ambitious plans for expanding their heavy industry plants and are still willing to export their raw minerals in exchange for finished products.

¹ Work on manuscript completed April 1939.

² Foreign mineral specialist, Bureau of Mines.

Many descriptions of the iron-mining districts in Europe, discussing the geology of the ore deposits, the ore reserves, and the grades of ore mined, have been published in English and in foreign languages. This report will attempt to show the distribution of the resources of iron ore supply in Europe in the individual countries and the interdependence of these nations on each other and on those outside Europe for their requirements in the manufacture of iron and steel products. Besides the iron ores, mention must needs be made of the sources of the ferro-alloy metals and ores, namely, manganese, tungsten, nickel, and chromium.

As the international flow of raw minerals in Europe is subject to the changing currents and tides of trade because of new embargos, tariffs, trade restrictions, and foreign exchange incident to frequent changes in the political relations between the nations, this report can present only a picture of the situation early in 1939.

The economic set-up of each nation, insofar as it relates to the raw mineral problem and in particular to iron, is discussed in the text of the report, while the estimated iron ore reserves of each country and the production and consumption figures are given in separate tables. Where possible, the plant capacities also are stated, and the extent to which governments are subsidizing, controlling, and protecting their mineral industries is indicated. Besides these features brief mention is made of the labor organizations as they relate to the mining industries.

IRON ORE RESERVES IN EUROPE

The most important iron ore fields in Europe are:

- (1) The Lorraine deposits of "minette" ore in northern France.
- (2) The Lapland magnetite deposits in northern Sweden.
- (3) The sedimentary deposits in eastern England.
- (4) The hematite deposits of Krivoi Rog in the Ukraine.

Germany has several scattered iron ore deposits that are being mined, as well as the large, low-grade deposits at Salzgitter in central Germany. Although important for domestic consumption, they cannot be compared in value to those of the four principal European areas. Moreover, the magnetite deposits of Magnetogorsk in the Urals, situated as they are, cannot be added to those of primary importance. Among the smaller countries Spain, Norway, and Austria (the last now included in Greater Germany) add a few million tons each year to the export trade in Europe, while in the Balkan States the iron-ore deposits are small and relatively unimportant.

The following descriptions of the individual countries include mention of the ore reserves and details on the occurrence of the ores and their composition. The accompanying table presents three iron ore reserve estimates for the countries with large reserves and single estimates for those with small reserves. The first estimates (I) are those published by the International Geological Congress in Sweden in 1910; the second (II) are those by Olin R. Kuhn in *World Iron Ore Reserves*, published in 1926; and the third (III) are taken from the *Statistisches Jahrbuch für die Eisen- und Stahlindustrie* for 1937. Tonnage estimates, however, are only part of the story, and in their valuation one must consider not only the size and composition of the ore bodies but the cost of mining, transportation facilities, vicinity of the iron ore deposits to coking coal, power and labor supply, and

consuming centers. One must also weigh the reliability of those who make the estimates. Those for Sweden are known to be conservative and to include only high-grade ore, while those of the Soviet Union may include deposits of low-grade ores requiring concentration and of doubtful commercial value.

Iron ore reserves of Europe

[In million metric tons]

Country		Actual	Possible	Iron content, per cent
Germany				
(+Lorraine).....	I	3,608	Enormous	35
(-Lorraine).....	II	1,317	do	33
	III	721	do	35
Great Britain.....	I	1,300	10,830	33
	II	5,970	9,500	33
	III	5,970	37,000	34.5
France.....	I	3,300		33
	II	8,164		44.8
	III	6,830	4,000	49
Soviet Union.....	I	865	1,056	64
	II	2,057	Enormous	63
	III	2,550	617	33
Government estimate 1938.....		10,600	Enormous	35
Sweden.....	I	1,158		51
	II	2,203		35
	III	2,200	674	37
Luxemburg.....		270		36
Belgium.....		62	66	33
Spain.....		711	273	35
Austria.....		219	23	37
Norway.....		367	1,545	36
Czechoslovakia.....		61	400	33
Poland.....		60	200	57
Italy.....		18.5	26.5	8
Rumania.....		26		49
Greece.....		100	50	39
Hungary.....		20	4	40
Yugoslavia.....		25	75	

The above table makes it evident that the known iron ore reserves are adequate to supply the blast furnaces in Europe for hundreds of years, but whether an importing nation may be able to secure the required tonnage depends on those who control the iron mines and their political interests. In some countries dependence on iron ore imports is being reduced by the development of low-grade domestic deposits, but most of these undertakings are noncommercial because of the high cost of mining, transportation, and coke consumption per ton of pig iron produced. There will doubtless be increased output from many of the European iron mines, but it is not believed that the changes will affect the present balance materially. Both Germany and Great Britain will continue to import high-grade iron ore and Italy scrap iron for a large percentage of their requirements.

PRODUCTION AND CONSUMPTION

The production and consumption statistics for iron ore and pig iron during the last 3 years may be considered a barometer of industrial conditions within the European countries concerned. Consumption is calculated by adding net imports to production and deducting net exports. All figures are in thousands of metric tons, and with few exceptions these statistics are taken from the official publications of each country.

Production and consumption of iron ore and pig iron in Europe, 1936-38, in metric tons

	Iron ore			Pig iron		
	1936	1937	1938	1936	1937	1938
Belgium and Luxemburg:						
Production	5,086,652	8,011,000	5,049,000	3,161,340	6,355,000	4,016,000
Consumption	14,869,681	18,138,040	12,395,639	5,304,107	6,581,301	3,946,388
Bulgaria:						
Production	6,258	12,500	16,771			
Consumption	16,492	115,287	(¹)	² 7,190	² 4,947	
Czechoslovakia:						
Production	1,089,263	1,836,000	(¹)	1,139,886	1,675,000	1,200,000
Consumption	1,570,218	3,153,898	(¹)	1,157,872	1,689,096	(¹)
France:						
Production	33,301,000	37,839,000	33,137,000	6,237,000	7,916,000	6,049,000
Consumption	15,440,726	19,438,782	18,060,734	6,154,496	7,535,849	5,547,953
Germany and Saar:						
Production	6,498,873	10,399,000	11,145,000	15,303,179	16,346,000	18,513,000
Consumption	24,962,325	31,009,736	33,067,153	15,273,901	16,401,564	18,896,014
Austria:						
Production	1,024,288	1,884,694	(²)	248,111	389,118	(²)
Consumption	813,876	1,548,970	(²)	251,457	358,565	(²)
Greece:						
Production	280,271	300,000	(¹)			
Consumption	1145,500	338,203	(¹)	² 6,325	² 7,729	
Hungary:						
Production	279,673	290,000	369,934	306,290	358,000	350,000
Consumption	593,575	692,350	782,935	392,604	384,414	(¹)
Italy:						
Production	838,833	998,270	997,000	828,484	869,000	928,000
Consumption	879,031	1,180,963	1,382,631	844,368	887,177	996,718
Norway:						
Production	846,809	1,008,000	1,545,000	167,357	181,000	170,000
Consumption	-146,224	-16,230	519,106	167,973	179,020	154,745
Poland:						
Production	466,659	780,152	872,591	581,869	724,296	968,700
Consumption	812,173	1,315,577	651,870	584,282	732,105	972,261
Rumania:						
Production	108,429	129,000	(¹)	97,095	127,000	120,000
Consumption	172,812	193,695	(¹)	101,141	132,222	(¹)
Spain:						
Production	(¹)	(¹)	(¹)	280,924	110,000	300,000
Consumption	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Sweden:						
Production	11,249,605	14,953,000	13,300,000	631,736	693,000	670,000
Consumption	51,779	988,448	614,974	720,724	793,251	650,584
U. S. S. R.:						
Production	27,918,000	32,500,000	27,000,000	14,546,077	14,459,000	15,000,000
Consumption	27,892,106	32,148,511	(¹)	13,835,416	14,321,728	(¹)
United Kingdom:						
Production	12,905,243	14,443,000	12,049,540	7,844,922	8,629,000	6,871,000
Consumption	12,943,981	14,527,188	12,111,880	7,994,937	9,121,461	7,176,972
Yugoslavia:						
Production	450,859	629,000	610,000	44,453	41,000	50,000
Consumption	137,412	128,865	(¹)	50,278	52,155	(¹)

¹ Exports.² Imports.³ Included with Germany.⁴ Not available

SUMMARY OF THE SITUATION EARLY IN 1939

That the European nations formerly deficient in iron ore supplies are becoming more self-sufficient and less dependent on imports is evident from the production statistics. In some instances their added output has been made at a high cost. Mines formerly abandoned and deposits regarded as worthless are being developed, as they can be made to yield iron ore from domestic sources, thus reducing the exportation of currency and helping to combat unemployment. The greater output of iron ore has been accompanied by expansion in blast-furnace and steel plants, as deficient countries realize that greater capacity to produce steel products for domestic use as well as for armament means greater industrial as well as political power.

Thus they justify noneconomic undertakings that would not be tolerated otherwise.

To attain additional control over the iron and steel industries, these deficient nations have restricted foreign trade as well as domestic consumption and in some instances have financed local companies and subsidized private concerns in an effort to increase output.

Political control of the iron and steel industries, particularly in Germany and to a smaller extent in Italy, Poland, and Rumania, is thus waxing greater, and private interests are becoming less powerful. Such control, however, usually has resulted in decreased efficiency, higher production costs, and inferior quality of products, as competition is largely eliminated. These conditions may continue for a number of years, as has been the case in Russia, but if and when the trade barriers of these nations are broken down and consumers are permitted to buy their requirements at world market prices, these protected, high-cost, producing mines and plants will have to be scrapped.

The tendency toward combination of the steel interests in foreign trade is becoming more marked through the growth of the International Steel Agreement, and only a small percentage of finished steel products in Europe is now sold on the world market outside of these agreements to which most of the largest producers have subscribed. The domestic markets in the individual countries are regulated more and more by large organizations, such as the Vereinigte Stahlwerke in Germany, the Comité des Forges in France, and the British Iron and Steel Federation.

A noteworthy feature, however, has been the decrease in international trade in iron and steel products due to self-sufficiency plans and expansion in the manufacture of iron and steel products in countries formerly more dependent on imports. Moreover, advances in technology have increased the use of low-grade ores and scrap iron and improved the quality of domestic products in the deficient countries.

Another feature that favors the deficient nations has been helping to explain their increased annual output of steel products in recent years; this is the labor situation. Both Germany and Italy, under their reorganization of industry and labor, developed plans that made arbitration compulsory and eliminated strikes. Social legislation provides for old-age pensions, paid vacations, and job security, and there is little unemployment in these countries. Forty-eight hours is the minimum work week, and as many work overtime the average weekly wage per worker is relatively high—but so is the output per worker. In France there has been a 40-hour week during the last few years, but the average work week was only 36 hours due to rotation of unemployed. Because of strikes, industry is handicapped and jobs are insecure; thus the weekly pay and output of the French worker are much less than those of the German worker. The attempt by French labor organizations to dictate terms to industry by strikes rather than by arbitration has unbalanced the iron and steel industry and has been one of the reasons for the reduction in steel output from 7,920,000 tons in 1937 to 6,168,000 in 1938. On the other hand, Germany, where strikes are prohibited, increased its steel output from 19,800,000 tons in 1937 to 23,200,000 tons in 1938 and Italy, where similar regulation holds, from 2,100,000 to 2,300,000 tons.

NATIONS DEFICIENT IN IRON ORES

GENERAL STATEMENT

Among the European powers, Germany and Italy both depend on imports for most of their iron ore requirements, as well as for manganese, chrome, tungsten, and nickel ores, and the possibility of obtaining adequate supplies from domestic sources is remote. To meet this deficiency, Germany imports iron ore from France in exchange for coke and from Sweden in return for manufactured products; she also obtains manganese ore from South Africa, chromite from Turkey, tungsten from China, and nickel from Canada. Italy's deficiency in iron ore supply is taken care of largely by imports of scrap iron, principally from the United States, and by more extensive use of pyrite ash for the production of pig iron in electrical furnaces. All of Italy's chrome and nickel ores and most of the manganese ore required are imported. Great Britain also imports part of her iron ore and scrap iron and all of her manganese, chrome, and nickel ores; it is thus not entirely self-sufficient as a nation, but most of these requirements are available from her overseas dominions.

Among the minor deficient nations are Poland, which depends largely on Sweden for iron ore and Belgium for scrap iron, and Rumania, which imports iron ore from Yugoslavia in exchange for petroleum.

GERMANY

GENERAL STATEMENT

Germany's progress in her attempt to augment domestic output of iron ore and to build up steel production is evident from the statistics. The output of iron ore in 1938 was 11,100,000 tons averaging 32 percent iron content compared with 6,400,000 tons in 1929, and that of steel was 23,200,000 tons compared with 16,200,000 tons in 1929; the 1938 figures include about 2,000,000 tons of iron ore and 420,000 tons of steel from Austria. As steel consumption has also increased rapidly the production of iron from domestic iron ores in 1938 constituted but 25 percent of the total output from iron ores, or about the same as in 1929. Besides iron ore Germany, according to estimates, produced in 1937 about 9,000,000 tons of scrap iron, so that the total iron, from domestic sources, that goes into the steel production amounts to nearly 50 percent. It is estimated that imports of scrap iron in 1938 were about 1,000,000 tons. Imports of iron ore have increased from 13,800,000 tons in 1935 to 20,600,000 tons in 1937 and in 1938 were 21,900,000 tons. These imports average over 50 percent iron content.

It is a well-known fact that one of the most serious problems confronting German industry as a whole is the deficiency of iron ore, the demand for which has been caused by the great acceleration of German industrial activity. The heavy industries in Germany before the World War were based on control of the Lorraine minette iron ore deposits, with their large reserves, which supplied over 90 percent of German requirements. Germany still procures a large portion of her iron ore supply from the Lorraine district in exchange for coking coal.

The desire to be less dependent on outside sources for iron ore and scrap resulted in the foundation of the Government-financed Hermann Goering A. G. in July 1937 to exploit the large deposits of low-grade siliceous iron ores at Salzgitter in central Germany and to provide for the construction of large steel plants, which will be an important factor in Germany's future steel supply. The formation of this Government-financed company was considered indispensable, as no private enterprise would risk such large investments in an undertaking of this type. The development of these new sources of supply, well away from the frontier, constitutes an important part of this nation's rearmament program. If the entire program at Salzgitter is carried out, Germany's output of steel products will be increased 4,000,000 tons. The first unit for manufacturing 1,000,000 tons of pig iron per year will be completed in 1940.

At Linz, on the Danube between Salzburg and Vienna, the H. A. Brassert Co. is building another steel plant for the Hermann Goering A. G. which is to produce 1,000,000 tons of pig iron a year, the ore coming largely from the Erzberg mine in former Austria and partly from mines in Bavaria. This also will be in operation in 1940.

The Government apparently is less concerned with the economic aspects of these new undertakings than with the project to supply Germany with greater quantities of iron ore. Increased domestic production of steel would go far toward meeting the greater demand and eliminating the present inadequate quota system among consumers.

Just how far this new company can go in its effort to supply domestic demand for pig iron is questionable, and certain prominent engineers in the German iron and steel industry are opposed to wide use of the domestic ores because of their unsuitability. They do not believe that Germany can improve her situation substantially by these uneconomic efforts.

The greater steel output is being necessitated because German industrial activity has risen to all-time high levels on account of armament production, highway construction with numerous bridges, railways, ship building, automobile manufacture, rebuilding of whole city blocks, and expansion in the electrical and machinery-building industries for export trade. There is a never-ceasing demand for increased exports of steel products to supply much-needed foreign currency to purchase the required raw materials. Insofar as these raw materials are used for armament or accumulated as military reserve stocks they obviously cannot be re-exported in manufactured form, and Germany's effective exporting capacity is thus restricted.

Noteworthy is Germany's large increase in net imports of pig iron and ferro-alloys, raw steel, and scrap, which were 572,000 tons in 1937 compared with 1,100,000 tons in 1938.

IRON-MINING DISTRICTS

Until recently the Siegerland district has been the largest producer. Here veins of siderite ore 3 to 30 feet wide containing 35 percent iron occur, and the ore when roasted contains 50 percent iron and 10 percent manganese. The ore reserves are estimated at 100,000,000 tons. During the last few years, however, the output of the Peine-Salzgitter district has been greater than that of Siegerland, although the iron content of this high-phosphorus ore is only 30 percent, with

1.6 percent manganese and 25 percent silica. This district is to be Germany's greatest source of iron and is being developed by the Hermann Goering A. G.

At Salzgitter, the center of development activity, 12 shafts 1,200 to 2,000 feet in depth are being sunk, and a total of 20,000,000 tons of ore is to be mined annually. There are said to be about 30,000,000 tons of ore that can be surface-mined by stripping $2\frac{1}{2}$ tons of waste rock per ton of ore and about 1,000,000,000 tons of ore reserves to be mined by underground methods. The ore deposits are beds of oolitic ore 60 to 300 feet thick and a few thousand feet long, which dip at angles of 20° to 60° . To develop these ore bodies in depth to produce the required tonnage is no small undertaking, and it may be found to be a greater task than is realized at present. During the next few years mining will be confined to the surface. The present output is about 3,000,000 tons a year.

At several localities in Bavaria and recently in Baden similar beds of iron ore are being mined and concentrated, and about 700,000 tons of 48-percent iron ore is being produced annually. The reserves are estimated at about 100,000,000 tons.

Another important district is that of Lahn-Dill, where hematite and limonite deposits averaging 42-percent iron content are being mined and about 600,000 tons is produced annually.

Other productive iron mines are in the Thuringia-Saxony and Vogelsberger districts. Of particular importance are the manganese-iron ores of the Taunus-Lindener district, where 200,000 tons of ore averaging 19 percent iron and over 12 percent manganese are produced annually.

Austria's principal contribution to Germany's iron ore resources is the Erzberg mine, with its estimated reserves of 200,000,000 tons of developed and probable limonite-siderite ore averaging 33 to 38 percent iron and 2.2 percent manganese. This ore when roasted averages 45 percent iron. Because of its low sulfur and phosphorus content this ore is comparable with those of central Sweden. About 85 percent of the ore is surface-mined, and the rest is obtained from underground workings that are being extended. Part of the ore produced is shipped to the Ruhr district in exchange for coke. The output is to be increased to 3,000,000 tons a year to supply the new blast-furnace plant at Linz, which is to produce 1,000,000 tons of pig iron annually.

The total output of the iron mines in Greater Germany in 1938 was 11,300,000 tons of ore averaging 32 percent iron compared with 21,900,000 tons of imported ore averaging over 50-percent iron content. The iron ore production should show a further increase in 1939.

PYRITE

Pyrite from which sulfur is burned, leaving a residue with about 60-percent iron content, is another source of iron. Germany imports large quantities of this ore. The present domestic production is about 300,000 tons, chiefly from the Meggen district in southern Westphalia. Due to its zinc content the cinder or ash from this pyrite, of which there is a stock of a few million tons, has not been used in blast furnaces. Experimental plants have demonstrated that the zinc content may be removed so as to yield a marketable zinc product, as well as a raw material for the iron and steel industry. Large plants

have now been constructed for utilization of this source of supply, which at most can add only a few percent to the present iron requirements.

SCRAP IRON

To meet industrial requirements for iron, large imports of scrap have been made, principally from the United States; owing to the shortage of foreign exchange these were reduced to 331,900 tons in 1936 but were increased to about 1,146,000 tons in 1938, including 463,000 tons from the United States. However, a greater amount of domestic scrap was consumed, and no effort has been spared to increase collections of it in Germany to obviate the necessity of imports.

In Germany scrap is becoming an increasingly important raw material in open-hearth steel manufacture. In 1913 only 29 percent of scrap was used in steel production, while in recent years the average has been above 40 percent.

ALLOY METALS

MANGANESE ORE

Germany has no important deposits of commercial-grade manganese ore but rather large reserves of manganiferous iron ores, namely, the siderite ores in Siegerland with 6 to 7 percent manganese and the iron-manganese ores of the Taunus area with just over 12 percent manganese.

In the following table only the production of ore containing over 12 percent manganese is given. The output of high-grade manganese ore with over 30 percent amounts to only 1 percent of the total production.

Production, imports, and consumption of manganese ore in Germany in 1929, 1932, and 1934-38

[In thousands of metric tons]

	1929	1932	1934	1935	1936	1937	1938
Production, over 12 percent manganese.....	183	20.6	140.5	224	242	180	191
Imports, net, over 30 percent manganese.....	390.3	106.8	222.7	392.6	229.6	554.2	425.8
Consumption.....	573.3	127.4	363.2	616.6	471.6	734.2	616.8

Only ores with over 12 percent manganese (those from the Taunus district) are classified as manganese ore, while under the iron ores are included several times the above tonnage from the Siegerland district, containing about 6 percent manganese. Of the ore imported during 1938, 63 percent came from South Africa, 14 percent from Russia, and 11 percent from Brazil. India supplied about 4 percent and Chile 3 percent.

In a report, *Die deutschen Eisenerzlagerstätten und ihre Nutzungsmöglichkeiten*, by Dr. G. Einecke (1935), it is estimated that in 1934, 570,000 tons of manganese was used in the production of 16,000,000 tons of steel and of this 359,000 tons of the metal was supplied from domestic scrap, slags, and ores, and 175,000 tons (one-third) was imported, showing the importance of manganese scrap as a source of supply. Consumption ranges from 30 to 40 kilos of manganese per ton of steel produced.

This lack of a domestic manganese supply is a real handicap to German industry. Research studies in the use of substitutes for manganese and the greater use of soda as a desulfurizing agent in steel making already have resulted in a reduction of manganese requirements.

OTHER ALLOY METALS

Ores of other alloy metals occur in small quantities mixed with other ores; and small, unimportant, unrecorded amounts of concentrates are produced as byproducts. Germany depends almost entirely on imports for its supply of chromium, tungsten, nickel, cobalt, tin, and vanadium. Having large metallurgical plants for treatment of custom ore it is more advantageous to import ores that contain these metals than the metal itself, and these imports have doubled during the last 3 years.

Chromium is next in importance to manganese in Germany's steel industries. Of the chromium ore imports, shown below for 1938, 34 percent came from British South Africa, 30 percent from Turkey, 8 percent from Greece, 8 percent from Southern Rhodesia, and 7 percent from Yugoslavia.

Tungsten is highly important in the manufacture of armaments and of hard, resistant alloy steels. The imports of tungsten ore were divided about equally between China and British India, with small amounts from Bolivia.

Net ore imports of chromium, tungsten, nickel, and tin into Germany 1932-38

[In metric tons]

Ore	1932	1933	1934	1935	1936	1937	1938
Chromium.....	42, 128	47, 370	76, 983	95, 440	123, 375	132, 162	176, 406
Tungsten.....	1, 714	3, 766	4, 385	7, 881	8, 726	11, 372	14, 200
Nickel.....	17, 698	34, 513	37, 609	29, 013	17, 651	19, 990	34, 215
Tin.....	1, 858	431	602	1, 231	1, 563	6, 624	6, 142

In the official statistics the imports of chromium and tungsten metal are combined with small amounts of molybdenum and cadmium. Of the total imports of nickel for 1938, 48 percent were from Netherland India, 39 percent from Canada, and 10 percent from Burma. Of the total tin imports for 1938, 5,939 tons were from Bolivia and 145 tons from the Mandate of German South-West Africa.

German imports and exports of chromium, tungsten, etc., nickel, and tin, 1932-38

[In metric tons]

Metal	1932	1933	1934	1935	1936	1937	1938
Chromium and tungsten, etc.:							
Imports.....	630	1, 317	2, 877	1, 611	4, 114	6, 605	7, 590
Exports.....	966	1, 205	1, 779	3, 101	2, 860	4, 151	3, 521
Nickel:							
Imports.....				6, 079	3, 392	3, 365	3, 984
Exports.....				150	55	85	76
Tin:							
Imports.....				11, 824	9, 177	10, 320	12, 090
Exports.....				815	702	79	245

The total imports and exports of these metals during the last 4 years were about equal. Statistics do not show the sources or destination of these metals.

COAL FIELDS

The Ruhr coal basin or Westphalian field is Europe's most important producer of coking coal; next in importance in Germany is the coal basin in Upper Silesia. The Saar, Aachen, and Lower Silesian coal basins are also important producers, as well as the Kladno and Plzeň coal basins in former Czechoslovakia. These coal fields are described in detail in Bulletin 414, *Coal Mining in Europe*, by George S. Rice and Irving Hartmann, issued in 1939 by the American Bureau of Mines, and in Supplement 4 of Bureau of Mines Mineral Trade Notes.

IRON AND STEEL PLANTS

Domestic pig-iron production has shown a continuous uptrend from 4,000,000 tons in 1932 to 16,000,000 tons in 1937 and 18,500,000 tons in 1938. This increase was due partly to the inclusion of the Saar district, which was reacquired by Germany on March 1, 1935, and to the inclusion of Austria in March 1938.

There has been a corresponding increase in the production of steel—from 5,700,000 tons in 1932 to 19,800,000 in 1937 and 23,200,000 in 1938.

Of the raw material used in the blast furnaces, about 20 percent of the iron is now derived from domestic ores, 60 percent from imported ores, and the rest from slags, sinter, and other material added as flux.

Germany's largest iron and steel plants are to be the Hermann Goering A. G. works at Watenstadt south of Brunswick. The mines, which are 6 to 12 miles away, are being connected by railways, and a branch canal is being built to connect the works with the main Mittelland Canal 10 miles to the north. The immensity and modernity of this undertaking can best be grasped by inspection of the plant. The first of four units will be in operation the middle of 1940. Each unit will have eight blast furnaces, as well as coke ovens, steel furnaces, and rolling mills, with a total capacity to melt 4,000,000 tons of ore which will yield 1,000,000 tons of pig iron. By 1940 the mines must be ready to produce 8,000,000 tons of ore, half of which will be sent to the Ruhr district partly as return cargo for the coking coal. When all four units are completed 15,000,000 tons of ore will be smelted, and 6,000,000 tons will then go to the Ruhr district. The H. A. Brassert Co. of London is in charge of the construction of this plant, and the soda-ash process is to be used for the reduction of these siliceous ores. This process for low-grade iron ores is being applied successfully at the Corby plant in Northants, England, and is described in detail under Great Britain.

INTERNAL TRADE

Since 1904, when the Stahlwerks-Verband A. G. of Düsseldorf was established, Germany has had a sales organization to market all iron and steel products, through which each producer obtains a quota for his products according to his capacity to produce and according to market demand. Within this big Verband (association) are several smaller groups handling the principal products, such as ingots, rails, bar steel, plates, tubing, and beams. Besides looking after sales and quotas it keeps its members informed on market conditions.

Under the new Four-Year Plan established by Hermann Goering, a control office was established for internal trade, and this office has been attempting to reduce imports and make greater use of domestic sources by apportioning available supplies of iron and steel according to urgency of demand and to oblige producers to have an adequate and constant stock on hand for some months to meet any exceptional emergencies. This control office is said to cause much confusion within the iron and steel industry, and its attempt to create prosperity within Germany by Government measures evidently is not a success.

FOREIGN TRADE

The imports and exports of iron ore and steel products are best shown in the following tables:

Imports of iron ore into Germany in 1929, 1932, and 1935-38

[In thousands of metric tons]

Country	1929	1932	1935	1936	1937	1938
France.....	8,167	3,241	6,180	6,860	5,740	5,056
Sweden.....	7,382	1,578	5,509	8,248	9,084	8,992
Spain.....	3,025	460	1,321	1,068	310	1,083
Norway.....	688	220	515	527	510	1,118
Other.....	2,605	478	1,102	1,766	4,977	5,679
	21,867	5,977	14,627	18,469	20,621	21,928

German imports and exports of steel products, 1929, 1932, and 1936-38

[In thousands of metric tons ¹]

	1929	1932	1936	1937	1938
Exports.....	3,970	1,457	2,651	2,564	1,900
Imports.....	1,338	658	518	545	925
Net exports.....	2,632	799	2,133	2,019	975

¹ From Bulletin, Comité des Forges de France.

There has been a marked decrease since 1929 in imports of ore from France and Spain and an increase in imports from Sweden. Luxemburg and Newfoundland also made large shipments to Germany in 1938. In recent years a greater tonnage of steel products has been exported and less imported, but the net export in 1937 was still under that of 1929. The present tariffs on some of the iron and steel products are as follows:

Iron ores, blast-furnace waste, and scrap iron of all kinds are free of duty.

On pig iron the rate of duty is 1 reichsmark per 100 kilos.

On steel in ingots, blooms, etc., the duty is 1.50 RM. per 100 kilos.

On manufactured iron and steel products in rough state, bars, piping sheets, etc., it is 2.50 to 7 RM. per 100 kilos.

Turn-over tax of 2 percent of the duty paid is also imposed.

Some years ago, owing to a shortage of foreign exchange, Germany realized the necessity of reducing its dependence on imports and the necessity of regulating the imports of raw materials for the iron and steel industry, also of shifting imports as far as possible to countries buying German products. On March 26, 1934, a supervisory board for the ferrous metals (Überwachungsstelle für die Eisen- und Stahl-

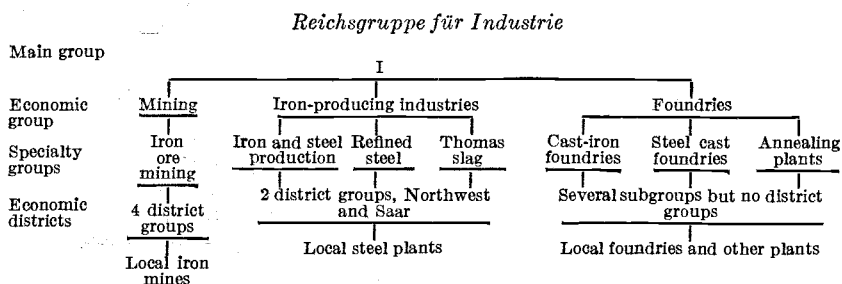
Industrie) was therefore established by ministerial decree, and independent of this control board was an advisory council (Beirat) composed of producers and sellers of ferrous products. Besides controlling imports, this board also controls domestic consumption. Consumers must apply for a permit to purchase their requirements, whether of domestic or foreign origin, and state whether these imports are needed for domestic use or for export in manufactured articles. If the raw material is to be exported in fabricated form, the permits are granted without delay, but if for domestic use it is more difficult to obtain the permit to import.

Through this board the Government is in a position to regulate the source of imports and the accumulations of stocks and to direct imports from countries where there is a market for German manufactured products rather than to those countries with which Germany has an unfavorable balance of trade. The board also has full powers for obtaining all requisite statistical data, including the consumers' metal stocks on hand. The decisions of the board are final.

IRON AND STEEL ORGANIZATIONS UNDER REICHSGRUPPE FÜR INDUSTRIE

Reorganization of the German iron and steel industry was begun soon after the World War, when well-studied plans were made to rebuild those branches of industry that had suffered most, due to the loss of territory and of world markets. Both political and economic forces were brought together to carry out a more united national program. There were, however, two tendencies to combat, one toward socialization of industry by the workers and the other toward the uniting and strengthening of industrial operations by the larger iron and steel trusts. This difficulty between capital and labor finally was adjusted early in 1934, after the change in government, when the National Labor Law of January 20 went into effect, when the Reichsgruppe für Industrie was established on February 27, and the Arbeitsfront for labor was organized in May 1934.

The accompanying diagram gives a general idea of the grouping of the branches of the iron and steel industry within the Reichsgruppe für Industrie, and the ramifications from the top to a local mine or steel plant. When this set-up was established it was understood that the State was merely concerned in directing national economy in such a way as was best-fitted to the requirements of the people and the State. Private initiative was not only unrestricted but was promoted by the State as long as it took into consideration the general economic policy of the State and abided by its laws.



When the Minister of Economy desires to discuss industrial questions that arise in reference to the industry, he calls in the heads of the economic groups, who then confer with their advising councils and those of the specialty groups concerned; they in turn obtain the opinions from the producers before action is taken. On the other hand, when the local producers wish to present their problems to the Minister of Economy, they can do so through the appropriate specialty group.

Bureaucracy is eliminated as far as possible, and if the iron ore producer has a question to discuss with a smelter operator or vice-versa, both parties can take it up directly without going to the head of the economic group.

Since the formation of the Hermann Goering Mining & Smelting Co. in 1937 politics has become a dominant factor in the industry, and the relations between the older industrialists and the Government are less friendly. The industrialists feel that the industry is becoming nationalized, and while they must take orders from the Government they are seldom consulted by it.

Today the Hermann Goering Co. includes subsidiaries for house construction in Brunswick and in Linz; the iron mines of Salzgitter in the Harz, the Erzberg mine in Steiermark, and the Doggererz mines in the Pfalz; sand, rock, and limestone quarries and brick factories; iron and steel plants at Salzgitter and Linz; control of the steel-manufacturing subsidiaries—Rheinmetall-Borsig A. G., Steyr-Daimler-Puch A. G., Maschinen u. Waggonbaufabrik Simmering, Steirische Gusstahlwerke A. G. and Pauker-Werk A. G.—and of the fuel companies—Vertriebs—g. m. b. H. and Benzolvertrieb der R. H. G., in Vienna; it also controls the transportation company Donau-Dampfschiffahrts A. G. of Vienna.

There is, however, cooperation between the iron and steel works technical staff and the German Iron and Steel Institute, and improvement in the art of making steel is said to have kept pace with American practice, while in fuel economy Germany is ahead of America. Were Germany to reduce her present rearmament policy and concentrate on foreign trade she undoubtedly would be a serious competitor to the United States on foreign markets because of her Government controlled and subsidized organizations for the iron and steel industry.

ITALY

GENERAL STATEMENT

The output of the Italian iron mines represents about one-quarter of the iron required for the steel industry. Another 10 percent of the iron is derived from treatment of pyrite ash in electric furnaces, and the rest is obtained largely from imports of scrap iron from the United States and France and from domestic scrap.

During the last few years, partly as a result of sanctions in 1935, there has been a noteworthy improvement in the iron and steel industry, accompanied by an increase in furnace capacities and better technique for the production and manufacture of steel products. The operators of the industry are doing their utmost to perfect their methods and organizations in harmony with the general plans of the Government looking toward national self-sufficiency, so as to meet the new conditions imposed upon the industry.

The lack of coal and the high cost of pig iron in Italy, however, constitute serious handicaps to this ambition, but the use of hydro-electric power and iron scrap have made it possible to overcome them, in part. For raw steel, the actual annual productive capacity is estimated at 3,500,000 tons, while the actual output is just over 2,000,000 tons a year.

Production and consumption statistics for Italy, 1929, 1932, and 1935-38

[In thousands of metric tons]

Commodity	1929	1932	1935	1936	1937	1938
Iron ore:						
Production.....	715	412	551	838	998	997
Net imports.....	191	93	187	40	183	386
Scrap iron: Imports.....	995	474	990	400	537	604
Pyrite ash: Consumption.....	240	122	309	(¹)	(¹)	(¹)
Pig iron:						
Production.....	671	461	633	828	869	928
Imports.....	178	48	78	27	22	69
Raw steel:						
Production.....	2,122	1,396	2,209	2,025	2,087	2,322
Imports.....	40	23	68	25	40	14.4

¹ Data not available.

Efforts are to be made to approximately double the iron ore output by 1940 by increasing the output of the Elba mines to 600,000 tons, of those at Cogne in Val d'Aosta to 350,000 tons, and of the Val d'Aspra mines from 50,000 to 100,000 tons; moreover, the Nurra high-phosphorus iron ore deposits in northern Sardinia are to be developed to produce 250,000 tons a year. These increases, together with the output of the smaller iron mines, are expected to supply nearly half of Italy's iron requirements from domestic sources.

IRON-MINING DISTRICTS

The principal deposits of iron ore are on the Island of Elba and at Cogne in the Val d'Aosta, which together yield 90 percent of the total Italian output.

The Elba mines are owned by the Government but are operated by the Societa ILVA (Alti Forni ed Accaieria d'Italia) of Genoa, which holds a long-term lease on a royalty basis. The ore deposits are large, irregular masses in the limestone-schist country rock often a few thousand feet in lateral extent and up to 20 feet in thickness. The ore is a limonite, with some hematite, and the product averages 51 percent iron, 10 percent silica, 0.07 percent phosphorus, and 0.09 percent sulfur. These deposits are mined by open-pit methods for the most part, and aerial ropeways are used to transport the ore from the workings to the washing plants and onto ocean steamers. About half of the product is made at the mines, and the remainder is sent to the washing plants, where the fines under one-fourth inch are screened out and discarded and the coarser material is hand-sorted. The ore recovery at the washing plants is said to be less than 60 percent. Although the reserves of developed ore are limited to several million tons, it is believed that explorations will reveal new ore bodies and that this island will continue to supply ore to the industry for some decades.

The total number of workmen employed is about 700; these work 280 days a year, and the annual production is about 400,000 tons (550 tons per man-year).

The mines in the Val d'Aosta are owned and operated by the Societa Anonima Nazionale Cogne of Turin. The ore deposit consists of magnetite masses in serpentine, 10 of which occur within an area 8 miles square. The principal operations are at the Liconi mine, which is being mined by open pits as well as underground. From this mine, at an elevation of 8,000 feet, the ore goes by a ropeway to the crushing and sorting plant at Cogne, at 5,000 feet elevation, thence by rail and ropeway to the blast furnace and steel plants at Aosta, which are 1,800 feet above sea level.

The ore reserves within this area are estimated at 8,000,000 tons. The annual production is about 150,000 tons and the number of workmen employed 350, so that about 400 tons is produced per man-year.

In northern Sardinia 15 miles from the port of Ponte Romano in the Nurra are extensive deposits of oolitic iron ore containing 0.8 percent phosphorus and 0.2 percent sulfur. Two beds occur in Silurian schists, an upper one 30 to 50 feet thick, largely of limonite, and a low one 6 to 14 feet thick, in which siderite predominates. The limonite ore contains 46 to 52 percent iron and 10 to 15 percent silica, while the siderite ore averages 41 percent iron and 6 percent silica. These deposits are owned by the Societa ILVA, and production (which started in 1935) is now at the rate of 100,000 tons a year, the maximum amount of phosphorus ore treatable by the Thomas process in Italy. The ore reserves are estimated at 5,000,000 tons of developed and probable ore.

During the last few years much attention has been given to the development of deposits of siderite in northern Italy, northeast of Bergamo; this ore averages 52 percent iron when roasted. There are a number of these deposits extending over many square miles and estimated to contain many million tons of iron. Another source now being exploited is in the ancient iron-slag deposits at Boratti and at Fallonica, on the mainland opposite the Island of Elba, and these are estimated at about 3,000,000 tons containing an average of 52 percent iron. At Strettoia near Massa another deposit containing 3,000,000 tons of 40-percent low-sulfur iron ore is being developed.

Several scattered deposits of magnetite and limonite occur in Eritrea, but according to engineers of the Italian steel companies who have investigated these deposits the transportation costs preclude ore shipments to the continent. As there are no coal deposits in Eritrea and no important market for iron and steel products, local production of iron and steel would be noncommercial.

In 1938 iron ore imports were doubled, Morocco supplying 216,212 tons, Turkey 33,048 tons, and Algiers 33,676 tons. In January 1939 a contract was made with the Nationalist Government in Spain for 45,050 tons of ore from the Bilbao mines to be delivered by June 1939.

PYRITE

The expansion in the reduction of pyrite ash to pig iron in electric furnaces has been an important factor in the reduction of imports of both iron ore and scrap iron. This ash is supplied from the large domestic deposits of pyrite that are mined for the production of sul-

furic acid. It is only in recent years and with the aid of electric furnaces that this ore could be treated advantageously in Italy, and today this source of iron supplies over 10 percent of total requirements for the steel industry. About 550,000 tons of pyrite ash averaging 50 percent iron content is produced annually, and of this, 63,000 tons was exported in 1938.

SCRAP IRON

Over half of Italy's steel is produced from scrap iron, and half of this scrap iron is imported. In 1938 the total imports of scrap iron were 604,000 tons, of which the United States supplied 407,000 tons and Switzerland 52,600.

By royal decree, dated June 28, 1938, a semi-Government organization for the distribution of scrap iron was organized under the name "Ente Distribuzione Rottami." This has the function of purchasing and distributing the iron and steel scrap and cast iron required by the iron and steel producers. This organization has headquarters in Rome and has a capital of 10,000,000 lire, comprising contributions of the manufacturers in proportion to the raw steel and iron produced by them during the period from July 1, 1936, to June 30, 1937. The Central Commissariat for War Manufacturers makes the assignments of scrap iron for newly constituted firms.

ALLOY METALS

MANGANESE ORE

In general, the manganese deposits in Italy are small and were in the hands of small operators who found it difficult to compete with the imported manganese ores used by the large consumers. However, as the supply of manganese is one of Italy's urgent mineral problems, certain of these mines in northern Italy have been acquired by the Società ILVA, and others on the continent and in Sardinia are being developed by the Azienda Metalli e Minerali Italiana (A. M. M. I.), which is financed by the Government. Production of manganese ore rose from 9,100 tons in 1935 to about 50,000 in 1938. The principal producers of high-grade manganese ore in 1938 were the Tre Monti and Gambatesa mines of the Società ILVA east of Genoa, with an output of about 15,000 tons containing 45 percent manganese, the Canneto mine near Pisa, which is also credited with an output of 15,000 tons containing 48 percent manganese, and the Mount Alpi and Mount Pu mines in Piedmont where 5,000 tons of 45-percent manganese ore is produced annually. Ore-dressing plants have been or are being built at all of these mines. At the Mormanno, Mount Precila, and San Polo Matese mines in southern Italy and on the island of San Pietro off the south coast of Sardinia developments and mill construction are in progress.

Noteworthy are the deposits of ferromanganese ore being mined at the Monte Argentario mine in Tuscany by the Società ILVA. In 1937 the output was 17,273 tons containing 16 percent manganese and 34 percent iron.

The output of high-grade manganese ore in 1939 is expected to reach about 50,000 tons and that of the lower grade 20,000 tons. Within the next few years it is believed that, with Government

financial assistance, Italy will be able to supply her normal requirements of this essential metal.

Imports of manganese ore were reduced from 75,384 tons in 1937 to 58,077 in 1938. Although the U. S. S. R. supplied 41,000 tons in 1937, these were entirely replaced by imports from British India, which were 50,588 tons in 1938.

OTHER ALLOY METALS

None of the more important alloys used in making special types of steel are produced in Italy or appear to have been imported in worthwhile quantities. Instead, special steels containing these alloy metals have been imported to meet the limited needs of the industry. It is not possible from available statistics to estimate the contents of tungsten, chromium, molybdenum, titanium, or vanadium of these alloy-metal imports. The imports of the actual metals have been limited to a few thousand kilograms.

COAL FIELDS

Only two small groups of mines in Italy produce a high-grade coal—that of La Tuille in the Piedmont and that at Seni in Sardinia, the total output being somewhat less than 100,000 tons a year. There are extensive deposits of lignite at Carbonia in Sardinia and at Arsa in Istria, the annual output averaging 1,800,000 tons. This lignite is high in ash and sulfur and is not adaptable in the metallurgical industry. Italy depends almost entirely on imported coking coal for the iron and steel industry; annual coal imports amount to 13,000,000 tons, most of which is shipped from Germany and Great Britain by boat plus a small tonnage from Poland by rail.

IRON AND STEEL PLANTS

Blast furnaces in Italy total 14, with daily capacities of 200 to 350 tons of pig iron; 12 belong to the Societa ILVA and 2 to the Societa Conge. In 1938, 9 blast furnaces were in operation.

The future program of the iron and steel industry is to raise the annual production of pig iron to 1,500,000 tons, to use greater quantities of pyrite ash for the production of pig iron by electric furnaces, and to make more extensive explorations for iron ore deposits in Italy at Government expense.

Early in 1938 the Duce approved a plan submitted by the Metal and Engineering Guild for reorganization of the Italian steel industry along autarchial lines. The Societa Italiana Accaieria Cornigliano (SIAC), an affiliate of the Ansaldo Co., was authorized to erect a new steel plant at Genoa with two blast furnaces each of 500 tons daily capacity, coke ovens, and rolling mills for steel products and alloys. The bulk of the Italian iron and steel industry will thus be concentrated in three great works—those at Bagnoli and Piombino, which will be extended and simplified, and that at Genoa. The first two plants belong to the Societa ILVA and the third to the SIAC, both concerns controlled by the Finsider organization. The Genoa plant will be able to produce 1,000 tons daily. It will utilize the Thomas converter process to treat the high-phosphorus ore from Nurra (Sardinia). An increased output of pig iron from iron ore, however, means increased imports of coking coal, and it still is more

convenient for Italy to use scrap iron as the raw material. Where possible, hydroelectric power and electric furnaces are used in place of coal and coke.

Although pig iron output showed a 7-percent increase in 1938, imports jumped from 22,000 tons in 1937 to 68,730 tons in 1938. This increase was largely from Spain, which supplied about 45,500 tons compared with only 1,342 tons in 1937. Imports of pig iron are controlled by the Consorzio Nazionale Materie Prima per Fonderia Ghisa (National Consortium for Raw Materials for Iron Works).

The total production of steel ingots and castings in 1929 was 2,122,194 tons compared with 2,086,905 tons in 1937 and 2,322,000 in 1938; thus only in 1938 has the output of 1929 been surpassed. Noteworthy, however, is the rapid increase in the use of electric furnaces to reduce coke consumption. The output of these furnaces has been increased from 211,000 tons in 1929 to nearly 700,000 in 1938. These furnaces average about 50 tons daily capacity and produce about 30 percent of the total steel output.

Imports of raw steel were 40,000 tons in 1937 and 14,420 tons in 1938, and those of iron and steel in bars and rods 108,485 tons in 1937 and 111,204 in 1938.

It is estimated that over 50 percent of the steel output is consumed by the war industries, namely, the production of munitions, tanks, airplanes, and warships, and less is being allowed for consumption in private industries.

For fixing sales quotas, market prices and their control, the steel interests established the Nuovo Unione Siderurgica Italiana (New Italian Iron and Steel Union), and since its establishment in 1935 a notable increase has occurred in the sales prices for steel products in Italy. This sales organization also represents the steel interests in Italy on the International Steel Agreement for exports.

FOREIGN TRADE

On April 1, 1936, a new import regulation went into effect requiring a license issued by the Ministry of Finance for imports of scrap iron and steel, scrap cast iron, pig iron, and crude iron alloys.

As to tariffs, iron ores, iron pyrites, and scrap iron are duty free. Duties on other forms of iron and steel are as follows:

	<i>Duty, lire per 100 kilos</i>
Cast iron in crude state.....	10. 30
Pig iron.....	15. 40
Steel in blooms.....	22. 00
Steel in ingots.....	14. 30
Special steel.....	30. 80
Ferromanganese (over 25 percent Mn).....	38. 40
Ferrosilicon.....	29. 40
Ferrosilicomanganese.....	47. 00
Common iron and steel in manufactured state.....	37. 30-68. 80

Besides the duty there is a sales tax of 2½ percent ad valorem calculated on the c. i. f. value payable to customs at time of entry.

To aid its export trade, Italy devalued the lire in October 1936. At the same time a new law was passed permitting the Government to change the import duties, and one of the first acts was to abolish the added duty of 15 percent ad valorem on most of the imports, particularly on raw materials. Other changes are gradually being made in order that the cost of foreign supplies required by industry in Italy

will not be excessive. The flow of mineral products in and out of Italy depends on many changing factors; of these, the rates and facilities for acquiring foreign exchange between the trading nations are most important.

LABOR AND INDUSTRIAL ORGANIZATIONS

The relations between industry and labor and the mechanism for settling disputes are working out more smoothly today than formerly, as a result of keener interest by the industrial companies and the Government in the welfare of individual workers and their families and in training the workmen to be more efficient. All workers are members of local representative syndicates, and they are becoming prouder of their occupations and the part they play in the national set-up. Of interest was the general increase of 8 to 10 percent in the wages of workmen and employees in September 1936.

The operators or industrialists, on the other hand, have realized the advisability of the Government control measures, particularly during the period of sanctions, but legislation as to these measures usually is decided by the industrialists themselves or by their representatives who are members of the Corporate State. The small mine or industrial operators are finding it more difficult to sell their mine products at a fair price, to get their requests for metal or mineral imports or exports granted, and to arrange through the Banca d'Italia for the necessary foreign currency or credit to pay for them. Both large and small industrialists hope that the present difficulties of exchange and legislative restrictions will soon be corrected and that the mineral sales organizations will be permitted in the near future to deal directly with their foreign clients within the limits of the cartel arrangements that may be in force.

Of particular interest are the organizations for labor and industry, which were established several years ago, and the direct approach to the Corporate State afforded the industrialists for presenting questions that require legislation. These start at the bottom of the following diagram, with the organization of small local syndicates for workmen and employers, followed by provincial federations or unions and national confederations, all of which are maintained respectively by industrialists and workers and are not Government organizations.

For industry		For labor
National Confederation for Industrialists		National Confederations for Labor
(For questions within industry)	(For questions with labor)	National Federations for Labor
National federations	Provincial unions	Provincial unions
Individual firms	Local syndicates	Local syndicates
	Individual employers	Individual workers

The Ministry of Corporations has indirect supervision of all the syndical associations of employers and workers within the nation, registration and enforcement of national and provincial collective labor agreements, general supervision of collective labor relations, conduct of programs of syndical education and instruction, elaboration of statistical information on questions of production and labor, and supervision of the social welfare organizations.

Under the National Council of Corporations are corporations representing the various industries and national activities, of which there are 12 groups. Each corporation is composed of an equal number of

members for industry and labor, chosen by the interested categorical groups; it also has a committee of several members, half for industry and half for labor, to examine all questions before their presentation to the National Council for enactment.

Individual demands for legislation within the mining industries are carefully studied and opinions given by the industrialists, the Bureau of Mines, and others before action is taken.

General questions within the industry, such as, for example, a provision to increase the production of iron ore in Italy, would be discussed at a general meeting by the members of the Federation of the Mining Industries, and this organization prepares the proposal for presentation through the National Confederation of Industries to the Ministry of Corporations. This ministry then obtains the opinion of the Geological Survey, the Bureau of Mines, and other authorities and requests the committee for the Corporation of the Mining Industries to prepare a report for the Council of Corporations, where the fate of the proposal is decided.

GREAT BRITAIN

GENERAL STATEMENT

Some 6 years ago it was realized that to assure economic security and prosperity there must be effective cooperation between the steel industry and the State. It was the State's duty to establish protective tariffs for internal trade, make trade agreements for export trade, and keep industry informed as to foreign markets and competition. At the same time it was also realized that the industry must remain self-governing and responsible within itself and to the community. The tendency to nationalize industry, as in Germany, is regarded as a downward step toward inefficiency and higher production costs. It may eventually be necessary, however, for the State to subsidize exports, as in Germany.

In 1932 the Import Duties Advisory Committee, organized to control the tariffs, helped to bring about an ordered and cooperative industry. In April 1934 the National Federation of Iron and Steel Manufacturers was reconstituted as the British Iron and Steel Federation; this is the central organ of the industry at present and has facilitated internal reorganization of the industry and investment of capital in it. Thus within the past 6 years the British iron and steel industries have ascended from the depths of a depression to an unprecedented prosperity. On July 31, 1935, the steel producers in Great Britain joined the International Steel Agreement—a cardinal point in rehabilitation of the industries' export trade. The test of this present reorganization in Great Britain will come in their ability to hold their own both at home and abroad and to resist another period of depression.

For the first time in history Great Britain's production of steel in 1937 averaged over a million tons a month, the total output in 1937 being 12,980,000 tons. During the first quarter of 1938 this output was maintained, but from April on, monthly production was below the million-ton mark, and reached as low as 655,700 tons in December; the total for 1938 was 10,400,000 tons. The low output was due to lack of orders, as consumers knew that lower steel prices would become effective the first of January.

Accumulated orders—together with Government demands for steel products for air-raid protection and defense, for armament, for ship-building, and for airplanes—should stimulate the output of iron and steel, and the outlook for the steel industry during 1939 is a bright one. Unsettled political conditions, however, still have a disturbing influence in retarding normal progress.

Steel-plant improvements in 1938 have raised the present annual steel-making capacity to 14,250,000 tons, a potential supply believed to be adequate in a national emergency.

In October 1938 the United Steel Companies, Ltd., and others proposed storage of pig iron in times of slack markets to stabilize production and thus render the nation less dependent on foreign sources of pig iron and scrap in times of great demand.

IRON-MINING DISTRICTS

The principal sources of iron in England are the bedded deposits in the Jurassic formations that extend from just north of Oxford to Middlesbrough on the east coast and include the Northampton, Leicester, Frodingham, and Cleveland mining districts. These districts supply about 80 percent of the total production. The ore when dried contains 25 to 38 percent iron, averaging 30 percent, with 0.3 to 1 percent manganese and 0.3 to 0.7 percent phosphorus. The beds, which range from 6 to 25 feet in thickness, are mined largely in open-cuts by steam shovels with an average output of 10 tons per man-shift; they are also mined underground, where the output averages 2½ tons per man-shift. The over-all average is about 6 tons per man-shift.

The hematite deposits in Cumberland and South Wales on the west coast were for many years the principal source of iron ore in England, but today these mines supply only about 20 percent of the total output. This hematite ore averages about 53 percent in iron content. Another source of iron is the iron carbonate ore that occurs in seams in most of the coal mines. Formerly these ores were mined very extensively but production is now confined to small areas in North Staffordshire. The production statistics are as follows:

Production of iron ore in Great Britain, 1934-38

[In thousands of long tons]

Iron ore	1934	1935	1936	1937	1938
West coast hematite.....	813	840	880	857	(1)
Jurassic siderite.....	9,483	9,742	11,417	12,919	(1)
Coal-measure siderite.....	143	167	174	179	(1)
Other hematite and limonite.....	148	146	230	261	(1)
Iron ore imports (including manganiferous iron ore).....	10,587 4,356	10,895 4,546	12,701 5,957	14,216 7,037	(1) 5,104
Consumption plus stocks.....	14,943	15,441	18,658	21,252	(1)

¹ Data not available.

NOTE.—10,012 workmen were employed in the iron mines in 1937.

RESERVES

The estimates for the bedded deposits in the Jurassic formation include 1,020,000,000 tons of positive and 2,160,000,000 tons of probable ore, with a total iron content of 940,000,000 tons. The hematite deposits along the west coast are estimated to include 25,000,000 tons of positive and 90,000,000 tons of probable ore con-

taining 60,000,000 tons of iron, and the ironstone or siderite ores in the coal measures have 1,040,000,000 tons of positive and 1,250,000,000 tons of probable ore containing a total of 730,000,000 tons of iron.

England is thus favored not only with large reserves of low-grade self-fluxing ore, which can be mined cheaply, but with extensive coking-coal deposits adjacent to these iron ore mines and plenty of skilled labor for both the mines and the steel industry. Although high-grade ores are imported the industry does not depend on these imports for its existence, as in Germany and Italy.

IMPORTS

Sweden, Spain, and North Africa are the principal sources of the imported ores, followed by Sierra Leone and Norway. These ores average about 52 percent in iron content and are essential for making proper blast-furnace mixtures. As many of the blast-furnace plants are near the shipping ports the transportation problem is simplified.

MANGANESE ORE

From 1912 to 1928 there was a small production of manganese ore from mines in North Wales and in the west of England, but since 1928 all of the manganese requirements have been imported. These imports totaled 240,637 long tons in 1936, 283,450 in 1937, and 193,000 in 1938; 85 percent comes from British India, 5 percent from Gold Coast, and 5 percent from the U. S. S. R.

COAL AND COKE SUPPLY

Great Britain produces about 240,000,000 tons and exports about 40,000,000 tons of coal annually. Approximately 20,000,000 tons of coal is processed and 14,000,000 tons of coke produced. Research in the manufacture of coke has resulted in the production of an improved coke from inferior coking coals; by its use, coke consumption has been reduced and blast-furnace output increased. Of the total coal output, just over 10 percent is consumed by the blast furnaces and steel plants. In 1937 a total of 20,136,400 tons of iron ore was consumed, and 9,663,700 tons of coke and 96,200 tons of coal were used in blast furnace operations. Most iron works have their own coking plants, as coke-oven gas is an essential factor in efficient open-hearth practice. Recent agreements have been made between the steel companies and coke producers whereby the price of coke is fixed according to a sliding scale based upon the price of steel.

IRON AND STEEL PLANTS

The statistical details of the iron and steel industry for the last few years are shown in the table below.

Iron and steel statistics of Great Britain, 1929 and 1936-38

[In thousands of long tons]

	1929	1936	1937	1938
Pig iron and alloys:				
Production.....	7, 589	7, 721	8, 493	6, 762
Consumption.....	7, 197	7, 920	9, 042	7, 104
Steel ingots and castings:				
Production.....	9, 636	11, 784	12, 984	10, 395
Consumption.....	10, 406	12, 229	13, 374	10, 678
Scrap iron: Net imports.....	-357	948	721	608

BLAST FURNACES

Most of the large steel companies in England have their own blast-furnace plants and produce about 70 percent of the pig iron used from domestic and imported ores. At the end of 1938 only 78 blast furnaces were in operation, and in January 1939 the number was increased to 83.

Although Great Britain apparently has lagged behind developments in the United States and Germany as to the size of blast furnaces, it should be remembered that a substantial proportion of British pig iron is made from domestic low-grade ores by a process wherein the furnace burden contains only half the iron content of that in the present German and American practice. However, in recent years many of the old blast furnaces in Great Britain have been replaced by those of about 500 tons daily capacity compared with 1,000 tons in the United States, and the increased output per furnace has been helped by application of the latest methods of feeding the furnaces with properly sized ore, coke, and flux. Application of information gained from studies of the temperature and pressure of the air blast has also increased their efficiency. Thus, with the development of better control in blast-furnace practice, inferior raw materials may now be used and a higher-grade product made at lower cost.

In 1937 the average number of furnaces in blast was 124, and the average daily output was about 225 tons of pig iron per furnace. To produce 1 ton of pig iron 2.250 tons of iron ore and 1.135 tons of coke were consumed. The total blast-furnace capacity at the end of 1938 was 13,000,000 tons, while the total output of pig iron in 1938 was 6,800,000 tons compared with 8,500,000 tons in 1937.

The raw materials consumed per ton of pig iron produced in 1937 included 1.53 tons of domestic iron ore, 0.65 ton of imported ore, 1.03 tons of coke, 0.25 ton of limestone, and 0.20 ton of pyrite ash and scrap materials.

In recent years there has been a steady increase in the output of basic pig iron, which now comprises about 60 percent of the total followed by hematite amounting to 21 percent and foundry 17 percent, while forge pig iron and ferro-alloys make up the balance in about equal amounts.

Imports of pig iron in 1938, largely from the United States, were 395,000 tons compared with 638,000 tons in 1937.

Exports of pig iron, which amounted to 101,000 tons in 1938 and 167,000 tons in 1937, go largely to Belgium, France, Denmark, and Germany.

STEEL PLANTS

In Great Britain, as in the United States, 90 percent of the steel output is made in open-hearth furnaces, as these permit more extensive use of scrap. At the end of 1937 there were 442 open-hearth furnaces with a total nominal capacity of 29.086 tons per heat.

In open-hearth steel production the daily capacity of the individual furnaces has been largely increased with better grading and handling of the raw materials through mechanical improvements as well as in the use of better quality refractories.

The gradual shift from the acid to the basic open-hearth process since the World War has been important, and today 82 percent of all open-hearth steel is made by the basic process. About 6 percent of

the steel is made in Bessemer converters, 2 percent in electric furnaces, and 2 percent by other processes for steel castings.

Consumption of pig iron and scrap in the production of steel in Great Britain, 1929 1935. and 1937-38

[In thousands of long tons]

	1929	1935	1937	1938
Pig iron.....	4,798	4,649	6,356	(1)
Scrap iron and steel.....	4,501	5,944	7,597	(1)
Percentage of scrap.....	46	56	54.5	(1)

¹ Data not available.

Raw steel imports into Great Britain were 48,000 tons in 1938 as against 78,000 tons in 1937, and raw steel exports were 32,000 tons in 1938 compared to 44,000 tons in 1937. Of the total iron ore, pig iron, scrap iron, and steel requirements, Great Britain produced about 60 percent from domestic sources and imported 40 percent.

IMPROVEMENTS IN PRACTICE

The treatment of low-grade ores high in alumina and silica has been an outstanding accomplishment at the United Steel plant, Corby, Northants, and at the Ebbw Vale, South Wales. The main feature of this so-called Brassert, or soda-ash, process is the use of soda ash. Ores are smelted in the blast furnace without regard to the sulfur content of the pig iron, while the resulting slag is comparatively high in silica content, the ratio between silica and lime being 1 to 1. The average sulfur content of the pig iron (0.3 percent) is reduced to 0.13 percent by introduction of a mixture of soda ash, fluorspar, and limestone in the bottom of the ladle (65 tons) into which the pig iron is poured and transferred from the blast furnace to the mixer (1,200 tons). The sulfur and silica in the pig iron are absorbed by the soda and fluorspar and form a thin slag film which is skimmed from the ladle before the pig iron is poured into the mixer. In the ladle transporting the pig iron from the mixer to the Bessemer converter more of the soda-ash mixture is used, and the sulfur content reduced to 0.08 percent sulfur. A total of about 20 pounds of soda ash, 20 pounds of fluorspar, and 40 pounds of limestone, costing about 15 cents in all, is consumed per ton of pig iron. In the Bessemer converter the sulfur content is reduced to 0.03 percent by the use of ferromanganese. Thus a 60-percent desulfurization is accomplished in the ladles and a 30-percent desulfurization in the converter.

A fundamental change is also being made at certain leading steel plants, where modern, continuous hot-strip, sheet rolling mills are being installed—at the Ebbw Vale works of the Richard Thomas & Co., in South Wales, and at Shotton, Cheshire, where the United Steel Co. and John Summers & Sons are to erect a continuous sheet mill plant equipped for mechanical mass production. The Ebbw Vale plant will include two blast furnaces, each of 500 tons daily capacity, and will have an annual capacity of 600,000 tons of finished and semifinished steel products. It is to be completed in June 1939. The new plant at Shotton will be of similar size, and its construction will be started soon.

PRINCIPAL BRITISH IRON AND STEEL COMPANIES

According to estimates of the Import Duties Advisory Committee capital investment in the iron and steel industry in July 1937 was 126,700,000 pounds sterling.

Eighty percent of this investment is represented by 16 companies whose capitalization, holdings, and dividends are as follows:

Name of company	Headquarters	Capitalization issued	Dividends	
			Year	Percent
United Steel Cos., Ltd.....	Sheffield.....	£8,821,820	1937	8½
Dorman Long & Co., Ltd.....	Middlesbrough.....	5,615,243	1937	10
Baldwins, Ltd.....	London.....	4,582,008	1936	10
Guest, Keen, Baldwins Iron & Steel Co., Ltd.....	Port Talbot.....	4,976,758	1936	2½
Guest, Keen & Nettlefolds, Ltd.....	Smethwick.....	12,969,107	1937	6
Colvilles, Ltd.....	Glasgow.....	5,919,550	1936	7
Cargo Fleet Iron Co., Ltd.....	Middlesbrough.....	1,000,000	1937	5
South Durham Steel & Iron Co., Ltd.....	do.....	1,237,820	1937	13
Consett Iron Co., Ltd.....	Durham.....	3,300,000	1937	7½
Lancashire Steel Corporation.....	Warrington.....	5,650,676	1937	2½
Stewarts & Lloyds, Ltd.....	Glasgow.....	7,370,275	1936	7½
Richard Thomas & Co., Ltd.....	London.....	7,495,346	1936	5
English Steel Corporation, Ltd.....	Sheffield.....	3,300,000	-----	-----
Vickers-Armstrongs, Ltd.....	-----	17,464,251	-----	-----
John Summers & Sons, Ltd.....	Chester.....	3,711,815	1936	6
William Dixon, Ltd.....	Glasgow.....	956,000	1936	2½

¹ B ordinary.

² Recent ordinary.

NOTE.—The above information has been taken from the Stock Exchange Official Year Book, 1938, and Ryland's Directory, 1938.

GOVERNMENT ORGANIZATIONS

The Government organizations from which the iron and steel industry receives help are the following:

The Import Duties Advisory Board, which helps in questions of protective tariffs on iron and steel products.

The Department of Scientific and Industrial Research and the National Physical Laboratories, which do for the iron and steel industries in Great Britain what the American Bureau of Mines and its experiment stations are doing in the United States.

The Fuel Research Board, which assists the iron and steel industry in making field surveys and analysis for coal.

The Board of Trade, which corresponds in a way to the United States Department of Commerce, as it helps the industry in its domestic and foreign trade.

There is also the Secretary of Mines, an office concerned primarily with safety in coal mines, but its inspectors are also detailed to supervise safety in the iron mines.

INDUSTRIAL ORGANIZATIONS

The organizations supported by the iron and steel industry are the following:

The British Iron and Steel Federation, which is by far the largest organization representing the industry as a whole in legislative matters connected with the Government and with the International Export Agreement. It has been a great help in rationalizing the industry, and with branches in all important steel-producing centers it has an

indirect influence on the Government. It issues an annual statistical report on the iron and steel industries of Great Britain and the other important steel-producing countries.

The British Iron & Steel Corporation, a limited company, which finances imports and exports of steel and controls large funds for imports of iron ore, scrap iron, and other materials. Export sales are pooled with this corporation.

The British Iron and Steel Research Council and the British Cast Iron Research Association are research bodies controlled by the British Iron and Steel Federation and aided by the Iron and Steel Institute. These are supported largely by the industry but partly by state contributions; the total expenditure for research work amounts to about \$600,000 a year.

The Iron and Steel Institute, which is a technical clearing organization supported by membership dues, holds periodical meetings. It publishes monthly proceedings and an annual report with papers on new technical developments and on the general progress in the industry.

The Iron and Steel Trade Employers' Federation, which represents the employers on all questions with labor, such as wages and hours of work. It is supported by a levy on tonnage produced.

The Iron and Steel Trade Confederation represents the labor unions on questions of wages, hours, and other matters with the employers. It is supported by dues from the workmen.

LABOR

The total number of workmen employed at the iron mines in 1937 was 10,012, and the average output per man-shift was 4 tons. At the blast furnaces, steel plants, and rolling mills 155,342 workmen in all were employed in 1937. The average annual wage of the workmen was £189 (\$888), the weekly pay ranging from \$12 to \$20. During the last quarter of 1938 average wages were \$17.60 per week. The average wages in Germany are about \$10 a week and in the United States \$28 a week.

The success of the iron and steel industry of Great Britain in its relations with the workmen has been based upon the acceptance of certain fundamental conditions, as follows:

1. The unqualified acceptance of trade-union organization as the basis of joint machinery of collective bargaining and the exercise by the trade union and employers' representatives of plenary powers in the conduct of negotiations.
2. Recognition of the sanctity of agreements and their full observance, and the unqualified acceptance by the parties of decisions secured by the means and methods mutually adopted.
3. Maintenance of rates of wages fixed in relation to ascertained conditions unless the working conditions are changed, and then revised only by the process of negotiation and mutual arrangement.

A factor contributory to avoidance of friction is no doubt the general practice of governing wages, over and above the standard rates, by a sliding-scale system of automatic regulation based upon the selling price of the various classes of material produced. This selling price is ascertained over bimonthly or quarterly periods by examination of employers' books by reputable accountants jointly engaged and paid by employers' and workers' organizations.

Hours of labor, fixed by agreement at 8 per shift, are being reduced to meet the conditions of more intensive mechanization, and holidays with pay recently have been adopted by mutual agreement in important sections of the industry and soon will be generally applied.

The workers are taking pride in the accomplishments of the mines or plants where they work and are beginning to recognize the importance of a prosperous iron and steel industry to the economic well-being of the country and to the vital issues of peace and war.

The average number of workmen employed at the blast furnaces, steel plants, and rolling mills and their wages in 1932, 1935, and 1937 were as follows:

Year	Workmen	Total wages ¹	Average per year ¹
1932-----	82,026	£11,538,778	£141
1935-----	115,596	18,787,839	163
1937-----	155,342	29,409,482	189

¹ Exchange rate, \$4.70 for £1 sterling.)

CZECHOSLOVAKIA

GENERAL STATEMENT

When Czechoslovakia became an independent State in 1918, the coal, steel, and other mineral industries were owned principally by stock companies and individuals and were largely under the control of foreign capital. During the years following the World War, certain companies were refinanced through Czechoslovak banks, and gradually domestic financial control was established. In recent years a special effort was made through the banks to acquire the foreign-owned shares in domestic mining and metallurgical industries in exchange for foreign securities held in Czechoslovakia. Until the partition of this country in October 1938 it was estimated that the iron and steel, coal, magnesite, and other mineral industries were 70 to 90 percent owned by Czechoslovak citizens.

Czechoslovakia has been by no means self-sufficient, even for the raw mineral products required for the iron and steel industries. It has depended for imports on the rich iron ores of Sweden and Yugoslavia, scrap iron from Belgium, United States, and the Baltic States, coke from Poland, and manganese from Russia and South Africa.

The large reserves of coking coal, together with the iron and manganese mines plus imports and plenty of skilled labor, have constituted the basis of the steel industry in Czechoslovakia. Machinery, tools, and armament are among the most important Czechoslovak export products.

The output of steel products in 1937 totaled 2,317,000 tons as against 2,080,000 tons in 1929. Export sales of iron and steel products in 1937 amounted to 479,281 tons valued at Kč. 1,820,338,000 (\$63,584,406.34) as compared with 658,000 tons valued at Kč. 1,803,787,000 (\$63,006,279.91) in 1929, the maximum year. Russia, Holland, and Sweden were the principal importers in 1937.

Production and consumption statistics for Czechoslovakia, 1929, 1932, and 1935-38

[In thousands of metric tons]

	1929	1932	1935	1936	1937	1938
Iron ore:						
Production.....	1,807	602	731	1,090	1,740	(¹)
Consumption.....	3,096	703	1,198	1,571	3,150	(¹)
Pig iron:						
Production.....	1,645	450	810	1,140	1,675	1,233
Consumption.....	1,438	463	822	1,157	1,705	1,259
Scrap iron: Imports.....	279	21	51	79	250	(¹)
Raw steel:						
Production.....	2,080	683	1,196	1,560	2,317	1,764
Consumption.....					2,304	(¹)
Coke:						
Production.....	3,163	1,277	1,551	1,955	3,297	(¹)
Consumption.....	2,665	1,229	1,356	1,665	2,529	(¹)

¹ Data not available.

The consumption figures are obtained by adding net imports to production and subtracting net exports.

In 1937 about one-third of the iron required for the above steel output was derived from domestic iron mines, one-half from imported ores, and one-sixth from imported scrap iron and pig iron. Of the 1,500,000 tons of iron ore imported 850,000 tons came from Sweden. Imports of scrap iron in 1937 were largely from the United States.

There was a notable decrease in the production of steel ingots during 1938, but the influx of orders for armament, railway supplies, and machinery was well-maintained during the first three quarters.

TERRITORIAL CHANGES

With the transfer of the Sudeten areas to Germany, Czechoslovakia lost about 93 percent of its lignite deposits as well as portions of the Teschen-Schatzler and Plzeň coal fields, comprising about 54 percent of the former production.

Even more serious to her industries was the territorial transfer to Poland of 1,300 square kilometers of highly industrialized, densely populated areas of the Olza district. This includes the Ostrava-Karwina coal field, with its high-quality coking coal, which forms the southern part of the Upper Silesia coal basin described under Poland. Metallurgical coke produced in the Karwina region was in recent years imported by Poland from Czechoslovakia, and during 1937 imports amounted to 52,000 tons valued at 2,000,000 zlotys (\$378,000). The quality of the Karwina coke renders it extremely valuable for steel production. Centers of the iron and steel industry—namely, Trzyniec, Bogumin, and Piotrowice—are also included in this area, and it is estimated that 23 percent of Czechoslovakia's total blast furnace capacity and 30 percent of the steel-mill capacity were lost by this recent assignment of Czechoslovak territory to Poland.

On March 15, 1939, Germany seized the Provinces of Bohemia, Moravia, and Slovakia while Hungary acquired Ruthenia; in consequence, the Czechoslovak Republic as such has been completely destroyed.

IRON-MINING DISTRICTS

There are two iron-mining districts in Czechoslovakia. One district is in Bohemia near Nucice and Beroun west of Prague, where deposits of limonite and hematite ore occur in the Silurian slates and

limestones. As a rule these deposits are found in synclinal folds, considerably faulted, and the beds of iron ore are up to 50 feet in thickness. The ore is mined by shafts and underground workings. The ore averages 37 percent iron, 12 percent silica, and 0.5 to 1.5 percent phosphorus. Roasting increases its iron content to 44 percent. Because of the high silica content of these ores, basic iron ores are imported to mix with them in the blast furnaces. The iron ore reserves of these deposits are estimated at 25,000,000 tons.

The other iron-mining district is in Slovakia west of Kosice, where several mines are producing a siderite ore containing 32 to 38 percent iron, 6 to 10 percent silica, and 2 to 4 percent manganese, which is increased to 50 percent iron content by roasting. These deposits occur in a mineralized zone about 6 miles in length in the Alpine Paleozoic rock series. The siderite veins are 3 to 100 feet wide, and they are mined from shafts 150 to 900 feet deep. The reserves of developed and probable ore are estimated at 8,000,000 tons. Of interest is the occurrence in these deposits of tetrahedrite, a mercury-bearing mineral from which a notable amount of mercury is recovered. In 1937 the output of iron ore from these Slovak mines was increased from 540,000 to nearly a million tons by reopening of the mines at Bindt near Hnilčík, which had been closed in 1932, and by increased activity at the mines of the Rimamurany Co.

Difficulty in obtaining supplies of Swedish ore, which is transported by boat up the Oder River, is the main cause of greater interest in the development of lower-grade domestic deposits.

The Bohemian mines are owned and operated by the Prague Iron & Steel Co., and the ores are smelted in their local blast furnaces. The mines in Slovakia are owned and operated by the Rimamurany-Salgotarjaner Eisenwerks A. G., and the ore is shipped to the blast furnaces at Vitkovice, about 125 miles to the northwest.

Besides the ore reserves indicated in the foregoing table there are also large tonnages of highly siliceous iron ore in Czechoslovakia whose value is questionable.

MANGANESE ORE

One of the principal manganese mines is that operated by the Vitkovice Mines, Steel & Iron Works Corporation at Kisovec near Poprad, Slovakia. Here a flat-lying bed of manganese ore about 3 feet thick occurs in the Tertiary shale and is being mined through adits. The ore mined averages 20 percent manganese and 3 percent iron. It is transported by a ropeway 7,000 feet long to Svalovce and thence by rail to Vitkovice, where ferromanganese containing 60 to 70 percent manganese is produced.

Another important manganese mine, owned by the Berg-und Hütten A. G., is at Chvaletice in East Bohemia. Here irregular masses of manganese ore occur and contain 12 to 14 percent manganese, 17 percent iron, about 20 percent silica, and 2 percent phosphorus.

The manganese ore derived from domestic sources averages 17 percent and the imported ores 42 percent manganese.

Manganese production, import and consumption statistics for Czechoslovakia, 1929 and 1934-38

[In thousands of metric tons]

	1929	1934	1935	1936	1937	1938
Production.....	96	59	71	93	106	(¹)
Imports.....	27.7	16	54	55	77.7	(¹)
Consumption.....	123.7	75	125	148	183.7	(¹)

¹ Data not available.

Of the 1937 imports, 31,862 tons came from Russia, 16,494 tons from British Africa, 13,337 tons from Egypt, and 7,353 tons from Brazil.

IRON AND STEEL PLANTS

There are 7 iron-smelting works in Czechoslovakia; they have a total of 21 blast furnaces of 100 to 600 tons capacity each and average about 300 tons daily capacity. In 1937, 6 smelting works and 17 blast furnaces were in operation, the total output of pig iron being 1,675,000 tons compared with 1,645,000 tons in 1929. In Bohemia the plants use the local iron ores with some imported ores and obtain the coke from Silesia and abroad. In 1937 about 26 percent of the total iron and steel output of Czechoslovakia was from the Prague district. The iron and steel plants at Vitkovice in the Ostrava Basin of Moravia depend on the local production of an excellent coking coal and the facility of importing Swedish iron ore by boat up the Oder River. These imports total 80 percent of the ore consumed, the other 20 percent coming from the Kosice district in Slovakia. In 1937 about 69 percent of the total iron and steel output of Czechoslovakia was made at the iron and steel works in and near the Ostrava Basin. About one-third of these iron and steel works were transferred to Poland.

For the production of mild steel, there are 60 open-hearth furnaces (15 acid and 45 basic) having 5 to 200 tons capacity and averaging about 50 tons daily, besides 7 small converters and 12 electric furnaces having 5 to 15 tons daily capacity. Eighty percent of the steel is produced by the basic Martin process.

IRON AND STEEL COMPANIES

Of the total capital invested in the iron and steel industries before partition of Czechoslovakia it is estimated that 70 percent was Czechoslovak and 20 percent divided between French and English ownership. In October 1938 Poland acquired the Czechoslovakia Mining & Iron Works Co., of Trinec. This company had coal mines, iron and steel plants, rolling mills, and wire and chain plants in the Ostrava district and employed 20,000 workmen. It was the second largest company in Czechoslovakia.

The biggest iron- and steel-producing company is the Vitkovice Mines, Steel & Iron Works Corporation, with a capitalization of Kč. 600,000,000 (\$22,000,000), which is controlled by the British-Alliance Assurance Co., Ltd., of London. Besides the large steel works at Vitkovice this company owns coal mines, coking ovens, and iron mines in Moravia. Its manufacturing plants produce all kinds

of finished machines and plants, including boilers, bridges, rolling mills, and mining machinery. In all, 35,000 workmen are employed.

Next in importance is the Prague Iron Co., controlled almost entirely by Czechoslovak capital, with mines and steel plants in the vicinity of Prague and Plzeň. Starting with a small blast-furnace plant at Kladno 80 years ago and using local iron ore and coal, this company has built up large steel plants and is now the principal producer of iron ore, coal, and pig iron in the district. It also produces large quantities of Thomas slag for fertilizers. About 13,000 workmen are employed.

Another iron- and steel-producing company is the State Iron & Steel Works at Podbresova, Slovakia, formerly owned by the Hungarian State and now a Czechoslovak State company under the control of the Ministry of Public Works in Prague. During the first years after the World War steps were taken to modernize the plants; they now comprise a blast furnace at Tisovec, steel foundry, rolling mills, and pipe factory at Podbrezova, and a foundry and enameling plant at Hronec. The iron mines at Nadabula and Zeleznik in Slovakia are also operated by this State company.

There are a number of steel-manufacturing companies in Czechoslovakia, the oldest and most renowned being the Skoda Works, Ltd., which is controlled by the French Schneider-Creusot Concern, although the management is Czechoslovak. Its capitalization is Kč. 200,000,000 (\$6,500,000), and its holdings include iron and coal mines, steel works, foundries, and rolling mills for the most part near Prague; these manufacture locomotives, motorcars, airplanes, munitions, various small engines, and machine tools. There are also electrical engineering works at Brno and shipbuilding yards at Komarno. Since its incorporation in 1899 the Skoda concern has absorbed many smaller companies, and its success has been due largely to economies in the centralization of administration, standardization of products, and cooperation with the Government. The total number of workmen employed is about 35,000.

The Poldi steel works is also situated near Prague, at Kladno and Chomutvo. During the World War these plants produced large quantities of armament and have since then confined production largely to high-grade steel products. About 4,000 workmen are employed, and the company is capitalized at Kč. 125,000,000 (\$4,400,000) and is essentially Czechoslovak in control.

CENTRAL SALES ORGANIZATIONS

The larger steel manufacturers in Czechoslovakia have a central sales organization known as the Vereinigten Tschechoslowakischer Eisenwerke, with headquarters in Prague, for most of their domestic and export sales. This is in turn affiliated with the International Steel Agreement for its foreign trade in most of the finished steel products, such as (1) joists and channels, (2) bars and sections, and (3) flats and plates over one-eighth inch thick. For the sale of tubes and pipes there is the Evidenzburo Rohrenwalzwerke, and for wire and rods the Centralburo Tschechoslowakischer Draht und Drahtstift Fabriken, which are also members of the International Steel Sales Organizations for their export trade. The fixing of quotas and the control of exports through these sales organizations or "comptoirs" are centered in the International Steel Agreement of Luxemburg.

GOVERNMENT CONTROL AND PARTICIPATION

As a result of unfavorable conditions after the World War, the new Czechoslovak state was confronted with the necessity for economic and social reorganization among the mining and metallurgical industries and their workers. This was carried out by the Ministry of Public Works. Most of these industries could establish satisfactory operating relations with the new Government and reorganize international trade relations. Certain industries formerly operated by the State, such as the lead-silver and radium mines, naturally had to be continued under the State. Coal and iron mines, as well as steel plants, that could not maintain operations had to be taken over by the State in order that unemployment would not be increased. Thus the Ministry of Public Works not only has the general inspection of all mining and metallurgical operations in Czechoslovakia but is part owner and operator of coal, iron, silver-lead, gold, and other mines. Since October 1938 its ownership in the mines and plants within the territories transferred to Germany, Poland, and Hungary has been lost, and since March 1939 all these industries have passed under German control except those in Ruthenia, which are now controlled by Hungary.

WORKMEN'S CORPORATIONS OR UNIONS

In Czechoslovakia, workmen's unions in the mining and metallurgical industries are unimportant. Strikes and lock-outs are the exception, and disputes are readily settled by arbitration.

One of the first enactments of the revolutionary National Assembly (December 19, 1919), was the introduction of an 8-hour day for most workers, with special provisions regarding night work as well as for the work of women and children.

A special Ministry of Social Welfare exists to handle social legislation, and for years social and unemployment insurance schemes and modern factory regulations have been operative.

In every mine or metallurgical plant with more than 20 employees the workers, according to the law, elect a work council (*zavodni rada*), which represents their interests in relation to the management of the enterprise. The main task of a work council is to intervene in disputes among workers and to mediate between workers and the management on wage and disciplinary questions. Members of work councils elect a workers' district council for every district as a higher body representing workers' interests. These workers' district councils must especially be notified and heard when laws concerning mining and metallurgical operations are in preparation or contemplation.

The miners' courts of arbitration are established in the centers of the most important districts. They consist in each instance of two representatives of employers, two representatives of employees, and a president who is a judge by profession. A representative of the office of the divisional inspector of mines and plants functions as technical adviser. The courts of arbitration pass decisions principally on complaints of workers in wage questions and on discharges.

Every employee of mines in Czechoslovakia is compulsorily insured against sickness, accident, old age, and invalidism. Contributions to the sickness insurance must not exceed 8 percent of average wages. The employer pays half of the contribution. Apart from this contri-

bution, there are special additional charges for the pension-insurance contribution established by Law 200 of 1936. These additional charges are paid entirely by the employer.

This entire set-up for labor probably will be changed to correspond with the labor organizations established in Germany.

RUMANIA

GENERAL STATEMENT

The Rumanian Government has taken greater interest in recent years in developing its heavy industries, and much progress has been made in the production of iron ore, pig iron, steel products, coal, and coke. As consumption of steel products for new construction, railways, and armament has also increased at a somewhat greater pace, Rumania is still just as dependent as before on imports of raw mineral products.

Rumanian production and consumption statistics, 1930, 1932, and 1935-38

[In thousands of metric tons]

	1930	1932	1935	1936 ¹	1937 ¹	1938
Iron ore:						
Production.....	92	8	93	108	129	(2)
Consumption.....	114	8	130	197	227	(2)
Manganese ore:						
Production.....	34	5	20	34	51	(2)
Consumption.....	7	2	6			(2)
Pig iron:						
Production.....	69	9	82	97	127	(2)
Consumption.....	77	12	89	103	134	(2)
Raw steel:						
Production.....	157	106	206	226	242	(2)
Consumption.....	227	140	200	327	317	(2)
Metallurgical coke:						
Production.....			44	61	63	(2)
Consumption.....			89	100		(2)

¹ Statistics for 1936-37 obtained from the Ministry of National Economy.

² Data not available.

The recovery of the industry from the depression level of 1932 has been promoted by large Government orders for railway equipment and armament and by demands of construction industries. Technical improvements in certain branches of metallurgical operations and import restrictions that have helped to eliminate foreign competition in the domestic market likewise have contributed to the progress made by the iron and steel industry. Notable capital combinations, particularly with Czechoslovak companies, for the expansion of the iron and steel industry of Rumania have been accomplished in recent years, and through these combined efforts much progress has been made. During the last few years the heavy industries have been freed from import-permit requirements for most raw materials, as well as from duties on industrial machinery; this relaxation of the Government attitude has been a big help to encourage investment in new plants. An agreement reached in 1937 between Rumania and Germany provided for supplying iron and steel plants in Rumania by Germany at the cost of approximately 25 million R.M. to R. I. M. M. A. (State Mining and Metallurgical Enterprises of Transylvania).

IRON-MINING DISTRICTS

Iron ores are not mined extensively in Rumania; and although production is increasing annually, domestic mines contribute only 15 percent of the iron requirements for the steel industry, the balance coming largely from imports of ore, scrap pig iron, and steel and domestic scrap. The most important iron ore mines are the Ghelar and Veda Dobril in the region of Hunedoara, which are State-owned and provide over half of the total iron ore production of the country. Next in importance are the Teliuc mines, owned by the "Titan-Nadrag-Calan" Co., which supply 30 percent of the iron ore, and the Ocna de Fier mines in the Caras district, which furnish about 10 percent of the total output. The iron ore bodies in the Hunedoara district are now being extensively developed. These deposits consist of siderite altered to limonite near the surface and generally are several hundred feet wide and a few thousand feet long. The grade of ore mined ranges from 36 percent for siderite ores to 48 percent for limonite ores.

Iron ore reserves have been estimated as 26 million tons of known and probable ore averaging about 40-percent iron content; the ore is largely siderite and limonite, with a relatively small percentage of magnetite and hematite.

Imports of iron ore are largely from Yugoslavia, the transport charges being low due to the short haul to the Resida works near the Yugoslav frontier.

MANGANESE ORE

The production of manganese has been principally from the Terezia mine in Bukovina and important deposits also occur in the communes of Jacobeni and Vatra Dornei in the region of Bistrita Aurii Mountains. The deposits are small, occurring as irregular masses or as narrow beds in schists and limestones. The principal ore is pyrolusite, and the average grade is 36 percent manganese. There are deposits of manganiferous iron ore ranging from 13 to 26 percent manganese in the commune of Delinesti in the Caras district.

Total reserves of manganese ores have been estimated at 9 million tons. Domestic production not only provides for internal requirements, amounting to about 10,000 tons a year, but in 1937 furnished about 40,000 tons for export to Belgium, France, and Poland.

PIG IRON

Rumania has 10 blast furnaces with a total annual capacity of 260,000 tons, which is more than adequate to supply domestic demands. Small quantities of special products, such as ferromanganese, ferromnickel, ferrosilicon, and ferrophosphorus, are imported for the manufacture of certain grades of steel. Pig iron is imported from Germany and Czechoslovakia, while imports of scrap iron are largely from the United States.

STEEL

The Resita and Ferdinand and newly completed Malaxa steel plants, as well as the R. I. M. M. A. steel mills now under construction, will be able to supply almost the entire Rumanian demand for raw steel when the latter is completed.

The rolling-mill capacity approximates 340,000 tons of rods, bars, and rail and about 70,000 tons of sheets.

Raw steel is imported from Hungary, Germany, and France.

METALLURGICAL COKE

The coal production in Rumania, three-fourths of which is lignite and one-fourth bituminous coal, is more than adequate for domestic needs; but the output of metallurgical coke, although insufficient, is being increased rapidly each year and may soon meet consumption demands. The Resita Iron & Steel Co. is the principal producer.

IRON AND STEEL COMPANIES

Rumania's principal iron and steel companies and their capitalization are as follows:

<i>Rumanian iron and steel companies</i>		<i>Capitalization (lei) ¹</i>
Name of company:		
Resita, S. A., 4 Strada Vasile Alexandri, Bucharest-----		1, 000, 000, 000
Titan, Nadrag, Calan, 3 Strada Clemenceau, Bucharest----		400, 000, 000
Fabrica de Locomotive N. Malaxa, 19 Strada Dionisie, Bucharest-----		400, 000, 000
R. I. M. M. A., 5 Strada Bursei, Bucharest-----		362, 000, 000
Astra-Vagoane, 4 Strada Povernei, Bucharest-----		420, 000, 000

¹ 1 lei=0.7204 cent.

It was not possible to obtain reliable information on the national ownership or control of Rumanian steel mills.

FOREIGN TRADE

Rumania's exports are under control of the National Export Institute, and through this control a system of compensation trade has been established. These export products include manganese ore, pyrite, marble, and kaolin, as well as petroleum products, the basis of Rumania's export trade.

To assure a quantity of foreign exchange adequate to pay for imports a High Commission for Import Quotas was established in 1932. Import quotas are determined by the inability of consumers to acquire a product from domestic sources and available foreign exchange. Such necessary products as iron ore, scrap iron, special steels, semimanufactured steel, and metallurgical coke are exempted from the import quotas.

STATE CONTROL OF INDUSTRY

Since the economic crisis of 1930 the Ministry of Industry and Commerce has expanded its functions with increasing powers in accordance with the interests of the nation. Under it is the Department for the Valorization of State Wealth, which includes the R. I. M. M. A. Co. or State Mining and Metallurgical Enterprises in Ardeal (Transylvania). The field of activity of the R. I. M. M. A. includes iron, manganese, and other metal mines, also iron foundries and steel-manufacturing plants. It is an attempt to give Rumania greater industrial and economic independence. In the Hunedoara district this company owns five blast furnaces with a capacity of 150,000 tons of iron ore, as well as steel foundries and rolling mills for the

production of various siderurgical products. This company in 1937 obtained a German credit of 20,000,000 R.M. for the erection of a steel plant including rolling mills and an additional loan of 5,000,000 R.M. for an installation to process iron in exchange for petroleum and manufactured products.

Rumania has issued certain decrees and is studying others by which the State will have greater control of both industry and labor through an organization set-up resembling that of the Italian Corporate State.

In April 1938 a Superior Economic Council was organized having the following duties:

- (1) To establish plans for the rationalization of Rumanian industries and to coordinate general economic policy.
- (2) To propose to the Government measures for the improvement of the economic condition of the country.
- (3) To give advice on economic and financial projects of law.
- (4) To give consultative opinions on draft conventions, treaties and accords of an economic, financial and social character when its opinion is solicited by the respective ministers or commissions.
- (5) To give advice on economic, financial, and social problems when so requested by the Presidency of the Council of Ministers.

The membership of the council consists of 15 ex-officio members (including ministers of Government departments of an economic or social character), and 15 permanent members, plus a president, who are named for 5-year terms by royal decree.

In July 1938 this council issued an official statement indicating that its future policy was to favor giving private initiative as much freedom as possible but to supervise it and control it when necessary for the public good.

There is also a Superior Council on Cartels to advise the Ministry of National Economy as to decisions to be made and laws to be applied. It is believed that these constitutional innovations are designed to assure normal development in the mining industries and to encourage private initiative.

LABOR

After a series of strikes in 1935 the State intervened, establishing chambers of commerce and industry in all industrial centers in April 1936 for the benefit of operators and creating chambers of labor to uphold the interests of the workmen in October of that year. The organization of these chambers is an attempt to bring industry and labor more under Government control, so that these forces may be used more efficiently in building up the industrial strength and productive capacity of the nation.

Since 1935 collective labor contracts in the mining industries have shown a large increase, with working hours ranging from 36 to 48 hours a week and wages from 25 to 60 lei (18 to 42 cents) a day for unskilled and 60 to 140 lei (42 to 98 cents) a day for skilled workers.

POLAND

GENERAL STATEMENT

The development of Poland's iron and steel industries is based on large reserves of coking coal, extensive reserves of iron ores in the vicinity of coal mines in the southwestern part of the country, and a plentiful supply of labor. Although partly dependent on foreign high-grade ore imports coming mainly from Sweden and Morocco, the productive capacity of the foundries exceeds domestic requirements,

consequently a substantial part of the production, chiefly rolling-mill products, is exported.

The heavy industries of Poland center in its southwest corner, between Czystochowa and Katowice. Activities in this district were at a maximum during the years just before the World War and again, to a somewhat smaller degree, in 1929 when the production of pig iron and steel was about 75 percent that of 1913. In the ensuing years production dropped sharply as a result of the depression, but since 1935 a gradual recovery has been evident.

Poland production and consumption statistics, 1929, 1932, and 1935-38

[In thousandths of metric tons]

	1929	1932	1935	1936	1937	1938
Iron ore:						
Production.....	659	77	332	468	776	(1)
Consumption.....	1,170	142	576	866	1,330	(1)
Pig iron:						
Production.....	704	199	394	584	724	980
Consumption.....	540	201	388	577	600	975
Raw steel:						
Production.....	1,377	551	945	1,141	1,443	1,549
Consumption.....	1,153	415	722	900	1,160	(1)
Coke:						
Production.....	1,858	1,091	1,387	1,616	2,126	(1)
Consumption.....	1,640	934	1,140	1,343	1,742	(1)
Scrap iron: Imports.....	516	123	360	451	643	426
Ferromanganese.....			8.2	8.3	11.3	(1)

¹ Data not available.

The consumption figures are obtained by adding net imports to production or subtracting net exports from production.

Poland imports about as much iron ore as is produced and exports one-fourth of her raw steel output and about one-fifth of her coke production.

Poland's own deposits of iron ores consist chiefly of low-content siderite ores, and it is for this reason that imports are comparatively large. As the Government policy is to reduce foreign imports, special emphasis recently has been placed on increased exploitation of the local iron ore deposits, and a decree was passed in April 1938 providing for tax exemptions on new mining and industrial activities. Iron ore is at present being mined at the rate of 800,000 tons a year, while annual consumption is about 1,400,000 tons. Besides the iron ore Poland's steel industry consumes annually about 600,000 tons of scrap iron, and 11,000 tons of ferromanganese, nearly all of which is imported.

Poland is essentially an agricultural country. The population, sixth in Europe and totaling 35,000,000, is classified as follows: Agriculture 64 percent, industry 15 percent, trade 6 percent, communications 3 percent, and other occupations 12 percent. Living standards are extremely low, especially in the largest occupational group, the peasants, with the result that the per capita consumption of industrial products is very small. Since 1934, however, as a result of certain far-reaching measures inaugurated by the Government, the domestic consumption of mineral products has increased steadily.

TERRITORIAL ACQUISITION

Of great importance to Poland's national economy is the absorption of the coal and iron mines and the steel plants within the Trans-Olzan area, recently acquired from Czechoslovakia.

The Olza district (that is, the former Czechoslovak communes of Cieszyn, Frysztat, and a part of the commune of Frydek) lies on the

northwest fringe of the West Beskid Mountains and to the west of the Olza River. On October 2, 1938, the Polish military and civil authorities formally took over from the Czechoslovak Government the first zone of Cieszyn and in the course of the next 9 days completed occupation of the district by stages. The final frontier is still in process of determination by a delimitation commission. It is, however, anticipated that, except for slight changes to straighten the boundary, the frontier of November 1, 1938, will stand and that such changes will not involve important territorial modifications or affect coal production. The new Polish district comprises an area of approximately 1,300 square kilometers which, by the census of 1930, supports a population of some 343,000. It includes more than half of the Ostrawa-Karwina coal field, which is itself a continuation of the great Silesia Basin.

The importance of this area is indicated by the coal output of about 10 million tons in 1937 compared with a total Polish production of 36 million tons.

Foundry coke produced in the Karwina region was in recent years imported from Czechoslovakia by Poland, and during 1937 imports totaled 52,000 tons valued at over 2,000,000 zlotys (\$378,000). The quality of the Karwina coke is such as to render it extremely valuable for steel production.

The Olzan district also includes the Schneider-Creusot works at Trzyniec, one of the largest in Central Europe; it employs 5,500 workmen and was operated by the Czechoslovak Mining & Iron Works Co., according to reports. This addition will increase Poland's pig iron production by 500,000 tons or 55 percent and her steel output by 750,000 tons or 50 percent, thus satisfying Poland's most pressing needs for national defense.

IRON-MINING DISTRICTS

There are four iron ore districts, (1) the Czestochowa-Wielun area adjacent to the German border, (2) the Kielce-Radom area, (3) the scattered deposits of limonite in Silesia, and (4) the Olzan district.

The Czestochowa district extends from Wielun to the north beyond Zawiercie to the southwest. Here beds of siderite 1 to 2 feet thick and averaging about 30 percent iron content are mined. It is estimated that there are 82 million tons of minable ore in the area; annual production is 300,000 to 400,000 tons.

The principal iron ore deposits in the Kielce-Radom area consist of beds of siderite 10 to 25 inches thick averaging about 28-percent iron content. There are lower and upper zones, each with several beds of siderite. The iron ore reserves are estimated at 60,000,000 tons, and 50,000 to 100,000 tons is mined per year.

In the third area (Silesia) deposits of limonite occur as surface pockets, often of large dimensions. Because of their irregularity, they are difficult to explore, but have the advantage of containing 40 to 45 percent iron and are close to the points of consumption. It is difficult to make any estimate of ore reserves, but they are believed to be about 7,000,000 tons; 15,000 to 30,000 tons is mined per year.

In the newly acquired Olzan district, the iron mines are situated in the immediate neighborhood of Trzyniec. Their annual output is about 150,000 tons, containing 30 percent iron.

The extent and future importance of areas with low-grade oolitic iron ores are being investigated, and in case of extreme need these may also be used as a source of iron supply.

The iron ores are extracted by mechanized surface and underground mining methods, but as the deposits usually are narrow the output per man-shift is low. Siderite ores are roasted in furnaces installed at the mines, while fine ores are subjected to sintering processes.

COAL FIELDS

The principal coal fields in Poland in Upper Silesia are an extension of the German coal field in the same basin. Only a small portion of the coal produced is of coking quality. Production, however, more than supplies domestic requirements, and about 35 percent is exported. These coal fields are described in Bulletin 414 of the Bureau of Mines and in Supplement 5 of Mineral Trade Notes.

IRON AND STEEL INDUSTRY

Polish steel production is based both on pig iron and on scrap iron, but since local supplies of the latter are virtually negligible, Poland annually imports about 600,000 metric tons of scrap valued at \$16,000,000 from Belgium, Germany, France, and the United States. This situation has caused concern to the Government for several years, and especial effort is being made to render steel production independent of foreign raw materials.

At the end of 1937, 15 blast furnaces with an average annual capacity of 720,000 tons were in operation. New investments recently made at a cost of \$4,000,000 include five large blast furnaces, and these will raise productive capacity 30 percent. Poland depends entirely on imports for manganese ore and other alloy metals. Poland imports about 80,000 tons of manganese ore and exports about 12,000 tons of ferromanganese. The tonnage of chromium and tungsten ore imported in recent years has averaged about 150 tons a year. The sources of Poland's chromite are British India and China and of tungsten (metal and alloys) Great Britain, Sweden, and Germany.

The principal iron-mining and steel-manufacturing companies and their capitalization are as follows:

<i>Polish iron and steel companies</i>	
Name of company:	Capitalization (zlotys) ¹
Katowicka Spolka Akcyjna dla Gornictwa i Hutnictwa, Kosciuszki 3, Katowice	100, 300, 000
Gornoslaskie Zjednoczone Huty Krolewska i Laura, S. A., Kosciuszki 30, Katowice	84, 000, 000
Slaskie Zaklady Gorniczo-Hutnicze "Huta Pokoj", S. A., Zamkowa 3, Katowice	50, 000, 000
Towarzystwo Starachowickich Zakladow Gorniczych, S. A., Starachowice	27, 000, 000
Spolka Akcyjna Wielkich Piecow i Zakladow Ostrowieckich, S. A., Al. Ujazdowskie 51, Warsaw	20, 000, 000
Towarzystwo Sosnowieckich Fabryk Rur i Zelaza, S. A., Moniuszki 10, Warsaw	20, 000, 000
Modrzewow-Hantke, Zjednoczone Zaklady Gornicze i Hutnicze, S. A., Srebrna 9, Warsaw	16, 000, 000
Tow. Akcyjne Zakladow Hutniczych "Huta Bankowa" w Dabrowie Gorniczej, Pierackiego 11, Warsaw	15, 000, 000

¹ 1 zloty = \$0.189.

FOREIGN TRADE

All export sales of steel products from Poland are made through the respective international sales offices under the International Steel Agreement of Luxemburg. The Polish group of steel manufacturers signed these agreements in July 1935 and became full members of the sales comptoirs in January 1936. The agreements have been extended until December 31, 1940.

Although Poland has also large surpluses of coal, zinc, and potash her development as an exporter of mineral products has been handicapped by the economic conditions of neighboring nations, namely, the limited purchasing capacity of those to the west, including Germany, and the relatively low stage of industrialization of those to the northeast and east, including Russia. Outlets to the north are affected by competition from other exporting countries with a surplus of these same raw materials. Poland, however, is doing much to increase foreign trade, and the situation showed notable improvement in 1937; however, this was not maintained in 1938.

As a result of an abrupt drop in the favorable trade balance during 1935-36, the Polish Government resorted to a more stringent foreign trade policy and introduced foreign exchange restrictions and complete control over foreign trade. In an effort to become self-sufficient, Poland is restricting imports to essential raw materials; for this reason all imports are controlled severely by the Government, and virtually every item must be covered by an import permit, as well as by a foreign exchange permit to remit payment. Import permits covering articles falling within the "nonessential" category are much more difficult to procure from the Ministry of Industry and Commerce than for essential raw materials and machinery, which virtually are the only items allowed unhindered importation. The issuance of import permits is conditioned further by the quota system, which offers preferential treatment to goods (even in the less essential categories) imported from countries with which Poland has reciprocal quota, barter, or clearing arrangements. Arrangements of this kind are in force with most European countries but not with the United States. This obviously is an obstacle to American exporters of goods falling within the Polish classification of "nonessentials."

GOVERNMENT CONTROL

Administrative control of industries in Poland is exercised by the Mining-Smelting and Manufacturing Industries Departments of the Ministry of Industry and Commerce. Territorial control over coal, petroleum, iron, zinc, and lead production is discharged by three territorial mining offices and their respective subordinate district offices. The iron and steel producers are represented in this ministry under the specialty group for iron and steel.

Representation before the ministry on behalf of the industries is entrusted to an autonomous economic organization known as the Central Association of the Polish Industry, which includes all major production and manufacturing associations in the country. Although this organization is composed of and supported by the manufacturers, it actually has a quasi-official status, in that frequently it is called upon by the ministry to act in an advisory capacity and to handle such administrative matters as the ministry assigns to it.

As a rule, sales are effected by the sales organizations maintained by the major industrial groups of producers and individual companies and are subject to the dictates of the ministry only as regards general policy, prices, terms, and export bounties.

NEW MINING LAW

A presidential decree dated November 22, 1938, provides that the exploitation of new coal deposits throughout Poland and of iron, manganese, and other mineral deposits in specified sections of the Kielce, Olza, and Opatow districts be reserved for the State. The State also reserves for itself all unexplored mineral areas. The object of these provisions is to protect the interests of the State by forestalling speculation and competition by private interests in areas where exploration work is conducted by the Government. It does not necessarily follow that private capital will be eliminated from exploration of mining areas reserved for the State, as such areas may be leased from the Government provided that the private companies comply with its economic policy.

LABOR

In the important industrial centers labor is fully organized. These unions exercise considerable political pressure on the Government. At times, however, political aims overshadow economic considerations.

All disputes between employees and employers are subject to arbitration, in which the state casts the governing vote. Strikes or lock-outs are not allowed if Government pressure can prevent them. A strike or lock-out becomes illegal if in protest against the final decision of the higher arbitration court.

NATIONS WITH ADEQUATE OR SURPLUS IRON ORES

Of the European nations that produce a surplus of iron ore France is the greatest exporter, followed by Sweden and Spain; other countries exporting some iron ore are Norway, Greece, Bulgaria, and Yugoslavia. The entire output of the U. S. S. R. is required for domestic consumption.

FRANCE

GENERAL STATEMENT

In 1938 France produced 33,000,000 tons of iron ore, averaging just over 30 percent iron content; 15,500,000 tons were exported (9,100,000 tons to Belgium-Luxemburg, 5,900,000 tons to Germany, and 338,000 tons to United Kingdom). About 18,000,000 tons were consumed by the domestic iron and steel industries.

The iron and steel industry of France is concentrated largely in the Lorraine Basin west of the Moselle River, with large reserves of iron ore extending from the Belgian border to Nancy and coal fields at the German frontier east of Metz. In 1938, 93.6 percent of the iron ore production came from this basin, 4.7 percent from the iron mines in Normandie, and the balance from Anjou-Bretagne and the Pyrenees.

The blast furnaces and steel plants are also found in this border area divided into the Est I (comprising the Meurthe-et-Moselle, the Haute

Marne, and Ardennes areas), and the Est II (Moselle area). Of the total 1938 output these two districts produced 77 percent of the pig iron and 67 percent of the steel; next in importance is the Nord district, which produced 13 percent of the pig iron and 19 percent of the steel.

France receded from second place in 1931 to fifth place in 1938 as a producer of pig iron as well as steel. This was due partly to labor troubles during the summer of 1936; again in 1938 these were a serious handicap, but relations between labor and industry showed much improvement early in 1939. At that time, however, several steel-manufacturing firms were obliged to release workers and reduce working hours to 32 hours a week because of the lack of orders.

A new agreement was made with Germany in March 1938, against payment of coke from the Saar. This will help to maintain output at certain mines, but total exports will be less. Because of the serious situation within the steel industry the Comité des Forges, representing the industrialists, has placed its services at the disposal of the Ministry of National Defense to help solve the difficulties. Rising prices of steel in France also discourage the development of foreign markets.

The following table indicates the trend of iron-ore production since 1929:

French production of iron ore in 1929 and 1935-38

[In thousands of metric tons]

Iron ore	1929	1935	1936	1937	1938
Total production.....	50, 731	32, 046	33, 302	37, 772	33, 137
Number of workmen employed.....	40, 084	22, 550	23, 322	29, 254	30, 632
Production, by districts:					
Est I.....	26, 643	16, 734	17, 268	19, 783	17, 256
Est II.....	21, 355	13, 656	14, 155	15, 627	13, 773
Normandie.....	1, 885	1, 390	1, 581	1, 892	1, 589
Anjou-Bretagne.....	534	230	253	387	386
Pyrenees.....	235	22	27	51	109
Other France.....	79	14	18	32	24
French colonies:					
Algiers.....	2, 196	1, 675	1, 884	2, 334	3, 033
Tunis.....	973	503	722	957	822
French Morocco.....				67	266

In comparison with 1929 there has been an average decrease of about 35 percent in the annual output during the last 3 years distributed about equally in each district.

In 1938, 30,632 workmen were employed in the iron mines compared with 40,084 in 1929. Ninety-one percent worked in the Lorraine Basin, and of these 76 percent worked underground and 24 percent on the surface. In 1937 the average wage for underground labor was 54.15 francs (\$2.16) and for surface labor 40.08 francs (\$1.62) compared with 33.75 francs (\$2.03) for underground and 26.52 francs (\$1.60) for surface labor in 1935. The increase has been due to successive exactions by labor and is largely offset by increased living costs. The average output of iron ore per man-shift in 1937 was about 7 tons for underground labor and 5.2 tons for all labor.

IRON-MINING DISTRICTS

LORRAINE BASIN

This basin, where the well-known minette ores occur, is made up of sedimentary beds of limestone, sandstone, and shales dipping slightly southwest or west. The areas in which these beds are rich enough to mine are limited to the Briey-Longwy, Metz-Thionville, and Nancy Basins.

The ore-bearing area covers approximately 282,000 acres, the center being at Briey. Mining has extended to a depth of 570 feet but drilling has proved the ore to a depth of 3,000 feet. The minable ore beds range in width from 6 to 25 feet, and in certain areas several beds of iron ore have been distinguished by drilling operations. The iron ore beds are not always continuous and often form lenticular accumulations, or the ore is mixed with too much sand to be minable. Usually they are quite flat, faults are rare, and where they occur the displacement of the beds is only slight.

The ore is a hydrated oolitic hematite, gray to brown, red, and even blue in color, and it usually is not hard and often is earthy, with a water content of 8 to 10 percent. Two principal grades of ore are recognized: (1) The calcareous or basic ores, which are most prominent in the Briey and Thionville areas; and (2) the siliceous ores produced in the region of Longwy and in the Nancy basin. These ores vary widely in composition as follows:

Composition of Lorraine ores, in percent

	<i>Basic ores</i>	<i>Siliceous ores</i>
Iron-----	26-37	30-39
Lime-----	12-20	4-10
Silica-----	5-10	12-25
Alumina-----	2-10	5-10

The output of basic ore is over four times that of siliceous ore. The ore as mined averages 30 percent iron content and about 0.3 percent manganese. Characteristic of this minette ore is its phosphorus content (0.7 to 0.9 percent), which in the past prevented its use but today is an advantage in the production of Thomas slag.

Except for unimportant open-cut operations along the eastern edge of the Lorraine Basin, all mining is underground. As the area is moderately flat, preliminary development work consists of trenching in the valleys along the outcrops of the iron ore to locate minable beds and then to sink shafts at a convenient place on the plateau. At Briey, for example, are a number of such shafts 250 to 300 feet in depth. Each mine usually has twin shafts, permitting an annual extraction of over a million tons. Due to infiltration of water in these shafts, pumps must be provided; in fact, at some Briey shafts the amount pumped averages 13 cubic yards a minute, or 13 cubic yards per ton of ore hoisted. Only in rare instances is it possible to drive a crosscut or an adit that will facilitate drainage. Such a tunnel is that of Angevillers, which is 4 miles long and serves both for drainage and transport of ore by electric locomotives.

The room-and-pillar method is used in mining, and the pillars are left to maintain the roof and thus prevent greater infiltration of water. The pillars between the drifts in the ore bed are mined, starting at the limits of the section to be mined away from the shaft and retreating

toward it. The percentage of ore left in pillars depends on the strength of the roof and ranges from 5 to 40 percent. Special precautions must also be taken when two or more superimposed beds are being mined within an area.

In mining, hammer drills, often mounted on tripods, are used; for blasting liquid oxygen is now generally employed, at the rate of one-half pint per ton mined. Mechanical loaders, shaking troughs, and belt conveyors are used where possible. Transportation in and out of the mines is by electric locomotives hauling trains of 2- and 4-ton mine cars.

OTHER FIELDS

In Normandie the principal mines are at Soumont, Saint Remy, Larchamp, and La Ferriere south of Caen. They occur in the folded Paleozoic rock beds as seams of hematite near the surface, which becomes a siderite ore in depth. The hematite ore averages 45 to 46 percent iron, 12 to 18 percent silica, and 0.6 to 0.7 percent phosphorus. The siderite ore is concentrated to about the same grade by calcining.

In the Brittany-Anjou district a series of synclines extends from northwest to southeast containing a number of iron ore seams interstratified in Silurian and Devonian rocks. This ore is a hematite ranging from 48 to 52 percent in iron content, with 8 to 12 percent silica. Due to its high silica content these ores have caused considerable trouble in the production of pig iron with less than 1 percent silica.

In the Pyrenees south of Prades occur the hematite deposits of Canigou, which consist of lenticular bodies of manganiferous hematite and siderite in Silurian limestone. The iron content of the ore is 51 to 57 percent, with 2 to 4 percent manganese and only 0.075 percent phosphorus. Production from these mines in 1929 was 235,000 tons and during the last 3 years has averaged only 62,000 tons.

Of future importance are the extensive surface deposits of Conakry in French West Africa, where 2,500,000,000 tons of ore containing 48 percent iron, 2 percent chromite, and 1 percent nickel occur in beds 10 to 30 meters thick. In 1937, 20,000 tons of this ore was sent to Neunkirchen, Germany, and, mixed with the French minette ores, gave satisfactory results in the blast furnace. An international company is being formed without German capital to explore this deposit. It is near the sea and can be mined at a low cost.

PRINCIPAL IRON ORE COMPANIES

In 1935, eight companies had an annual production of over a million tons. The names, capitalization, and output of these companies follow:

French iron ore companies

Name	Department	Product, in thousands of metric tons	Capital (francs)
Société Minière des Terres Rouges.....	Moselle.....	2,465	20,000,000
Société Métallurgique de Knutange.....	do.....	1,169	75,000,000
Société Lorraine des Acieries de Rombas.....	do.....	1,511	150,000,000
Société des Forges et Acieries de Nord et Lorraine..	do.....	1,160	80,000,000
De Wendel et Cie.....	do.....	1,768	117,180,000
Do.....	Meurthe et Moselle..	1,260	117,180,000
Cie. des Forges et Acieries de la Marine et Homécourt.....	do.....	1,033	180,000,000
Société des Mines d'Amermont-Dommary.....	do.....	1,477	9,000,000

The capital of all of these companies is under French control.

FOREIGN TRADE AND DOMESTIC CONSUMPTION

The variations in foreign trade and domestic consumption of iron ore for 1929 and the last 4 years are shown in the following table:

Foreign trade and domestic consumption of French iron ore, 1929 and 1935-38

[In thousands of metric tons]

Iron ore	1929	1935	1936	1937	1938
Production.....	50,731	32,046	33,301	37,839	33,137
Exports.....	21,525	17,183	18,252	19,321	15,505
Imports.....	1,141	453	392	921	437
Consumption.....	30,347	15,316	15,441	19,439	18,069

Exports to Germany were reduced from 7,133,000 tons in 1937 to 5,864,000 tons in 1938. Exports to Belgium-Luxemburg were reduced from 11,600,000 tons in 1937 to 9,145,000 tons in 1938 and to Great Britain from 405,000 tons in 1937 to 337,570 tons in 1938.

In 1938 imports also showed a substantial decrease over 1937; this decrease was greatest in imports from Belgium-Luxemburg, Sweden, Tunis, and Algiers.

SCRAP IRON

The consumption of scrap iron in 1936 was 2,102,605 metric tons. Imports in 1938 totaled 13,157 metric tons against 11,095 tons in 1937. The Union of Belgium-Luxemburg supplies about 70 percent of this scrap.

During the first few months of 1938 the demands for scrap iron were greatly reduced, and demands for the immediate future cannot be appraised until a more definite idea is formed of the iron and steel output during that year.

In January 1938 prices for scrap iron ranged from 307 to 386 francs (approximately \$10 to \$13) per ton delivered in France. There was an export tax of 200 francs (\$6.50) per ton on scrap iron in France which made it almost impossible to compete in the world markets. This tax was reduced to 100 francs in April 1938, and it may now be possible to export scrap iron to Italy and to England, where there is a limited market.

The exports of scrap iron (620,798 tons in 1935) were reduced to 131,868 tons in 1937 and increased to 439,113 tons in 1938. Great Britain, Italy, and Poland are the principal importers of scrap iron from France.

In March 1939, at the request of the Ministry of War, the Minister of Commerce declared a ban on shipments of scrap iron to Italy.

MANGANESE ORE

France is one of the principal consumers of manganese ore, and all of her requirements are now imported. From 1923 to 1928 the annual output averaged about 5,000 tons but since 1932 production has ceased. Imports in 1936 were 418,834 metric tons and in 1937, 489,479 metric tons.

COAL FIELDS

The most important coal fields in France are situated in the Nord and Pas-de-Calais Basin, which extends easterly across the Belgian border. Next in importance are those of Moselle, an extension of the Saar Basin, the St. Etienne or Loire Basin, and the Bourgogne, Gard, Tarn, and Bourbonnais Basins. These coal fields are described in detail in Bureau of Mines Foreign Minerals Quarterly, Volume 1, No. 4, 1938, and in Bulletin 414, issued in 1939.

PIG IRON

Nearly 80 percent of the pig iron comes from the Est I and Est II areas within the Moselle Basin, 13 percent from the Nord area, and 5 percent from the Ouest area. The other three areas—Centre, Sudouest, and Sudest—produce the balance. The statistics for 1929, and the last 4 years are as follows:

Data on pig iron in France, 1929 and 1935-38

[In thousands of metric tons]

Pig iron	1929	1935	1936	1937	1938
Number of men employed.....	(¹)	7,789	8,091	(¹)	(¹)
Production.....	10,364	5,790	6,237	7,916	6,049
Imports.....	40	57	66	41	31
Exports.....	658	178	149	421	554
Consumption plus stocks.....	9,746	5,669	6,154	7,536	5,446

¹ Data not available.

Production is being concentrated on high-phosphorus pig iron, output of which in 1938 was 5,338,000 tons, or about 88 percent of the total.

To produce a metric ton of pig iron the following tonnages of raw materials were consumed in 1935 and 1936:

Raw materials consumed in producing 1 ton of French pig iron

Raw material:	1935	1936
Iron ore.....	2.828	2.846
Scrap iron.....	.077	.082
Slag, limestone, etc.....	.170	.179
Manganese ore.....	.060	.054
Pyrite ash.....	.027	.022
Phosphate rock.....	.010	.010
Coke.....	1.022	1.026

There are 211 blast furnaces in France; 102 of these were active in January 1938 and 87 in January 1939 compared with 154 in 1929. There are also 125 electric furnaces in France, and 44 in the Centre, Sudouest, and Sudest areas were active in 1937.

During 1938 pig iron exports were 534,000 tons compared with 149,000 tons in 1936; most of the tonnage went to Great Britain.

STEEL INDUSTRY

The set-back suffered by the steel industry during the summer of 1936, due to labor disturbances which resulted in many concessions to labor, was of short duration. These concessions, however, have caused

such an increase in costs that competition in the world markets is greatly hampered. In spite of this retarding factor, production during 1937 increased over that in 1936; but during 1938, because of strikes, the output was notably less than in 1937.

The production statistics for 1929 and the last 4 years were as follows:

Steel production in France, 1929 and 1935-38

	1929		1935		1936	1937	1938
	Output	Number	Output	Number	Output	Output	Output
Production of ingots and castings thousands of metric tons	9,700	-----	6,277	-----	6,708	7,920	6,174
From furnaces:							
Thomas (basic Bessemer).....do.....	6,680	79	4,004	79	4,387	5,250	3,733
Martin (open hearth).....do.....	2,753	77	1,966	83	1,997	2,291	2,067
Electric.....do.....	151	58	247	60	272	316	306
Bessemer (acid).....do.....	99	56	46	50	41	48	48
Crucible.....do.....	17	17	14	19	11	15	20
Workmen employed.....number.....	(¹)	-----	9,704	-----	10,497	(¹)	(¹)
Consumption of raw materials per ton of steel:							
Pig iron.....do.....tons.....	(¹)	-----	0.804	-----	0.824	(¹)	(¹)
Scrap iron.....do.....	(¹)	-----	.324	-----	.313	(¹)	(¹)
Limestone.....do.....	(¹)	-----	.109	-----	.113	(¹)	(¹)
Castings.....do.....	(¹)	-----	.005	-----	.005	(¹)	(¹)
Iron ore.....do.....	(¹)	-----	.003	-----	.003	(¹)	(¹)
Fluorspar.....do.....	(¹)	-----	.002	-----	.002	(¹)	(¹)

¹ Data not available.

Steel production in France, by districts, 1929 and 1935-38

[In thousands of metric tons]

Production, by districts	1929	1935	1936	1937	1938
Est I.....	3,674	2,311	2,388	2,925	2,142
Est II.....	2,985	1,972	2,208	2,618	2,012
Nord.....	1,698	1,140	1,249	1,416	1,151
Centre.....	567	357	367	398	363
Sudouest.....	56	34	35	46	44
Sudest.....	125	79	68	78	77
Ouest.....	595	384	393	429	385

Of the total steel output in 1938, 6,025,000 tons were ingots and 149,000 tons castings. Of this total, 37 percent was produced in the Est I area, 33 percent in the Est II area, and 16 percent in the Nord area.

In all, 209,749 workmen were employed in the steel plants and shops in 1936 compared with 264,559 in 1929. The distribution of workmen in 1936 was as follows: At blast furnaces, 8,091; at coking plants, 2,837; at steel furnaces, 10,493; at rolling mills, 33,995; at foundries, 18,008; for transportation and maintenance, 47,696; in engineering shops, 53,744; and for clerical and miscellaneous work, 14,885.

The total cost of steel production is figured on the following percentage basis: For raw materials, 40 percent; for workmen's wages, 25 percent; for small salaries, 15 percent; for large salaries, 5 percent; and miscellaneous, including taxes and amortization, 15 percent.

The sales prices for iron and steel products have been increased 50 to 60 percent during the last 2 or 3 years, or about in proportion to the price increase in the world markets.

The export trade in steel declined in 1937 compared with 1936, and as there seems to be no way to reduce production costs to meet foreign competition certain exporters have withdrawn from the export market for the time being.

PRINCIPAL IRON AND STEEL COMPANIES

The names and capitalization of the principal iron- and steel-producing companies in France are as follows:

Steel-producing companies in France

Name of company	Headquarters	Capitalization
		<i>France</i>
1. Cie. des Forges et Aciéries de la Marine d'Homécourt (Armaments).	St. Chamond.....	180,000,000
2. Société Anonyme des Forges et Aciéries du Nord et de l'Est.	Paris.....	163,000,000
3. Société Aciéries de Longwy.	Mont St. Martin.....	156,000,000
4. Société Lorraine des Aciéries de Rombas.	Rombas.....	150,000,000
5. Union de Consommateurs de Produits Métallurgiques et Industriels.	Paris.....	105,000,000
6. Société Schneider & Co. (Armaments).....	do.....	100,000,000
7. Société Commentry-Fourchambault et Decazeville.	do.....	66,000,000
8. Société des Hauts-Fourneaux de la Chiers.	Longwy-Bas.....	60,000,000
9. Société des Hauts-Fourneaux, Forges et Aciéries de Pompey.	Pompey.....	60,000,000
10. Cie. des Forges Chatillon Commentry et Neuves-Maisons (Armaments).	Paris.....	43,000,000
11. Société des Hauts Fourneaux, et Fonderies de Pont-à-Mousson.	Pont à Mousson.....	40,000,000
12. Société Anonyme des Hauts Fourneaux, Forges et Aciéries de Denain et D'Anzin.	Paris.....	62,000,000
13. Société Anonyme des Aciéries de Micheville.	Micheville-Villerupt.....	100,000,000
14. Société Anonyme des Laminiers, Hauts-Fourneaux, Forges, Fonderies et Usines de la Province.	Marchinne-au-Pont (Belgique).	86,000,000
15. Société Métallurgique de Senelle-Maubeuge.	Longwy.....	82,500,000
16. Société Métallurgique de Knutange.	Paris.....	75,000,000
17. Société Métallurgique de Normandie.	do.....	118,000,000
18. Société des Hauts Fourneaux de Rouen.	do.....	15,000,000
19. Société d'Electro Chimie, d'Electro Métallurgie et des Aciéries Electriques d'Ugine.	do.....	130,000,000
20. Les Petits Fils de F. de Wendel et Cie.....	do.....	117,180,000

Of the above the largest producer of ingot steel is company 20, followed by companies 1, 11, 2, 3, 4, and 5.

Companies 1, 6, and 10 are the principal producers of armament. All are controlled by French capital.

COMITÉ DES FORGES DE FRANCE

This association was organized in 1884 by the majority of the iron and steel producers to protect their economic, industrial, and commercial interests. It is supported by the industry, which contributes in proportion to production or the number of workmen employed. All questions of Government legislation, labor, production, domestic and foreign markets, and prices and other problems are studied by the members of this association, and each year it publishes a yearbook summarizing operations by each company and giving the annual statistics. Each month it issues a bulletin giving current production, import and export statistics, and other data of interest to France and foreign countries.

SALES ORGANIZATION

The French Steel Cartel (*Comptoir Sidérurgique Française* or C. S. F.) was organized after the World War with full approval of the Government.

The C. S. F. was reorganized on December 17, 1926, with new statutes providing for the establishment, through a single organization, of several specialized cartels (*comptoirs*), each independent as regards commercial activities and financial results but operated in accordance with a certain defined policy through affiliation with a single body.

The C. S. F. cartels have been renewed from time to time, as required. The majority are effective until December 31, 1940.

The present divisions of the C. S. F. are: Cartels for rails, machine wire, semifinished products, small beams, merchant steels, strip iron, cold-rolled iron, strong- and medium-strength plates, thin plates, and large flats.

Besides the above, cast-iron producers have grouped themselves into two organizations independent of the C. S. F.—that manufacturing phosphorus cast irons and that manufacturing hematite cast irons.

The C. S. F. also includes a division of the International Steel Agreement (*Entente Internationale de l'Acier*) which controls the operations of the French group of the E. I. A.

The cartel control extends, in principle, to sales in French territory, including colonies, as well as to those in foreign markets.

An arbitration body was constituted in 1932 to make compulsory and final decisions on all litigious matters arising between members in connection with the operation of a cartel.

MARKET DEMAND

The Government orders for public works projects and for rearmament have given a great impulse to the iron and steel industry in France during the last few years, but labor troubles have retarded output. Normal demand by private industry has not increased as (1) the textile plants are producing in excess of present demands, (2) the railways are keeping expenditures at a minimum as they are gradually being nationalized, (3) ship construction is at a very low point because costs are too high compared with other countries, (4) agricultural machinery of French manufacture is finding competition with foreign products difficult, (5) the building industry has remained stationary in recent years, and (6) the automobile industry has not maintained its position as to output for some time.

LABOR

During the last 3 years an average of 260,000 workmen have been employed in the French mines; of these, 85 percent were at the coal mines, 10 percent at the iron mines, and 5 percent at other mines and quarries. Of those employed, 90,000 were foreigners, including 60,000 Poles and 11,000 Italians. The great majority of miners belong to unions affiliated with the C. G. T. (*Confédération General du Travail*). The union collects 5 francs a month from each member.

Each mining company or mine operator is authorized by law to make a collective agreement with the workmen, stipulating minimum

wages and the methods of applying the maximum weekly hours, fixed by law at 38 hours and 40 minutes for the mining industry. The workmen are represented by local syndicates or branches of the labor union, and the operators by representatives of the "Confédération Générale du Patronat Français," a national federation for all industrialists. When there is a grievance or labor problem to be solved, the secretary of the local syndicate writes to the mine director asking for an appointment to discuss the question and the director replies by letter making the appointment. If the question cannot be settled between the interested parties the matter goes to the local committee of conciliation. If the latter cannot induce an agreement, the question is submitted to subsequent stages of arbitration which must be concluded within a month. In general practice, however, where questions arise which cannot be adjusted at the mines, the local Bureau of Mines engineer is called upon to investigate the difficulty and to suggest a solution; in many cases, his advice is taken and the matter settled. As a result, some of the Bureau of Mines offices find that much of their time is now taken up with labor problems, leaving but little for their numerous other duties.

SWEDEN

GENERAL STATEMENT

Sweden is by far the most important source of high-grade iron ore in Europe; as domestic consumption is relatively small, it is the world's second largest export country.

The total iron ore shipments from Sweden jumped from 11,000,000 tons in 1936 to 13,900,000 tons in 1937 and 12,700,000 tons during 1938. Of this 1938 total, 10,700,000 tons originated in the mines of the Grängesberg concern, which are in Lapland and the rest principally in the mines of Central Sweden. The Government, which owns a half interest in the Grängesberg concern, gave this company authority early in 1938 to increase its annual iron ore exports from 10,000,000 to 12,200,000 tons until October 1, 1940. The intention was to increase shipments both to Germany and Great Britain, as the latter was anxious to obtain more Swedish ore to replace the possible loss of ore supplies from Spain.

Although shipments to Germany have continued virtually undiminished, it is expected that the reduced German-Swedish clearing balance will oblige the Germans to curtail future iron ore imports from Sweden. Exports to Great Britain also decreased during the last half of 1938, and because of these reverses Swedish plans for greater exports have not been realized. Factors that affect the smaller consumption of Swedish ore include the increased utilization of scrap iron and the exploitation of the low-grade ore deposits in Germany. Because of the present situation certain iron mines have reduced their output and discharged part of their workmen.

Most Swedish ore is high in iron and goes direct to blast furnaces, although certain mines maintain ore-dressing plants for the low-grade ores, and about 15 percent of the total output is in the form of concentrates. The Gellivara mines are the principal producers of concentrates.

Sweden for many decades has made an important output of high-grade steel products for export trade. Of the total output, 87 percent

is made in open-hearth furnaces, 12 percent in Bessemer furnaces, and 1 percent in electric crucible furnaces. Although Sweden has a capacity adequate to produce most of her iron and steel requirements, her imports of finished steel products (largely from Germany in exchange for iron ore) are nearly double her exports. In 1937 the total imports of iron and steel products totaled 900,996 tons and exports 424,050 tons, while in 1938 imports were 484,449 tons and exports 413,375 tons, according to the Swedish Chamber of Commerce Statistical Report of December 1938.

The Swedish iron and steel industry, which was started in the Middle Ages, was based on iron mines in the Bergslagen area west of Upsala. Today the bulk of the production comes from the magnetite mines of Gellivara and Kiruna in Lapland.

Production and consumption of iron ore, pig iron, and raw steel in Sweden, 1929, 1932, and 1935-38

[In thousands of metric tons]

	1929	1932	1935	1936	1937	1938
Iron ore:						
Production.....	11,468	3,299	7,933	11,250	14,953	¹ 13,300
Consumption ²	569	1,080	214	52	988	¹ 615
Pig iron:						
Production.....	490	265	570	632	693	¹ 670
Consumption ²	509	271	602	720	793	¹ 651
Raw steel:						
Production.....	694	528	896	977	1,106	⁽³⁾
Consumption ²	673	523	876	958	1,085	⁽³⁾

¹ Estimated.

² Consumption figures are production + net imports - net exports.

³ Data not available.

IRON-MINING DISTRICTS AND ORE RESERVES

The Kiruna and Gellivara groups of mines, which belong to the Luossavaara-Kirunavaara Co., are among the richest in the world and the third largest as to iron ore production. These mines are owned half by the Trafik A. B. Grängesberg-Oxelösund and half by the Swedish Government.

At Kiruna the ore mined is a finely grained mixture of magnetite and apatite which is divided into six classes of ore ranging from 0.03 to 1.8 percent phosphorus and from 56 to 71 percent iron; this ore runs not more than 0.05 percent sulfur, 0.70 percent manganese and magnesia, 1.5 percent silica, 0.75 percent alumina, 3 percent lime, and 0.3 percent titanium. This deposit lies above Lake Luossajarvi, and the tonnage of proved ore above the lake level is estimated at 265,000,000 metric tons. About 90 percent of the Kiruna ores are surface-mined. The ore is loaded by electric shovels, the majority being of the caterpillar type; it is hauled from the mine in cars of 30 to 35 tons capacity and dumped through a shaft into railway cars at lake level. At Kiruna approximately 1,800 men are employed in mining and handling the ore. The output is approximately 15 to 18 tons of ore per man-shift. Wages average 18 to 20 kronor (\$4.50 to \$5.00) per day.

Across the lake from Kirunavaara at Luossavaara is a small open pit about 3,900 to 4,900 feet long and 130 feet wide. The ore is extracted by the same methods employed at Kiruna. About 150 men are employed at Luossavaara, and output per man-shift is about 5.5 tons.

At Gellivara about 50 miles south of Kiruna the deposits consist of steeply dipping lenses 30 to 100 feet thick in a mineral zone 4 miles long. The grade of the ore is similar to that of Kiruna, but it is mined almost entirely underground, the annual output being about 1,500,000 tons.

The total estimated metallic iron ore reserves in the mines of the Luossavaara-Kirunavaara-Tuolluvaara groups in Northern Lapland are 226,000,000 tons in the developed ore, 260,000,000 tons in the probable ore, and 520,000,000 tons in the possible ore reserves. At the Gellivara group in Southern Lapland the reserves, estimated in metallic iron, are 83,000,000 tons in the known ore, 82,000,000 tons in the probable ore, and 74,000,000 tons in the possible ore reserves.

As already mentioned, the oldest mining district is that of Bergslagen in central Sweden near Grängesberg, west of Upsala and 124 miles northwest of Stockholm. The ores here are a high-phosphorus magnetite averaging 60 percent iron and a low-phosphorus hematite averaging about 50-percent iron content. Most of the ore is mined underground. During the last few years extensive mining interests have been acquired by German capital, and developments are being pushed to meet any decrease in exports from the northern fields. The estimated iron content of the ore reserves is 90,000,000 tons in the known ore and 60,000,000 tons in the possible ore. The Grängesberg-Orelösund Co. of Stockholm owns and operates the principal mines in this district, although several other companies are producing and conducting important developments. All of the high-phosphorus magnetite ore is exported, and the low-phosphorus hematite is utilized in the Swedish iron industry.

ALLOY METALS

MANGANESE ORE

Sweden is not a large consumer of manganese ore, and domestic production is about adequate to meet demands. During the last few years the output has averaged about 6,400 tons containing 33 percent manganese and imports about 500 tons. The manganese mines are at Spaxeryd and Hohult south of Jönköping and at Langbau in Värmland.

OTHER ALLOY METALS

Although Sweden is an important producer of ferro-alloys due to cheap electric power, it depends on ore imports of the alloying metals, such as chrome, tungsten, vanadium, and nickel, and imports of ferromanganese. In 1937 the net imports of ferromanganese were 5,591 tons while the exports of silicomanganese amounted to 12,735 tons. The A. B. Ferrolegeringar is the largest manufacturer of these ferro-alloy products in Sweden.

COAL SUPPLIES

Coal production and known reserves are inadequate to meet domestic demands; in consequence, Sweden imports a large percentage of its annual consumption. Among the European countries that produce but a small fraction of their coal requirements, Sweden suffered more than any other country from the effects of the stoppage of coal shipments from England during the World War.

The total tonnage of coal consumed in Sweden in 1937 was 6,595,693 metric tons valued at 142,264,314 kronor. As Sweden produces only about 7 percent of the coal consumed in the country, it is evident that coal is an outstanding item of strategic importance to the economic welfare of the country.

The coal deposits in Sweden are in the Province of Scania in the south of Sweden and cover an area of about 300 square miles. Two coal seams are being exploited; the upper is 16 to 20 inches thick and the lower, separated by 12 to 16 feet of shale, 24 to 30 inches thick. The coal is a noncoking, low-grade bituminous coal high in ash and has little value to the iron and steel industry, which depends almost entirely on imported coal.

IRON AND STEEL PLANTS

The manufacture of iron and steel was one of the leading industries in Sweden during the past century and was based on the low-phosphorous ores in central Sweden and the use of charcoal. It was not until the development of the Bessemer process about 50 years ago, making it possible to utilize the high-phosphorus Swedish ores, that large-scale exportation of iron ore was begun. As there is a scarcity of coking coal in Sweden and as the domestic market for steel products is limited the manufacture of iron and steel products has also been limited.

Furnaces in operation in Sweden during 1937 and their output of pig iron and steel

Type of furnace	Number of furnaces in operation	Total days operated	Total output in metric tons	Output of furnace per day (metric tons)
For pig iron:				
Blast furnaces (coke).....	11	2, 154	269, 742	131. 69
Blast furnaces (charcoal).....	39	10, 938	318, 358	29. 11
Electric furnaces (charcoal).....	6	1, 461	54, 991	37. 64
Electric furnaces (other fuels).....	4	736	4, 502	6. 10
Total.....	60	15, 289	647, 593	42. 36
For steel:				
Bessemer acid.....	7	1, 384	16, 385	11. 90
Bessemer basic.....	5	591	92, 895	157. 20
Martin acid.....	27	7, 281	272, 181	37. 38
Martin basic.....	32	7, 964	469, 836	58. 97
Crucible.....	3	480	495	1. 03
Electric.....	48	9. 102	253, 810	27. 88
Total.....	122	26, 802	1, 105, 602	41. 25

The majority of the blast furnaces and steel plants are in central Sweden, although there are a few furnaces in southern Sweden and one at Lulea on the Baltic, the ore-shipping port. Of interest in the production of pig iron is the large number of small blast furnaces still in use, as well as the use of electric furnaces which make about 10 percent of the total pig iron output. In the manufacture of steel, 67 percent is produced by the Martin or open-hearth furnaces. In these furnaces, however, greater use of pig iron is made than in most countries, as the supply of scrap iron is limited. To meet the increased demands for pig iron and scrap iron in steel manufacture Sweden has had to increase her annual net imports of pig iron to about 100,000 tons and of scrap

iron to about 90,000 tons. Noteworthy also is the greater output of steel in electric furnaces.

A committee appointed by the Government recently submitted a report in regard to investigations of charcoal pig iron and coke pig iron produced in blast furnaces and in electric furnaces. The committee ascertained that blast furnaces are more economical than electric furnaces, regardless of whether they burn coke or charcoal. They propose to erect two blast furnaces, one to use charcoal (with an annual capacity of 20,000 tons of pig iron) and the other to use coke (with an annual capacity of 45,000 tons). The city of Lulea is suggested as the best location for these proposed furnaces.

IRON AND STEEL COMPANIES

One of the oldest steel-producing companies in Sweden is the Stora Kopparbergs Bergslags A. B. of Falun. This company has its own mines in central Sweden and its own forests for charcoal, as well as copper, lead, and zinc mines and paper-pulp factories.

The Hofors Bruk A. B. is also a large producer of steel, with its own mines. It owns a controlling interest in the S. K. F. Ball Bearing Co., which has large factories in Sweden.

The Sandirakens Järnverks A. B. is one of the largest producers of iron and steel and operates rolling mills, wire, and tube mills.

The A. B. Bofors is another producer of raw steel and is one of the largest manufacturers of armaments.

FOREIGN TRADE

During the last 3 years iron ore exports were as follows:

Swedish exports of iron ore, 1936-38

[In metric tons]

Country of destination	1936	1937	1938
Germany.....	8,131,118	9,459,378	(¹)
United Kingdom.....	1,467,345	2,213,301	(¹)
Czechoslovakia.....	418,765	761,721	(¹)
Other.....	1,180,598	1,530,227	(¹)
Total.....	11,197,826	13,964,627	12,685,026

¹ Data not available.

Shipments to England decreased early in 1938. The English iron and steel industry experienced a pronounced depression early in the year, and it was reported that delivery of all the Swedish iron ore purchased could not be accepted on delivery; the potential English purchases contributed materially to the new agreement negotiated between the Government of Sweden and the Grängesberg concern for increased output. Shipments to Germany appear to have continued virtually undiminished during 1938. It was expected toward the end of the year that the reduced German-Swedish clearing balance would oblige the Germans to reduce their future iron ore imports from Sweden, as a considerable portion of the funds available had to be used for the payment of interest on German bonds held in Sweden.

There are two main sources of iron ore for export—(1) the Grängesberg mines in the Bergslagen field and (2) the Gällivara and Kiruna

areas in Lapland owned by the Luossavaara-Kirunavaara A. B. The first of these is under direct Government restriction as to export, and the second (which is far more important) is indirectly restricted. The State is in a position to control not only the tonnage but the destination of iron ore exports.

Although the Grängesberg mines were the first to start exports of iron ore in 1880 they were soon overshadowed by the Gellivara mines starting in 1892, and these in turn are exceeded by the mines in the Kiruna area which started to export in 1902.

In 1937 Sweden exported 14 million tons of iron ore, and of this 10.9 million tons was from the Gellivara and Kiruna mines in Lapland. From the Gellivara mines the ore goes to the port of Lulea and that from the Kiruna mines to the port of Narvik in Norway. Some of the ore from the Kiruna mines, however, goes to Lulea, and a small tonnage of the Gellivara ore goes to Narvik.

TRANSPORTATION PROBLEM

The tonnages shipped were as follows:

Swedish ore shipments in 1936 and 1937

[In metric tons]

	1936	1937	Distance, miles
To port of Narvik:			
From Kiruna mines	5,643,433	7,594,660	107
From Gellivara mines	103,464	90,643	175
	5,746,897	7,685,343	
To port of Lulea:			
From Gellivara mines	1,228,820	2,495,256	132
From Kiruna mines	218,019	253,575	190
Other mines (Freja)	250,271	377,237	132
	1,697,110	3,126,068	

Of the shipments from these mines in northern Sweden, 73 percent were from the Kiruna group, 23 percent from the Gellivara group, and 4 percent from other mines.

The Swedish State Railways freight rates in 1938 were as follows:

	<i>Kronor</i>
Kiruna to Norwegian frontier	3.01
Kiruna to Lulea	3.85
Gellivara to Norwegian frontier	3.78
Gellivara to Lulea	3.10

It is 27 miles from the Norwegian frontier to Narvik, and the freight rate is about 1 krona (25 cents) a ton.

In an agreement of 1927 between the Swedish Government and the Luossavaara-Kirunavaara Co., this company was to pay additional freight to the State railways amounting to one-fifth of the excess sale price of the ore above 16.75 kronor per ton on board at Narvik or Lulea. The company report for the fiscal year ended September 30, 1938, showed that it received an average price of about 19.75 kronor per ton of ore shipped during the year.

Shipments from the port of Kiruna appear to be favored over those from Lulea, as the owners of ore vessels do not like to send their ships to Lulea in winter for fear that they may become icebound before having time to load. For this reason the bulk of the exports will continue to be via Narvik.

SALES OF IRON AND STEEL ABROAD

Most of the sales of iron ore on the foreign markets are made by the Trafik A. B. Grängesberg-Oxelösund, with headquarters in Stockholm.

Swedish producers of raw iron and steel products are not organized into national cartels or members of the International Steel Agreement. For the sale of high-quality steel products Swedish exporters work together and have a price-stabilizing organization.

With regard to iron and steel scrap, exports were permitted under license during 1937 in lots of not less than 500 metric tons each, and for 1938 the minimum tonnage was reduced to 200 tons. However, no scrap can be exported that has not first been offered for sale and refused by the Swedish iron and steel industry. In terms of quantity or tonnage, Sweden is a net importer of semifinished and finished iron and steel products; but in terms of value, it is a net exporter.

GOVERNMENT CONTROL

Although the Swedish Government is financially interested in the iron-mining industry, it does not exercise any control over the iron and steel industry, except scrap-iron exports.

To stimulate a domestic iron and steel industry and to insure adequate supplies for domestic consumption, a movement that began in the last decade of the past century, which in a sense could nationalize the industry, has been under way. Those favoring State control of iron ore exports from the outset have not been concerned with State ownership of deposits or absorption by the State of producing companies but have endeavored to channelize the development of the Lappic deposits to avoid uneconomic exploitation of the country's outstanding mineral reserves.

During the past 40 years a series of contracts has been negotiated between the State and the mining companies, the specific provisions of which are not as important as the fact that each amended or revised contract tended to place the operating companies and their properties under greater control by the State.

Industry generally, especially the mining and metallurgical industries, is supervised by the Ministry of Commerce. In addition to this central Government agency the Swedish Board of Trade serves in an administrative and advisory capacity with regard to certain phases of mining activity and trade in mineral products.

Not until 1907, when the State joined private capital in development and operation of the iron ore deposits, was there any sign of Sweden becoming an important factor as a producer and exporter of iron ore or a competitive industrial nation.

There are several semiofficial organizations, such as the Engineers' Technologic Academy, which was created in 1919 and engages in technical and scientific research intended primarily for economic development and conservation of the country's natural resources. This organization is subsidized in part by the Swedish Government. The Federation of Swedish Industries, founded in 1910, represents the industrial groups of the country both in their contact with Government agencies and in promoting the interests of the several industrial groups.

The General Export Association, established 50 years ago, maintains representatives abroad, and while its activities generally are directed toward promotion of foreign trade it likewise serves as an intermediary between the State and organized exporters.

SWEDISH MINING LAW

The present mining laws of Sweden are based on a code passed in May 1884. Special commissions have been engaged from time to time since then on a revision of the original code. At present landowners are entitled to a half interest in mining claims on their property; it has been proposed that this right be abolished and transferred to the State. Only with the consent of the Government can a foreigner become a director of a mining company or operate a mine. The same restriction applies to foreign corporations. Corporations must have at least five Swedish subjects as organizers of a company, which may not be capitalized for less than 5,000 kronor.

Any Swedish subject may explore for minerals anywhere in Sweden except on exempted State-owned lands. A permit must be obtained to make excavations. This permit is valid for 3 years. Operations on a claim must start within 8 months. Although a landowner may participate to a maximum of 50 percent in the profits of a mining enterprise, he likewise may collect rental for all land required for buildings, storage, and other surface operations.

GOVERNMENT PURCHASES OF RAW MATERIALS

In the summer of 1937, 70 million kronor was appropriated by the Swedish Riksdag for the purchase on State account of certain essential raw materials that can be easily warehoused, such as fertilizers and coal. The Government intended that these imports should be stored for emergency use.

SOVIET UNION

GENERAL STATEMENT

The Soviet Union produces roughly 28,000,000 tons of iron ore, 15,000,000 tons of pig iron, and 18,000,000 tons of steel a year. About two-thirds of this output comes from the Krivoi Rog mines in the Ukraine and the balance from mines in the Urals. One of the main objects of the First and Second Five-Year Plans of the Soviet Union was the creation of an iron and steel industry capable of supplying all branches of the various industries with their requirements. It is also realized that a large iron and steel industry is highly essential for national defense.

It must not be overlooked, however, that pre-war Russia was a substantial producer of iron ore and steel, and it was not until 1930 that present Russia surpassed 1913 production figures. During the last 7 years iron and steel production has about tripled, and a much larger proportion of high-grade products, such as special steels, alloys, and complex structural forms, is being made. This accomplishment has required not only the investment of several billion rubles but the employment of outside technical skill, largely American, first to draw up plans and then to carry them to completion.

Each year the Planning Committee in Moscow stipulates the increased tonnages to be made, but output during the last few years has

fallen much below these specifications, and only a small increase has been recorded.

This slowing of the production of iron and steel is naturally a handicap to the fulfillment of the Government's plans for a greater output of automobiles, tractors, machinery, and armament. Shortage of skilled labor and lack of technical direction as well as transportation facilities, will retard future advance in the iron and steel industry.

The progress that has been made during the last 7 years is shown by the published production statistics for the ferrous industries in the following table.

Production statistics for the Soviet Union, 1932-38

[In thousands of metric tons]

Commodity	1932	1933	1934	1935	1936	1937	1938
Iron ore.....	12,085.7	14,454.5	21,508.8	26,845.0	27,918.0	26,000	(¹)
Pig iron.....	6,161.1	7,109.8	10,428.3	12,488.9	14,395.0	14,520	14,711
Ferro-alloys.....	15.7	20.9	67.0	117.1	(¹)	(¹)	(¹)
Steel ingots.....	5,927.1	6,889.1	9,693.2	12,588.0	16,400.0	17,824	18,088
Rollad steel.....	4,288.0	4,881.7	6,733.5	8,995.0	12,470.0	12,900	(¹)
Coke.....	8,421.4	10,225.4	14,213.0	16,752.0	19,850.0	20,000	(¹)

¹ Data not available.

Iron ore production figures for 1937 and 1938 have not been published. The plan for 1938 provided for an output of 32,000,000 metric tons. It is reported that in 1938 the Krivoi Rog district, which supplies two-thirds of the total supply of iron ore of the U. S. S. R., finished the first half year with an output over 2,000,000 metric tons less than that called for in the production program. Production in July 1938 dropped still more, and there was apprehension that during the coming winter months some of the metallurgical plants would suffer seriously from a shortage of iron ore.

In the spring of 1938, L. M. Kaganovich, People's Commissar for Heavy Industry, reorganized all enterprises engaged in the production of iron ore into a separate trust called "Glavruide."

IRON-MINING DISTRICTS

There are 13 iron-ore-producing territories or regions in the Soviet Union, 4 of which produce less than 10,000 tons a year and are either unimportant or in an early stage of development. The 9 principal territories or regions, according to their importance as producers, are as follows:

Principal iron-mining territories or regions in the U. S. S. R. and production, 1932-37

[In thousands of metric tons]

Territory or region	1932	1933	1934	1935	1936	1937
Southern Ukraine: Dnepropetrovsk.....	7,925.5	8,991.6	13,297.0	16,549.4	(¹)	(¹)
Ural:						
Chelyabinsk.....	3,054.6	2,793.5	4,485.4	6,062.9	(¹)	(¹)
Sverdlovsk.....		1,257.4	1,631.4	1,565.5	(¹)	(¹)
West Siberia.....	54.7	197.9	508.3	766.4	(¹)	(¹)
Central Russia:						
Voronezh.....	322.4	433.4	478.4	683.0	(¹)	(¹)
Moscow.....	179.8	254.3	381.6	548.0	(¹)	(¹)
Crimea.....	516.3	282.1	382.4	456.0	(¹)	(¹)
South Ural:						
Bashkir.....	(¹)	169.6	204.9	136.7	(¹)	(¹)
Orenburg.....	(¹)	36.0	97.9	56.2	(¹)	(¹)
Other.....	32.4	38.7	41.5	21.0	(¹)	(¹)
Total.....	12,085.7	14,454.5	21,508.8	26,845.0	27,918.0	26,000

¹ Data not available.

The reserves of iron ore were estimated at 9,450,000,000 tons in 1935, compared with 9,850,000,000 tons in the United States. This estimate excludes the enormous reserves of low-grade iron ore deposits, such as the Kursk and Krivoi Rog quartzites. In 1938 the official estimate was 10,600,000,000 tons.

The 1933 estimates for the individual districts were as follows:

Estimates of U. S. S. R. iron ore reserves

District	Reserves, in billion tons	Type of ore	Iron con- tent, per- cent
Southern Ukraine: Dnepropetrovsk	1.2	Hematite	50-60
Crimea (Kerch)	2.7	Limonite	30-40
Urals:			
Sverdlovsk	.5	Mixed	30-50
Bakal	.1	Siderite, limonite	32-42
Magnitnaya	.5	Martite, magnetite	35-55
Orsk	.4	Limonite, laterite	30-40
East Siberia:			
Kuznetz	.3	Magnetite	40
Other	.7	Hematite	50-60
Central Russia	1.4	Limonite	30-40
Caucasus	.2	do.	30-50
Kola Peninsula	.4	Quartzite	30-50
Northern region	.3	Limonite	30-45
Other	.7		
Total	9.4		

UKRAINE

The Krivoi Rog iron mines in the Dnepropetrovsk region are situated along the Zheltaya Saksagan and Ingulets Rivers in a narrow zone over a length of about 25 miles in a northwest-southeast direction, the ore occurring in beds several feet thick or forming huge, chimney-like bodies a few thousand feet in length and depth and 30 to 150 feet in width. For the past decade or more, these mines have produced and still do produce over 60 percent of the total output of the U. S. S. R. The ore is essentially martite associated with hematite and magnetite, and the product averages 57 percent iron, 8 percent silica, 0.25 percent manganese, and 0.05 percent phosphorus.

Underground mining methods are used for the most part; at the larger mines sublevel stoping or caving systems are followed, and the output per man-shift averages about 5 tons.

URALS

There are several iron-ore-mining districts scattered over the Urals, by far the most important being that of Mount Magnitnaya at Magnitogorsk, 150 miles southwest of Chelyabinsk, with an annual output of nearly 6,000,000 tons. Here the ore is surface-mined, and the output per man-shift is 8 tons. The ore averages about 45-percent iron content. Next in importance as producers are mines that center around Sverdlovsk, namely, those of Mount Vysokaya with about 700,000 tons a year, those of Bakal with 500,000 tons, and those of Blagodatskiy with 250,000 tons. There are other mines in the Urals with smaller production, such as the titaniferous iron ore mine at Kusa with 75,000 tons a year, besides enormous low-grade deposits of concentrating ores, which are being studied.

ALLOY METALS

MANGANESE ORE

MINING DISTRICTS

There are five mining districts in the U. S. S. R. that produce manganese ores, the two largest being the Nikopol district in Ukraine and the Chiaturi in Georgia, which together contributed 93 percent of the total output in 1935. The Nikopol district had the larger output in 1932 and 1933, while in 1934 and 1935 the Chiaturi mines produced a somewhat larger portion. The other districts are in West Siberia and in Orenburg in Middle Volga and Bashkir in the South Urals, but these are still in the stage of development.

Nikopol district.—This district is situated on the right bank of the Dnieper River below the town of Zaporozhe and is divided into eastern and western sections by a zone of crystalline rocks barren of ore. The western section is about 12 by 6 miles in total area. In the eastern section five separate ore bodies of the same type have been outlined. The first extends from the Breia ravine to the Bolshaya Kamenka ravine over an area 1.2 miles wide and about 3.1 miles long. The second is northeast of the Bolshaya Kamenka ravine along the Tomakovka River and covers a 1.2- by 0.9-mile area. The third district extends up the Tomakovka River to the mouth of the Grushevka ravine and includes an area 0.3 mile to 2.2 miles in width and 3 miles in length. The fourth, covering a 1.6- by 0.9-mile area, is in the vicinity of Nikolaevka village, also on the left bank of the Tomakovka River and north of the third deposit. The fifth ore body lies east of the third, extends from the Krutava ravine eastward to beyond the Grushevka ravine, and is 1.9 miles wide by 2.5 miles long. The ore bed ranges from 3 to 11 feet in thickness, averaging about 6 feet, and it usually is being mined by shafts to depths of 50 to 280 feet. From the main haulageways drifts are extended to the face of the ore, which is mined by the longwall system; the roof is allowed to cave after the ore is extracted. Numerous props are required to support the roof. The use of machines and mechanical equipment has increased rapidly during the last few years.

The crude ore as mined is said to range from 20 to 36 percent in manganese content, the average being about 30 percent. Where possible, the lumps of rich manganese ore are hand-sorted before going to the concentrating plant. At these plants the ore is crushed and washed in log washers and jigs and concentrated with Harz or Hancock jigs and tables or by flotation; a concentrate ranging from 40 to over 50 percent manganese is produced. About 3 tons of crude ore is required to make 1 ton of concentrate. It is estimated that the output of crude ore per man-shift is 1.5 to 2 tons.

In 1900 N. A. Sokolov estimated the ore reserves in the Nikopol district at 50,000,000 tons; in 1931 P. I. Vasilenko estimated a total of 398,000,000 tons.

Chiaturi district.—The Georgian manganese deposits of Chiaturi probably are better known than those of any other country, as they have been the largest world producers of high-grade manganese ore. Most of the ore for export comes from these mines, while domestic demands are supplied from the Nikopol deposits. These deposits

are similar to those in Ukraine, occurring in a horizontal bed $6\frac{1}{2}$ to 10 feet thick and extending along a zone 19 miles long by 5 to 6 miles wide. This area is bisected by canyon like valleys; the manganese ore bed lies 1,250 to 1,900 feet above the bottom of the valleys and is overlain by 330 feet or more of Oligocene beds, consisting of shales and sandstones. All of the mining is done from tunnels that follow the bed. A narrow pillar of ore is left between the areas being mined; otherwise no pillars are left, and the roof is allowed to cave. A long-wall retreating system of mining is used, and a large quantity of mine timber is required to support the roof. The ore is quite soft, and drill holes are made with electric augur. The plants consist of log washers or jigs, screens, and tables, and a concentrate ranging from 44 to 52 percent manganese is produced. The largest of these plants recently completed has a capacity of 2,000 tons a day; in this plant Hancock jigs are used for coarse concentration with tables and a sintering plant for the finer concentration. It is stated that 2.5 to 3 tons of ore is required to make 1 ton of concentrate. The ore reserves in the Chiaturi district were estimated in 1931 to be 162,700,000 tons, containing 43,000,000 tons of manganese.

Because of the demand for manganese ore at the new iron and steel centers in the Urals and in Siberia, certain newly discovered deposits are being developed in Bashkir and at Kazakhstan in the Sverdlovsk region in the Urals and in West Siberia. The mines in West Siberia started with an output of 64,000 tons in 1934 and 131,000 tons in 1935. In Bashkir 22,000 tons was produced in 1934 and 29,000 tons in 1935. At Kazakhstan 10,000 tons was mined in 1935. The ore is principally pyrolusite, with manganite and psilomelane. New deposits are also being developed in the Matveev Kurgan district near Taganrog on the Sea of Azov.

PRODUCTION

The official statistics for the production and consumption of semi-concentrated manganese ores appear in the table below.

Production and consumption of semiconcentrated manganese ores in the U. S. S. R., 1932-38

[In thousands of metric tons]

	1932	1933	1934	1935	1936	1937	1938
Production.....	832.1	1,021.3	1,820.5	2,385.0	3,002.0	2,700	(1)
Consumption and stocks.....	416.6	366.3	1,083.6	1,740.1	2,396.3	1,699	(1)
Production of ferro-manganese.....	52.3	69.8	92.8	116.8	(1)	(1)	(1)

¹ Data not available.

No recent production figures have been published in the Soviet press concerning the production of manganese ore in the Soviet Union. The program for 1937 provided for the production of 3,400,000 metric tons of ore; that for 1938, for 3,200,000 metric tons. The reduced program for 1938 would seem to indicate that the program for 1937 was not fulfilled and that the actual output was about 2,700,000 metric tons.

Production during the first 6 months of 1938 remained below plan provisions. There are indications that the actual output was even below that of the preceding year.

This unsatisfactory trend of production probably caused the decrease in Soviet manganese exports, which totaled only 230,494 metric tons for the first 8 months of 1938, as against 674,465 metric tons for the corresponding period of the preceding year.

CHROMITE

Instead of continuing to be an important exporter of chromite, the Soviet Union has prohibited its export because of the increased domestic consumption of chromite refractories in the steel industry. This policy is also indicative of a deficiency of rich minable chromite ores and the need to conserve what is available for domestic consumption.

Production, exports, and consumption of chromite in the U. S. S. R., 1932-36

[In metric tons]

	1932	1933	1934	1935	1936
Ore produced.....	65,900	109,400	127,400	177,900	219,000
Concentrate.....	1,200	3,000	3,900	6,500	7,500
Exports of ore.....	42,000	41,037	36,499	11,480	None
Consumption.....	23,900	68,363	90,910	166,420	220,000

In 1936 the Soviet Union became the largest world producer of chromite. In 1935 it supplied 22 percent of the world output, enough for its own needs with an exportable surplus.

The principal deposits are those at Saranovskoe in the Sverdlovsk region (Urals). The official ore reserve estimate published in the guidebook of the International Geological Congress, 1937, is 13,750,000 tons of a compact ore containing 30 to 40 percent Cr_2O_3 , but the tonnage of developed ore estimated by certain members of this congress, which convened in Moscow during July 1937, was not over 1,000,000 tons. This ore is used for the most part in the manufacture of refractories. Next in importance is the Kluchevskow deposit 12 miles west of Sverdlovsk, with an estimated reserve of 631,000 tons averaging 16.6 percent. This mine is equipped with a concentrating plant that raises the grade of the ore to 48 percent. The Gologolski deposit about 6 miles west of Sverdlovsk has an estimated reserve of 163,000 tons of high-grade ore. The ore is mined by open-cuts, and there is a concentrating plant on the property for the low-grade material. The Verbylyuzhi Gora deposit at St. Kartaly, the railway junction to Magnitogorsk, is another deposit with reserves estimated at 170,000 tons. This deposit was opened in 1931, and the ore is mined by open pits and underground. The ore is hand-sorted, and the product averages 40 percent Cr_2O_3 . At Bashart, 25 miles west of Magnitogorsk, a similar deposit is being developed.

At Khalilovo, on the main railway west of Orsk in South Bashkir, is a small but rich deposit. Because of its high-grade ore, this deposit has been one of the sources for export via rail to Novorossisk on the Black Sea, a distance of 560 miles. There are other deposits in the Kazakh Republic at Akkarga in the Adamov district, where reserves

are estimated to be 30,000 tons, including 9,000 tons of high-grade compact ore.

In most instances, however, chrome deposits are situated so far from seaports that transportation costs prevent profitable competition on the world markets. There were no exports of chromite in 1936.

TUNGSTEN

For a long time the only source of tungsten ore was the Transbaikal deposit in the Far East. The later discovery of other occurrences of tungsten ore at Dzhida in the Kharamdaban district of the Far East added considerably to the reserves. Large deposits of scheelite were likewise found at Gumbeika, South Urals, and at Tuismk, Minusinsk district in Siberia.

At present the following tungsten mines are producing on a small scale:

Transbaikal Tungsten Combine (Belukha and Bukuka deposits).
 Kalbinsk tungsten mine (Eastern Kazakhstan).
 Dzhidinsk tungsten mine (Buryato-Mongolian Republic, Far East).
 Ubinsk tungsten mine (Eastern Kazakhstan).
 Gumbeisk tungsten mine (Urals).

By far the largest deposits are those of the Belukha and Bukuka mines in Transbaikal, where the tungsten reserves in 1933 were estimated to be 1,776 to 2,098 tons, respectively. In the Sherlovaya Gora, also in Transbaikal, are small placer deposits estimated in 1933 to contain 900 tons of tungsten (65 percent WO_3). The total estimated reserves, including possible ore in the U. S. S. R., was 13,600 tons.

Imports of tungsten in the U. S. S. R., 1934-37

Year:	In metric tons
1934.....	839
1935.....	1, 056
1936.....	1, 523
1937.....	2, 214

NICKEL

Nickel was produced in the Soviet Union for the first time in 1934 when the output totaled 853 metric tons. During 1938, according to preliminary estimates, the production of nickel will be three times as great or about 2,500 metric tons. The producing mines are at Ufaiei in the Central Urals and at Aktyubinsk near Orsk in the South Urals.

It is reported that one of the new nickel plants, the Severonikel Combine at Monchegorsk (Monche Tundra, Kola Peninsula), was put into operation in October 1938 and that another plant, the Yuzhuralnikel Combine at Orsk (South Urals), will begin operation in 1939. It is hoped that when these two plants are opened the Soviet Union will be in a position to cease the importation of nickel from abroad. For the time being, however, a foreign supply of nickel is still imported, amounting to 7,406 metric tons for the first 8 months of 1938 as against 5,766 metric tons for the corresponding period of the preceding year.

COAL FIELDS

By far the most important coal field in European Russia is the Donetz Basin in the Ukraine. Next in importance is the Moscow Basin, followed by the scattered coal fields in the Urals and in the Caucasuses. These coal fields are described in detail in Bureau of Mines Bulletin 414 and in the Foreign Minerals Quarterly of June 1938.

IRON AND STEEL PLANTS

BLAST FURNACES

In January 1937, 92 blast furnaces were in operation, with a total capacity of 49,460 cubic meters—538 cubic meters per furnace. Based on 280 operating days the daily output per furnace averaged 520 tons.

Output of pig iron and ferro-alloys in Soviet Union blast furnaces, 1932-37

[In thousands of metric tons]

Kinds of pig iron and ferro-alloys	1932	1933	1934	1935	1936	1937
Steel-making iron.....	4,127.9	5,034.7	7,196.0	9,043.4	(1)	(1)
Foundry iron.....	1,851.0	1,902.4	2,921.5	2,975.8	(1)	(1)
Spiegeleisen.....	98.8	73.2	140.7	255.5	(1)	(1)
Ferromanganese.....	52.3	69.8	92.8	116.8	(1)	(1)
Ferrosilicon.....	31.1	23.0	42.0	55.0	(1)	(1)
Chromium nickel.....		6.7	35.3	36.6	(1)	(1)
Vanadium iron.....				5.8	(1)	(1)
Total coke iron.....	5,417.7	6,255.0	9,496.3	11,638.8	14,395.0	14,550.0
Total charcoal iron.....	743.4	854.8	932.0	850.1		

¹ Data not available.*Output of pig iron and ferro-alloys in the U. S. S. R. by areas and districts, 1932-36*

[In thousands of metric tons]

Areas	Districts	1932	1933	1934	1935	1936
South.....	Ukraine, Crimea, Azov-Black Sea.....	4,300	4,672	6,780	8,088	9,302
Central.....	Moscow, Gorki, Kirov, Voronezh.....	360	426	598	746	1,131
Eastern.....	Sverdlovsk, Bashkir, Chelyabinsk, West and East Siberia.....	1,502	2,033	3,127	3,655	3,961
Total.....		6,162	7,131	10,495	12,489	14,394

The planned output of pig iron was 16,000,000 tons in 1937 and 16,280,000 in 1938. Actual output is about 10 percent less, owing chiefly to a shortage of coal, coke, and iron ore. Although the total steel output probably will be about 4 percent higher in 1938 than in 1937 it will be 10 percent below the planned figure of 20,260,000 tons.

STEEL PLANTS

The total number of open-hearth furnaces in the U. S. S. R. in 1927 was 162; 44 were added during the First Five-Year Plan and 82 during the Second Five-Year Plan, making a total of 288. Many of these furnaces have been dismantled.

The output of steel by methods of production, according to published statistics, is shown in the table below.

Output of steel in the U. S. S. R. by methods of production, 1932-37

[In thousands of metric tons]

Kinds of steel	1932	1933	1934	1935	1936	1937
Total steel.....	5,927.1	6,889.1	9,093.2	12,588	16,400.0	¹ 17,800
Open hearth.....	5,036.1	5,803.4	8,292.1	10,839	14,055.5	
Bessemer.....	610.6	726.4	851.0	1,001	1,187.0	
Thomas (basic Bessemer).....	172.9	158.9	203.7	244	291.1	
Electric.....	100.9	193.8	343.7	440	862.0	
Crucible.....	6.6	6.6	2.7	7	4.5	

¹ Details not available.

Output of steel in the U. S. S. R. by areas and districts, 1932 and 1934-36

[In thousands of metric tons]

Areas	Districts	1932	1934	1935	1936
South.....	Ukraine, Crimea, Azov-Black Sea, Transcaucasia.....	3,573	5,257		
Central.....	Moscow, Gorki, Leningrad, Kirov, Stalingrad.....	1,242	1,945		
Eastern.....	Sverdlovsk, Bashkir, Chelyabinsk, West and East Siberia.....	1,112	2,491		
Total.....		5,927	9,693	12,588	16,400

¹ Details not available.

New mills and plants have been completed or are under construction at Krivoi Rog, Zaporozhe, and Mariupol in Southern Ukraine, at Lipetsk in the Central Black Soil region, and at Tula in the Moscow region. Of particular interest is the Azov plant at Mariupol, which started operations in 1934 and consists of blast and open-hearth furnaces, rolling mills, coke and chemical works, and large sintering and flotation plants. The latter are to treat the Kerch vanadium ores which, according to estimates, will yield 500 tons of vanadium a year for the manufacture of high-grade steel.

In Eastern Siberia, iron and steel plants are also under construction, and here, too, a large metallurgical base eventually will be established.

Of special interest are the ferromanganese plant in the Chiaturi district, which has an annual capacity of 50,000 tons and is to be increased to 100,000 tons, and a new plant to be built in the Nikopol district, with 75,000 tons capacity. It has been suggested that Russia may become an important exporter of ferromanganese.

The investments in the iron mines, pig iron, and steel plants during the First Five-Year Plan are said to have been 3,000,000,000 rubles, while over 9,000,000,000 were to be spent during the Second Five-Year Plan. The Third Five-Year Plan was started in January 1, 1938.

From statements and statistics for 1937 it is evident that the shortage in pig iron output already mentioned is felt in the steel plants and is frustrating full production from the steel and rolling mills. It is also reported in the Soviet press that the average quality of the steel has become worse since 1935. There has, however, been an increase in the output of "quality steel", that is, high-carbon and alloy steel, from 680,000 tons in 1932 to 2,350,000 in 1936.

FOREIGN TRADE

SOVIET FOREIGN TRADE MONOPOLY

The principal administrative organization in charge of foreign trade is the People's Commissariat for Foreign Trade. Actual business transactions are conducted for the most part by the foreign trade combines under the jurisdiction of the commissariat. In 1937 there were nine export combines, five import combines, eight export-import combines, and five transport combines. These combines, as will be pointed out hereafter, purchase or sell on behalf of various commissariats or trusts or other organizations attached to the various commissariats.

Apart from these combines, the People's Commissariat for Foreign Trade maintains trade delegations in most of the principal countries recognizing the Soviet Union; these delegations are also authorized to enter into business transactions with foreign firms. In most countries the trade delegations in reality form part of the diplomatic mission and enjoy many of the rights usually accorded to diplomatic missions. The United States Government refused to recognize the right of the Soviet Government to establish a trade delegation in the United States enjoying diplomatic immunity, therefore the place of such delegation has been and is taken by the Amtorg Trading Corporation, a concern organized under the laws of the State of New York but owned, directed, and controlled completely by the Soviet Government. In England, the Soviet Government maintains a trade delegation as well as a trading company known as Arcos, which is incorporated under English law and which functions in a similar way to Amtorg in the United States.

Despite continued pressure by the Soviet authorities, a comparatively small number of foreign firms selling products to the Soviet Union have either consented to sign contracts in Moscow or to include a Soviet arbitration clause in their contracts. This is not true, however, of foreign firms purchasing Soviet goods. A majority of firms in this category have signed contracts in the Soviet Union providing for arbitration as indicated above.

INTERNAL ADMINISTRATION AND ORGANIZATION

The People's Commissariat for Foreign Trade maintains representatives in most of the republics, krajs, and oblasts of the country, as well as in the principal ports. These representatives are directly responsible to the commissariat in Moscow, are attached to the local executive committees in their districts, and hold the position of vice president of the export commission in their respective districts. The function of the export commission is to ascertain what products in each district are obtainable and available for export. After this information has been procured, a report is submitted to Moscow, where a final plan is drawn up outlining the possible exports from each district. It is the duty of the representative of the commissariat to endeavor as far as possible to obtain the goods needed for export and to see that the export plan is executed.

The sale of the products available for export is effected either by the appropriate combine in Moscow to foreign firms that have made inquiry for such products or by the trading organizations abroad

endeavoring to interest foreign buyers in purchasing such products. Whether the contract is signed with the trading organization abroad or with the appropriate combine in Moscow, the latter organization in reality obtains the product and makes the shipment abroad.

The import combines, on the other hand, exercise very little initiative of their own, since they are in general restricted to a predetermined import plan drawn up by the State Plan Commission. These combines are under the direct control of the Import Administration of the People's Commissariat for Foreign Trade and are responsible to it although, as pointed out above, they may enter into direct negotiations with foreign firms to purchase goods on behalf of trusts or enterprises without obtaining prior authorization, provided the latter organization has enough foreign currency appropriations for such purchase. The State Plan Commission, after fixing the import plan for the year, assigns to the chief administrations of the various people's commissariats fixed yearly appropriations from the sums available to be used for the purchase of foreign goods. These sums are allocated among the various trusts or enterprises under the chief administrations; in general, the enterprises must not exceed during any 1 year the sums for the purchase of foreign products allocated to them under the plan. Of course, in certain instances authorization may be obtained for the purchase of additional foreign equipment if it is deemed to be essential and necessary. On the basis of the appropriations allocated to them the various enterprises request the respective import combine to make specific purchases for them. In certain instances the enterprises advise the import combines that they want a particular machine manufactured by a given foreign firm or they may simply indicate to the combine that they want a certain type of machine for a specific purpose, thus allowing the combine to use its discretion as to where the product or machine is to be purchased. The import combines effect the purchase of the required products either by direct negotiations with the firm, if possible, or through its representative attached to the trade delegation or other Soviet organization abroad. As indicated above, the import combines are endeavoring at present to the best of their ability to consummate all purchases with the foreign firms direct rather than through the organizations abroad.

Although the majority of foreign purchases are effected by the various import combines, either directly with foreign firms or through the Soviet organizations abroad, there are certain exceptions to this rule. For example, the People's Commissariat for Heavy Industry, the People's Commissariat for Ways of Communication, and the People's Commissariat for Defense Industry in certain instances make purchases directly from foreign firms rather than through the appropriate foreign trade combine. Under these circumstances the commissariat usually sends a commission of experts to the foreign country to make a thorough investigation of the products or equipment to be purchased, and the final contract is negotiated and signed by the direct representatives of the commissariat attached to the Soviet trade delegation or other organization abroad. This procedure usually is followed only in connection with large, important transactions, such as the purchase of an entire steel mill.

The above paragraphs show that, in general, Soviet foreign trade is conducted according to a prearranged plan.

Regarding the physical handling of products for export, the People's Commissariat for Foreign Trade and the combines under its jurisdiction maintain their own warehouses in the principal ports, as well as a limited number of warehouses in various centers in the country. In general, bulk goods for export, such as coal, petroleum, and wheat, are not stored in separate warehouses but are shipped from the warehouses of the various trusts to the ports, where they are loaded directly on the steamers.

FOREIGN TRADE IN IRON AND STEEL

The published foreign trade statistics for the ferrous industries are shown in the table below.

Export statistics for the ferrous industries of the U. S. S. R., 1932-37

[In metric tons]

	1932	1933	1934	1935	1936	1937
Iron ore.....	342, 272	509, 058	342, 428	158, 195	25, 894	351, 489
Manganese ore.....	415, 000	655, 000	737, 000	645, 000	606, 000	1, 001, 000
Pig iron.....	87	5	115, 401	331, 198	710, 661	137, 272
Other ferrous metals.....	4, 968	4, 661	15, 484	42, 894	49, 793	(¹)
Rails.....	3, 307	32, 450	15, 843	1, 629	12, 185	17, 625
Ferrous metal products.....	6, 000	5, 000	5, 836	6, 224	1, 955	(¹)

¹ Data not available.

Iron ore exports are relatively unimportant. The United States has been the principal market for manganese ore and the Amtorg Trading Corporation of New York acts as sales agent. Pig iron is exported principally to Japan, Sweden, Belgium, and Great Britain. Other ferrous metals are exported to Turkey, Finland, Great Britain, and Estonia. Large shipments of rails have been made to Iran, Mongolia, and Turkey. Exports of the ferrous metal products consisting of structural and sectional iron and steel were made to Turkey, Finland, Great Britain, and Estonia.

Import statistics for the ferrous industries of the U. S. S. R., 1932-36

[In metric tons]

Ferrous metals	1932	1933	1934	1935	1936
In raw state.....	75, 806	48, 735	51, 386	78, 523	74, 225
Products for industrial purposes.....	104, 995	126, 379	78, 066	196, 960	175, 839

The imports of raw ferrous metals included also ferro-alloy materials, such as nickel and tungsten, in which the U. S. S. R. is deficient. The principal sources were Sweden, Norway, and China.

The ferrous metal products included castings, machine parts, and construction steel used largely in the construction of new industrial plants. These were imported principally from Great Britain, Germany, United States, and Belgium.

ADMINISTRATION, OPERATION, PLANNING, AND FINANCING OF SOVIET INDUSTRY

ORGANIZATION OF PEOPLE'S COMMISSARIATS FOR HEAVY, DEFENSE, AND MACHINE-BUILDING INDUSTRIES

In general, all Russian industry is either directly or indirectly under the control of one of the various commissariats of the U. S. S. R. or one of the commissariats of the seven constituent republics. The various commissariats are under the control of the Soviet of People's Commissars of the U. S. S. R. or of the corresponding organization in the constituent republic. Under the new constitution, amended as of January 15, 1938, all commissariats, except those of Local Industry, Education, Municipal Economy, and Social Security, are directly subordinated to the central administrative organ of the country, the Soviet of People's Commissars of the U. S. S. R. All planning and plan fulfillment are under the direct control of the Economic Soviet and the State Plan Commission of the U. S. S. R. and the latter's subordinate planning commissions in the constituent republics.

In practice, all industry and other organizations are under the control of the Central Government in Moscow and the power and functions of the individual commissariats are not as important as they might appear to be at first.

It should be pointed out that after adoption of the new constitution at the end of 1936 the former People's Commissariat for Heavy Industry has been split up into three separate commissariats—the People's Commissariat for Heavy Industry, the People's Commissariat for Defense Industry, and the People's Commissariat for Machine-Building Industry. The separation of the work of the three commissariats may be outlined as follows:

Heavy Industry: Mining, oil production and refining, chemical production, production of semimanufactured goods, and buildings.

Defense Industry: Manufacture of most essential industrial products for the armed forces.

Machine-Building Industry: Manufacture of machinery, parts, and finished articles from the raw materials or semimanufactured products of the Commissariat for Heavy Industry.

The general production plan is drawn up by the State Plan Commission on the basis of data prepared by the various individual enterprises indicating their needs, potential production capacity, and so forth, and with such emphasis as the central authorities desire to place on the output of various products.

DISTRIBUTION OF PRODUCTS BETWEEN PLANTS (SALES)

Under the system of planned economy practiced in the Soviet Union, where all means of production are owned and controlled by the State, the system of distribution or "sale" of the products of the various industries to other State-owned enterprises or to individual consumers has little in common with the distribution systems set up in capitalist countries.

In the Soviet Union the production and distribution of raw and manufactured goods are fixed each year according to a predetermined plan drawn up by the State Plan Commission and approved by the Economic Soviet and the Soviet of People's Commissars. After analyzing the production capacity and requirements of the various

industries, the commission fixes the distribution of the raw and semi-manufactured goods by areas (to coordinate transportation facilities), as well as the proportionate amount of each product that will be required by the various branches of industry using it. The sales and supply divisions of the chief administrations of the producing and consuming organizations, having been informed regarding the fixed plan, distribute the production as well as the material required by the various plants accordingly. The individual enterprises are informed by their chief administration regarding the quantity of the product in question that they are to receive from a given producing plant or group of plants as well as regarding the quantity of products they are to supply to other enterprises. Enterprises then make contracts with one another, fixing the details of the transaction in question, such as quality and dates of delivery of the articles required. These contracts are signed by the enterprises themselves and approved by the two chief administrations involved. The individual enterprises are held responsible for fulfillment of the contract. The prices to be paid for all products are fixed by the central authorities according to plan.

The above outline of the Soviet distribution system covers in general the theory governing "sales" of products among various Soviet enterprises. It will be realized, however, that due to the fact that economic planning on a national scale is still a new science, in practice it has often proved difficult for Soviet organizations and enterprises to live up to the fixed plans for production and distribution. Obviously, if for one reason or another the planned production of any basic material or group of basic materials should not be fulfilled, it affects the production of other industries using these deficit products.

FINANCING OF SOVIET INDUSTRY

As in the case of the Soviet distribution system, the financing of Soviet industry is organized along lines different from those in capitalistic states. This fact is apparent when it is realized that the Soviet State owns all the means of production and fixes all wages and prices to be paid for various products by enterprises as well as by the ultimate consumers.

The control of all financial matters is vested in the People's Commissariat for Finance of the U. S. S. R., which is charged not only with drawing up and verifying all financial plans but also with the approval, supervision, and in certain instances calculation of such matters as wages and prices.

Generally speaking, the financing of Soviet industry is effected in the following five ways: Capital investments, working capital, credits, State subsidies, and revenues from profits.

The capital funds for new enterprises are furnished initially by the Soviet Government through the State budget, while additional capital funds for going concerns are obtained partly from the State budget and partly from the accumulated funds of the industry in question. The capital funds furnished by industry also include specific funds that each industry must by law set aside periodically to cover depreciation for use in effecting capital replacements and repairs.

Apart from the funds for capital investments, each new industry is also given enough working capital by the Government to start opera-

tions. The working capital of going concerns may be added to or deducted from by the chief administration of the industry, in accordance with the needs of the different concerns, and the various industrial commissariats can redistribute surplus working capital among the several organizations under its jurisdiction.

Individual enterprises needing additional capital for operating purposes can obtain short-term credits through the State bank if the enterprise can show that it needs such funds for a specific purpose in connection with its planned and contracted-for production.

Although strenuous efforts recently have been made to put industry, particularly heavy industry, on a profit-and-loss basis, many branches of heavy industry still are operating at a loss and require subsidies from the State to balance their books. It should be pointed out in this connection that under a socialist form of economy, where all enterprises comprising one branch of industry are owned and controlled by the same State organization, the profits from one enterprise can be utilized to offset the losses of other less productive enterprises of the same industry. For this reason the chief administrations of various industries are permitted under the law to redistribute among their various enterprises not only any surplus working capital but also profits or depreciation funds as they may see fit, thus permitting marginal producers to operate who probably would be forced out of business under the capitalistic system existing in most countries. Despite this flexibility many branches of heavy industry still operate at a loss and require State subsidies to make ends meet.

In addition to the financial sources indicated above, Soviet enterprises are permitted to retain certain sums from their operating revenue with which to pay premiums to outstanding workers and to improve general living and cultural conditions.

The Government revenues for financing industry and the national economy as a whole are obtained primarily from a sales tax, generally referred to as a turn-over tax, a large percentage of which is obtained from a direct or indirect tax on agricultural products. Approximately 74 percent of the budgetary revenues for 1937 accrued from this tax, of which approximately 60 percent was obtained directly or indirectly from agricultural products. The bulk of the remaining revenues is derived from the contributions to the budget from the accumulations of the national economy as a whole, State loans, income tax, contributions from social insurance, and the profit tax on State economic enterprises and organizations.

It may be seen from the above that the financing of industry in the Soviet Union resolves itself primarily into a series of bookkeeping transactions. The peasant and the ultimate consumer pay the bill in the form of (1) direct or indirect taxes and (2) comparatively low wages and high prices.

SPAIN

GENERAL STATEMENT

In 1913 Spain produced 9,862,000 tons of iron ore and ranked fifth among world producers. At that time about half of her output was exported to England and one-fourth to Germany and Holland. Since the World War production was halved, and most of the exports continued to go to England. Starting in 1931, labor trouble seriously

affected mining operations, and the annual output dropped to 1,760,000 tons in 1932 but rose to 2,633,000 tons in 1935. Again in 1936, mining was retarded by the civil war, and although no official statistics are available it is estimated that the 1936 and 1937 output was about 1,000,000 tons and rose to over 2,000,000 tons in 1938. About 60 percent of this tonnage is exported, more going to Germany and less to England than in the past. The largest producer is the Orconera Iron Ore Co., Ltd., controlled by British capital, with mines in the Bilbao district. A large portion of its output is sold to local iron and steel works, and most of the iron ore exports to England are made by this company. Permits and payments for iron ore exports from Spain can be made only through the Spanish National Bank.

IRON-MINING DISTRICTS

By far the most important iron ore deposits are along the northern coast of Spain at Bilbao and Santander in the Province of Vizcaya and in the Provinces of Oviedo and Lugo. There are three groups of mines in the hills near Bilbao—the Sommorostro mines near the coast, the Sopuerta mines to the south, and the Galdames group still farther inland. Most of the ore is surface-mined, although future production will depend more and more on extension of underground mining. The ore mined is hematite and limonite, ranging from 48 to 58 percent in iron, with about 1 percent manganese and 0.03 percent phosphorus. In depth, however, these ores change from the oxide to the carbonate form, and more of the lower-grade carbonate ore is now mined as the reserves of higher-grade ores are being depleted.

At the mines of the Orconera Iron Ore Co., the carbonate ore is calcined in 12 furnaces with a total capacity of 1,500 tons a day, and a product containing 58 percent iron is made. There is also a concentrating plant with a capacity of 1,600 tons in 8 hours for the treatment of old dumps, and a 52-percent product is recovered. The total output of the Orconera mines in 1938 was about 850,000 tons. This is ore of good Bessemer grade and for many years has been shipped to the blast furnaces in Great Britain for mixture with the lower-grade ores from the mines along the east coast of England.

In the Santander district are extensive deposits of clay containing 20 to 35 percent of rich iron ore, which is being excavated and concentrated at the large washing plants of the Obregon and San Salvador mines in the Cabarga Mountains, 9 miles from the Bay of Santander. The total annual capacity of these plants is 400,000 tons of product, but the actual output is only 150,000 tons, averaging 57 percent iron. A railroad connects these mines with the port, and shipments have been for the most part to British iron and steel works.

In southeastern Spain the mines at Alquiffe have similar ore deposits and continue to make ore shipments from the port of Almeria. There are other iron mines in the Province of Murcia, which is making small shipments from the port of Aguilas, and in the Province of Malaga, which ships from the port of Marbella.

In the Teruel-Guadalajara district 120 miles east of Madrid are several iron mines in the Sierra Menara Hills, but no information is available as to present activity in this section. The ore reserves in this district are estimated at 65,000,000 tons of developed ore and 24,000,000 tons of possible ore.

ORE RESERVES

The total iron ore reserves were estimated in 1910 to be 711,000,000 tons of developed ore, with 52.5-percent iron content, and about the same amount of possible ore containing 46.6 percent iron. About 75 percent of the ore is hematite, and the balance is classed as spathic ore, which is made usable by roasting.

In addition to the iron ore there is in Huelva a large reserve of iron pyrites exceeding 150,000,000 tons. This material is first treated in chemical works for removal of sulfur, then processed to remove undesirable elements; this pyrite ash is then agglomerated for blast-furnace use. Although these reserves are extensive, the tonnage available each year is governed by the demand for sulfuric acid.

The iron mines in Spanish Morocco at Melille have come into prominence also during the last few years. Estimates indicate that ore reserves amounting to 30,000,000 tons of a 62-percent iron are very low in phosphorus. These mines are said to be equipped to produce 1,500,000 tons a year, and early during the civil war General Franco appreciated their value and assumed control by military force. All exports from these Moroccan mines are made by the Hisma, Ltd., a German-Spanish company formed for this purpose, and all of the output of iron or manganese ore is at its disposal. Most of the ore was exported to Germany in exchange for war supplies.

MANGANESE ORE

The last available statistics, those for 1935, give a manganese ore production of 1,252 tons and imports of 11,297 tons. During the World War in 1918 the maximum output was 77,000 tons, but this declined to 17,000 tons a year in 1931 and since then has dwindled to that of 1935.

Manganese ores occur in the Province of Huelva on the northern slopes of the Sierra Morena near the Rio Tinto mines, where lenses of rhodochrosite and rhodonite are being mined; in the Province of Ciudad-Real, where bedded surface deposits 4 feet thick occur on the plateau of La Serena and consist largely of psilomelane; and in the Province of Oviedo at Covadonga where the deposits of the oxide ore occur capping beds of limestone and are surface-mined. In addition to the production of manganese ore there are the manganimiferous iron ore deposits in the Cartegena region in the Province of Murcia. These contain 10 to 20 percent manganese and 20 to 25 percent iron. This ore was exported to England.

COAL FIELDS

The most important coal deposits in Spain are those in the north-west part of the Province of Asturias, which supplies two-thirds of the total output, and in the Provinces of Cuidad-Real and Cordoba in southern Spain. The total annual output averages about 7,000,000 tons.

IRON AND STEEL PLANTS

The basis of the iron and steel industry is the combination of the iron mines in the Province of Vizcaya and the Austrian coal mines in the adjoining Province of Oviedo. Most of the blast furnaces and steel plants are in these two northern provinces. There are also small

steel-producing plants in southern Spain near the coal fields in the Provinces of Ciudad-Real and Cordoba as well as steel-manufacturing plants near Madrid, Barcelona, and elsewhere.

Production of iron and steel from Vizcaya and of coal from Asturias, Spain

[In thousands of metric tons]

	1929	1932	1935	1936	1937	1938 ¹
Pig iron.....	425	184	241	158	108	226
Steel.....	564	302	355	220	97	254
Coal.....	4,814	4,474	4,527	3,600	276	2,520

¹ 9 months.

Production of iron and steel in Spain, in 1935, by districts

[In metric tons]

District	Pig iron	Steel
Vizcaya.....	241,041	354,856
Asturias.....	70,315	85,626
Santander.....	32,192	30,341
Guipuzcoa.....	3,389	21,056
Barcelona.....		18,742
Valencia.....		69,557
Alava.....	1,141	
Total.....	348,078	580,178

Principal iron and steel companies in Spain

Name	Blast furnaces	Capacity in tons of pig iron	Capitalization, in pesetas ¹
Soc. Altos Hornos de Vizcaya.....	7	500,000	125,000,000
Soc. Metalurgica Duro-Felguera.....	2	60,000	77,500,000
S. A. Fabrica de Mieres.....	2	35,000	12,280,000
Comp. Industrial Asturiana Fabica de Moreda y Gyon.....	1	40,000	20,000,000
Comp. Siderurgica de Mediterraneo.....	2	180,000	75,000,000
S. A. Echevarria.....	1	35,000	22,000,000

¹ peseta=\$0.06.

STRUGGLE FOR MINERAL SUPPLIES

The Spanish Civil War has been largely a reflection of the struggle by the powers behind Franco for raw materials, principally mineral. Spain constitutes a far richer preserve of the basic elements that nourish industry than the former German colonies and Ethiopia.

In 1934 a German-Italian business consortium was formed to exploit Spanish mineral wealth. German interests were represented by the Metallgesellschaft, including the powerful I. G. Farbenindustrie Krupp, and M. G. Dubnikoff of the former organization was sent to Spain as adviser. The Federation of Italian industrialists represented Italian interests.

In Spanish Morocco the German-controlled Hisma Limitado Carranga de Beruhardt was set up and obtained a monopoly of all raw materials from Moroccan mines. A branch organization in

Berlin was called "Rowak"; and the "Hisma-Rowak," under German protection, acted as a clearing house for imports and exports.

British and French capitalists, on the other hand, have been the dominant foreign interests in Spain, and although their Governments do not appear to have made effective protests in support of their interests, many of them still believe that they can always "control" a victorious Franco.

Lack of currency and consequent inability of Germany and Italy to buy freely prevent the mining companies in Spain from profiting from German and Italian armament booms. Now that the civil war is ended it is anticipated by some that British and French capital will flow into the Bank of Spain, that export trade will again be active, and that this bank will help finance Spain's raw material industries. The Penarroya, Orconera, Rio Tinto, and other foreign mining companies in Spain and Morocco may then be in a position to pay dividends again.

NORWAY

GENERAL STATEMENT

The production of iron ore in Norway was begun in the sixteenth century, when charcoal was used to reduce the iron ore to iron. A maximum output of 772,423 tons was reached in 1930, declined to 374,000 tons in 1932, and rose to a new high level with an output of 1,275,000 tons in 1938. Most of this ore is exported to Germany and Great Britain, only a small portion being reduced to pig iron in blast furnaces in Norway. Domestic consumption of pig iron is about 50,000 tons, one-fourth being imported.

The iron ores are essentially magnetite low in phosphorus and sulfur, and a small fraction of the production contains some titanium and vanadium. The main ores average 25- to 35-percent iron content and are concentrated in mills using magnetic separators to a product containing 63 to 67 percent iron, 6 percent silica, about 0.01 percent phosphorus, and the same proportion of sulfur.

The development of cheap hydroelectric power starting in 1900 gave the impetus to expansion of the metallurgical industries in Norway, and today these industries alone consume over a million horsepower.

Electric furnaces are used almost entirely for the production of pig iron, steel, and various alloys, of which Norway produces a number.

The statistical data are as follows:

Production of iron ore, pig iron, ferro-alloys, and steel in Norway, 1929, 1932, and 1935-37

[In thousands of metric tons]

	1929	1932	1935	1936	1937
Iron ore:					
Production.....	746	374	765	847	1,075
Exports.....	734	343	786	994	1,002
Pig iron:					
Production.....	20	19	32	33	36
Imports.....		10	15	25	25
Ferro-alloys: Production.....	134	84	98	135	145
Iron and steel:					
Production.....	4	(¹)	(¹)	(¹)	(¹)
Total imports.....	264	190	268	322	387

¹ Data not available.

In 1938 the steel output declined 25 percent owing to dwindling European market demand.

IRON-MINING DISTRICTS AND ORE RESERVES

Most of the iron ore comes from three sources—the Sydvaranger mines at Kirkenes, the Fosdalen mine at Malm, and the Rødsand mine at Nesset.

The ore produced at the Sydvaranger mine is magnetite with an average content of 34 to 35 percent iron, 0.01 to 0.07 percent phosphorus, 0.01 to 0.07 percent sulfur, 0.1 to 0.4 percent manganese, and 0.04 to 0.35 percent titanium oxide; it is mined by open-pit operations. The ore reserves are estimated to be at least 200,000,000 tons to a depth of 250 meters. The ore is concentrated by magnetic separators that yield a product with an iron content of about 66 percent.

At the Fosdalen mine the magnetite ore contains about 45 percent iron and is mixed with streaks of pyrite; it is mined underground by the shrinkage-stoping method. The crude ore is treated in a magnetic concentrating plant of 1,000 tons daily capacity which yields concentrates containing 65 percent iron. The ore reserves are large.

The ore at the Rødsand mine is titaniferous magnetite containing some vanadium. The iron content of the crude ore ranges between 30 and 40 percent iron. The titanium oxide content is 6.7 percent and the vanadium content about 0.45 percent. The crude ore is concentrated in a magnetic separation plant. The magnetite concentrates from this plant contain 62 to 63 percent iron, 2 percent titanium oxide, and 0.55 percent vanadium. The ore reserves of this mine are extensive.

Estimated reserves of iron ore totaling 383,500,000 metric tons of actual ore and 1,366,000,000 metric tons of possible ore place Norway in a secondary position with respect to Sweden as a source of this essential raw material. Not only are the estimated actual reserves of Norway only about one-seventh those of Sweden, but the Norwegian ore is of a lower grade than that of Sweden.

According to O. R. Kuhn, Norwegian iron ores may be grouped into four classes: Concentrating ore, which represents about 90 percent of estimated reserves; titaniferous ore, a variety of magnetite with an admixture of ilmenite, and second in importance with respect to reserves; direct-smelting ore; and sulfide ore.

ALLOY METALS

MANGANESE

There is no production of manganese ore in Norway, although deposits of considerable importance are being explored. Norway thus depends on imported ore for her ferromanganese industry.

Norwegian imports of manganese ore and exports of ferromanganese, 1934-37

[In thousands of metric tons]

Commodity	1934	1935	1936	1937
Manganese ore: Imports.....	108.5	81.3	102.6	130.7
Ferromanganese: Exports.....	37.3	48.4	59.3	67.1

Most of the ferromanganese production is from Electric Furnace Products Co. at Sauda, a subsidiary of the Union Carbide Co.

CHROMITE

One of the principal iron alloys produced in Norway is ferrochrome, and for this product it is necessary to import chrome ore. During the last few years these imports and the production of ferrochrome was as follows:

Ferrochrome industry of Norway, 1933-36

[In metric tons]

	1933	1934	1935	1936
Production of chromite.....	326	42		
Imports of chromite.....	18,217	37,365	38,178	41,953
Exports of ferrochrome.....	8,000	11,887	11,859	11,036

Data on the origin of imports and destination of exports are not available.

NICKEL

Mining of nickel in Norway was begun about 1840; but toward the end of the century, due to competition with New Caledonian ores, operations came to a complete standstill. At present, mining is conducted only at Evje and Hosanger. There are no estimates as to reserves.

The Flaate mine at Evje produces an ore containing 0.9 percent nickel and 0.65 percent copper, from which a concentrate with 4 percent nickel and 3 percent copper is made, the 1937 output being 15,000 tons. The Hosanger mine produced 4,500 tons of similar concentrates in 1937.

Although inactive, the mines in the Nakkerud district, 25 miles northwest of Oslo rank second in importance to the Evje nickel deposits. Nickel-bearing ores are found in many districts in Norway, but commercially important deposits are relatively few. The nickel occurs associated with pyrrhotite containing some copper. The ore mined is shipped to the Falconbridge Nikkelverk A. S. at Kristiansand, the only nickel refinery in Norway, where it is smelted into a sulfide matte containing about 45 percent nickel and 37 percent copper. From this matter the nickel is separated by the Hybinette electrolytic process, developed in Norway in 1910. This refinery, which was enlarged in 1927, is supplied largely with imported ores from the Falconbridge Nickel Co. smelter in Canada, domestic ores furnishing only about 20 percent of the nickel produced.

Statistics for several recent years follow:

Data on Norwegian nickel, 1930, 1932, and 1934-37

[In thousands of metric tons]

	1930	1932	1934	1935	1936	1937
Nickel ore:						
Production.....	29	23	29	31	33	22
Imports.....	2.1	4.4	8.5	9.0	9.2	12.0
Smelter production.....	1.0	3.1	5.3	5.9	6.1	6.7
Exports of metal.....	.7	4.1	5.6	5.8	6.0	6.8

Of the exports of nickel in 1937, 2,191 tons went to Poland, 1,498 to Italy, 750 to Czechoslovakia, 740 to Japan, 701 to Switzerland, 315 to France, and 254 to the United States.

IRON AND STEEL PLANTS

The iron and steel plants of Norway are relatively small, as many of them produce special steels, including high-speed tool steels, stainless steels, tungsten steel for magnets, and a series of chrome and chrome-vanadium steels for engineering purposes and automobiles.

There are 10 such plants where pig iron or steel and ferro-alloys are produced.

Pig iron is produced by electric furnaces by the Christiania Spigerverk at Oslo and by the Bremanger Kraftselskap at Bremanger. The furnace of the Christiania Spigerverk has an annual capacity of 12,000 to 15,000 tons of high-grade pig iron, while the furnace of the Bremanger Kraftselskap has an annual capacity of 18,000 tons. Christiania Spigerverk also has an electric steel furnace with an annual capacity of 50,000 to 60,000 tons.

Ferro-alloys are manufactured at the following plants:

Plants in Norway that manufacture ferro-alloys

Name of plant:	Situation	Specialty
1. Hafslund Karbidfabrik.....	Sarpsberg.....	Ferrosilicon.
2. Porsgrund Elektrometallurgiske A/S.	Porsgrund.....	Ferrosilicon, ferromanganese.
3. Tinfoss Jernverk A/S.....	Notodden.....	Do.
4. A/S Fiskaa Verk.....	Kristiansand.....	Ferrosilicon, silicomanganese.
5. Electric Furnace Products Co.	Sanda.....	Ferromanganese.
6. A/S Bjølvfossen.....	Alvik Hardanger..	Ferrosilicon, ferrochrome.
7. A/S Meraker Smelteverk.....	Meraker.....	Do.
8. Lilleby Smelteverk.....	Trondheim.....	Do.
9. Ila Smelteverk.....	do.....	
10. Arendal Smelteverk.....	Arendal.....	Ferrosilicon.

YUGOSLAVIA

GENERAL STATEMENT

The iron industry in Yugoslavia got its real impetus during the World War when, under the Austro-Hungarian Empire, the extensive iron deposits of Ljubija near Prijedor in Bosnia are said to have yielded 1,000 tons a day. These mines and others at Vares, north of Sarajevo, which are operated by the State, are today the principal sources of iron ore production. Since 1932 the output of iron ore has increased from 21,725 tons to 630,000 in 1937. Although 70 percent of the iron ore is exported, largely to Hungary, Yugoslavia still imports a large tonnage of pig iron and scrap.

An important advance in Yugoslavia's industrial organization was the registration on August 19, 1938, under a Government regulation issued June 24, 1938, of a Government-controlled company under the designation Yugoslovenski Celik (Yugoslav Steel), with headquarters at Sarajevo, under which will be fused the State-owned steel mills at Zenica (Industrija Gvozdja d. d. Zenica), the Ljubija iron mines, the Vares iron mine and iron foundries, and the Zenica and Breza coal mines. The object of this fusion of enterprises, all of which were

already under Government ownership and direction, in the form of a joint stock company controlled by the Government, is to attain a greater efficiency in management than it has been possible to achieve under ministerial direction; for example, the finances of the company will not be subject to the laws of State accounting, as is the case with Government economic enterprises operated under Government ministries, and the fusion will represent the vertical concentration of industries contributing to steel production, from the raw materials to the sale of the finished product. This national steel company will have full power to engage in all industrial, commercial, and financial activities necessary to promote the purposes for which the company is formed.

Although the output of iron ore in Yugoslavia is now about 600,000 tons, that of pig iron is not adequate to meet domestic requirements, and the balance is made up by imports of pig iron and scrap iron, as shown in the statistical table. To reduce such imports, plans for the expansion of the iron and steel industry, including large rolling mills, armament plants, and coke ovens, were drawn up in 1934, and in 1935 arrangements were made with the Frederic Krupp Co. in Germany for their construction. These have now been completed in part; thus Yugoslavia is becoming less dependent on imports for national needs.

The following table shows the great progress in the development of the iron and steel industry in recent years.

Iron and steel industry statistics for Yugoslavia, 1932 and 1935-38

[In metric tons]

	1932	1935	1936	1937	1938
Iron ore:					
Production.....	21,725	234,729	450,859	629,172	610,000
Consumption.....	21,096	55,176	137,412	129,033	235,800
Pig iron and alloys:					
Production.....	6,959	21,792	44,453	41,006	60,000
Consumption.....	10,737	35,469	60,594	52,161	(1)
Scrap iron: Imports.....	18,166	32,463	43,022	26,126	(1)
Steel in ingots and castings:					
Production.....	40,000	(1)	32,124	(1)	(1)
Consumption.....	41,450	(1)	45,808	(1)	(1)
Manganese ore:					
Production.....	159	928	1,718	4,420	3,200
Consumption.....	191	916	1,568	4,190	(1)
Chrome ore:					
Production.....	39,142	52,367	54,044	59,932	51,000
Exports.....	20,022	21,959	23,781	24,749	(1)

¹ Data not available.

IRON-MINING DISTRICTS

The iron ore production of Yugoslavia is derived from the extensive State-owned deposits of Ljubija, 12 miles south of Prijedor in Bosnia, and of Vares, 25 miles north of Sarajevo. Developed and probable ore reserves of the country are estimated at 200,000,000 metric tons of hematite, limonite, and some siderite.

The hematite ore deposits of the Vares district occur in irregular lenses along a steep overthrust fault between beds of Triassic shales and dolomites, which overlie Jurassic limestone beds. The ore bodies are largely surface-mined, although in some instances underground mining is being done. The principal mines are at Smreka, Drozkovac,

Brazik, and Frzici, along a zone 4 miles in length just south of Vares. The ore mined ranges from 40 to 60 percent iron, 1 to 9 percent manganese, 6 to 12 percent silica, 0.1 to 0.3 percent sulfur, and 0.1 to 0.3 percent phosphorus. The iron industry was founded at Vares in 1846, and once there were 50 small charcoal furnaces and forging plants in the district.

The Ljubija deposits consist of extensive beds of siderite, largely altered to limonite, which occur in shales, sandstones, and limestones of Carboniferous age. The area being mined is 4,300 feet long and 1,600 feet wide; the thickness of the beds is about 500 feet. Within this area are three principal open-cut mines—the Jazavac, Adamisa, and Litica—and the tonnage of developed ore in these mines is estimated to be 30,000,000 tons, of which two-thirds is limonite containing 50 percent iron, 2 percent manganese, and 8 percent silica. The other third is siderite with a 45-percent iron content. The probable reserves of siderite are very great.

About 25 miles northwest of Ljubija is the privately owned Topusko group of iron mines. The ore deposits are limonite and are largely surface-mined. The principal mines are near Utinje and Vojnic.

Scattered over the northern Provinces of Yugoslavia are a number of magnetite deposits along the Ibar River, and extensive deposits of limonite and siderite occur in other areas. However, the lack of transportation facilities and market demand discourage the exploitation of these deposits in the near future.

ALLOY METALS

MANGANESE ORE

Although production of manganese ore is small, it is ample for domestic requirements. The output of manganese ore now comes from an extensive deposit being developed at Stikovo and Jasnovó 30 to 35 miles south of Uzice. The ore bodies here occur in a crystalline limestone of Triassic age near the contact of serpentine intrusives. The minable ore is found along a zone about 160 feet wide, which has been explored for 2,000 feet in length and is known to extend much farther. The ore is surface-mined and hand-sorted. The product, which averages about 53 percent manganese, is transported by trucks over poor roads to the railway station at Uzice. Plans are being made to increase the present production substantially.

Manganese deposits occur at many other points in Yugoslavia; some of these have been productive in the past, but no work is being done on them at present. One of the largest is at Cevljanovici northeast of Sarajevo.

CHROMITE MINES

The relative importance of the chromite industry in Yugoslavia is indicated in the accompanying production and export tables. During the Austrian occupation in 1915-16 greater activity was initiated, roads were built, and certain mines were equipped with modern machinery. This interest continued after the war; but work at many of the mines was suspended owing to lack of capital and to transportation difficulties, so that today the exploitation of chromite is confined largely to a single group in the Ljuboten area northwest of Skoplje.

In this area, as in the other localities, the chromite deposits occur in serpentine near its contact with the intruded Paleozoic schists.

Here the serpentine mass (Ljuboten massiv) covers an area of 20 square miles, being 8 miles long in a north-south direction.

The ore occurs in (1) irregular masses, which are mined by open-cut and underground workings at Orasje and Radusa; (2) lodes, consisting of a series or parallel veins at Kapeojak near Skoplje; and (3) lenticular masses, with chromite disseminated or scattered throughout the serpentine mass, as at Jazince and Ljuboten. All grades of mineralization, from serpentine free from chromite to concentrated mass deposits, are found, and often there are no division lines between ore and waste. The largest deposits are at Orasje and Radusa, and those at Orasje are now the principal producers. The deposits at Radusa were largely mined during the war, when 30,000 tons were shipped from this operation alone.

Smaller mines have been developed on the north, middle, and southern portions of this area, but their production is unimportant.

ALLATINI MINES, LTD.

This company was formed with British capital in 1928 to operate the mines at Orasje 15 miles northwest of Skoplje and a concentrating plant at Radusa which is connected with the mine by a narrow-gage railway 4 miles long.

The mine produces annually about 10,000 tons of hand-sorted shipping ore, which contains 51 percent chromite, and about 50,000 tons of milling ore, which averages about 25 percent chromite and from which about 15,000 tons of shipping ore is obtained.

The ore body is very irregular and limited, as well as displaced by faults. It is developed by adits, drifts, and connecting raises, and from the lowest adit level a shaft has been started. The cut-and-fill method is used, and about 300 men are employed at the mine. The ore reserves are estimated to be adequate for 6 to 8 years at the present rate of production. The mill at Radusa is a gravity plant, with jigs and tables, completed by the Frederic Krupp Co. of Magdeburg in 1929; it has a daily capacity of 100 tons. Plans are being made to increase this plant to 200 tons daily capacity. All of the product from this mine goes to Salonika, from which port it is exported. This company also owns several manganese ore properties along the railway from Skoplje to Belgrade.

LJUBOTEN A. C.

This concern is a joint stock company, with the head office at Skoplje and the mine at Radusa near Skoplje. The ore is mined by the cut-and-fill method and treated at the mill belonging to Allatini, Ltd., at Radusa, to which it is transported by horse-drawn carts. Production in the period 1925 to 1936, inclusive, totaled 48,500 tons; at present, production is conducted at the rate of 9,000 tons annually. The chrome content of the ore ranges from 15 to 50 percent.

ASSEO MINING CO., SKOPLJE

This company exploits chromite deposits along a serpentine belt on the slopes of the Shar Mountain between Uroshevac and Djakovica, variously located at 20 to 55 miles from the nearest railway at Uroshevac. Owing to the altitude, mining operations do not continue throughout the year and cease almost entirely from December to March. The ore is mined by open pits and underground workings and is all hand-picked. Production is limited to ore with 44 to 52

percent chromite; ore under 44 percent chromite is left in the field, awaiting the construction of a washing plant.

MINES IN CENTRAL BOSNIA

At Dubostica small chromite deposits occur in the serpentine masses that intrude the Cretaceous sandstone, shale, and limestone beds. They are relatively small, irregular ore bodies that were actively mined during the war but only contribute a small tonnage to the present annual output of chromite. The mines are situated 10 miles north of Vares, and the ore is transported over a narrow-gage railroad to Zavidovici, where it is concentrated in a mill and shipped for export. The mines are operated by a private company in which the State holds a large interest.

IRON AND STEEL PLANTS

For the production of pig iron there are two blast furnaces in Vares owned by the State—one furnace of 120 tons and the other of 80 tons daily capacity of pig iron. These were built in 1899 and are operated with imported coke. Present annual production from this district is 30,000 tons, and this is to be increased to 50,000 tons.

At Topusko and Beslinac are two other blast furnaces owned by private companies. These use charcoal and have a daily total capacity of 30 tons of pig iron, which is shipped to the Krajinaka Druzba Co. steel works at Fuzina in the northwest corner of Yugoslavia.

Cast-iron foundries are situated in Vares, where cast-iron pipes and other articles are produced; the output in 1936 was 3,800 tons.

At Zenica there are at present three Siemens-Martin furnaces with a capacity of 15, 18, and 22 tons per day, as well as small rolling mills operated by the State.

At Jasenice are larger rolling mills with a total annual capacity of 200,000 tons, but these are operated at only a small part of their capacity, depending on the market demand.

Future plans for the iron and steel industry call for an expenditure of at least 100,000,000 dinars (\$2,300,000) for the erection of five blast furnaces and acid open-hearth furnaces, as well as extension of the electric power plant at Zenica, and a large iron foundry is to be erected between Sarajevo and Podlugovo. Yugoslavia will thus have its own steel center adequate in size to supply most of the manufactured-steel products required for the agriculture, transportation, and construction industries.

Of interest is the report in November 1938 of a new company backed by the I. G. Farbenindustrie and Frederic Krupp Co., capitalized at 10,000,000 dinars, which would supply public-works plants in exchange for mineral products.

GOVERNMENT CONTROL

The mining industry in Yugoslavia is under the direct supervision of the Ministry of Mines and Forests in Belgrade. The Mines Department of this ministry is divided into two divisions. One division is responsible for issuing mining rights and concessions, the safety inspection in mines, and the collection of statistics on production, labor, and accidents. The other division is in charge of the operation and administration of the State-owned mines.

Although Yugoslavia has clearing agreements with many European countries to which minerals and metals are exported, trade with most

of these countries is now being regulated in such a way as to avoid any large accumulation of frozen claims, and the question of delayed payments through the national bank is not one that seriously interferes with the flow of exports. The free movement of minerals and metals may from time to time be influenced by, for instance, trade agreements with other countries whereby Yugoslavia undertakes to supply a fixed quota of a specified mineral to another country. However, at present the movement of exports is comparatively free.

LABOR

About 50,000 workmen are employed in the mining industry of Yugoslavia and of these about one-fourth are members of labor unions. Two such organizations attempt to control labor; one is the Socialist International Union, having about two-thirds of the members and the more extreme ideas, and the other is the Socialist National Union, a more arbitratative organization with about one-third of the members.

Actual strikes are rare, and when they do occur the matter is referred to the mine operators' organization in Belgrade, which discusses the matter with the Federal authorities; measures are then taken to settle the strikes quickly.

HUNGARY

GENERAL STATEMENT

The iron and steel industry, which is at least two centuries old, is the only important metal industry in Hungary. Before the World War, Hungary produced more than enough iron ore to satisfy its domestic requirements and exported one-fourth of the total output, but the large iron mines in Slovakia and smaller ones in Transylvania were lost after the war. Although the output of iron ore has been increased in recent years it has not kept pace with the increased demand, and imports are still large.

The capacity of Hungary's iron and steel plants is more than enough to supply her requirements. Less than one-fourth of the iron that goes into the steel production is from domestic mines. The balance is imported as iron ore, largely from Yugoslavia; pig iron, from Germany and Italy; and scrap iron, from the United States, United Kingdom, and Egypt. Hungary is a large supplier of iron and steel products to Yugoslavia, Rumania, Bulgaria, Sweden, and other countries, in exchange for raw materials.

Production and net imports, Hungary, 1929, 1932, and 1935-38

[In thousands of metric tons]

	1929	1932	1935	1936	1937	1938
Iron ore:						
Production.....	252	52.9	192.4	289	289.5	(1)
Net imports.....	570	83	247	347	485.1	(1)
Pig iron:						
Production.....	368	66.3	195.6	306.3	357.9	335
Net imports.....	3.5	3.5	73	92.6	26.3	(1)
Scrap iron: Imports.....	(1)	25.1	52.7	48.9	56.8	(1)
Raw steel:						
Production.....	513	179.9	446.1	552.5	665.3	655
Net imports.....	(1)	8.3	63	43	27.1	(1)
Manganese ore: Production.....	19	2	6.3	27.2	25	(1)
Coke:						
Production.....	(1)	(1)	23	31	22.7	(1)
Net imports.....	(1)	163.7	167.2	265.3	370.7	(1)

¹ Data not available.

Efforts are being made, particularly by the Government, to expand the iron and steel industry and to increase the domestic production of iron and manganese ores.

IRON-MINING DISTRICTS

The iron ore deposits now being worked are in the Miskolc district about 185 kilometers northeast of Budapest. The ore consists of veins and small masses of limonite and siderite. At present these are surface-mined for the most part. The iron ore reserves are stated in the 1937 *Statistische Jahrbuch für die Eisen-und Stahl-Industrie* to consist of 20,000,000 tons of developed ore and 4,000,000 tons of probable ore averaging 39-percent iron content. In October 1938 Hungary acquired from Czechoslovakia the iron mines at Rozsnyo and vicinity, with an annual output of 240,000 tons. It is believed that a much larger production may be obtained from these mines and iron ore imports reduced. Present iron ore imports are largely from Yugoslavia.

MANGANESE ORE

Manganese ore production in Hungary is from the mines near Urkut at the south end of the Bakony Forest. These were reopened in 1935 by the Deutsche Bank, and the output of the mines is now more than adequate to meet requirements for the steel industry in Hungary and leave a surplus of a few thousand tons for export to Germany. Production is being increased by the working of old mines and by the development of new deposits in other parts of Hungary.

COAL AND COKE SUPPLIES

Lignite from mines in the district is used for generating power both in mining and steel-plant operations; a small part of the coke used for the reduction of ores comes from the coal mines at Pecs, while the imports are from Poland and Czechoslovakia.

IRON AND STEEL PLANTS

In the Miskolc district there are two iron and steel plants. One is owned by the Hungarian Government and is situated at Diosgyor, 6 kilometers north of Miskolc; the other and larger plant is owned by the Rimamurany-Salgotarjani Vasmu R. T. and is situated at Ozd 40 miles northeast of Miskolc. The Government plant is equipped with Martin furnaces. The total annual capacity of these plants is about 700,000 tons of steel, more than ample to meet domestic requirements.

Exports of raw and finished steel products total about 150,000 tons annually and most of these are shipped to the Balkan States.

GOVERNMENT CONTROL

The Austrian mining law of 1854, with minor changes, is still in effect in Hungary. Before 1936 all industries were under the control of the Ministry of Commerce and Communications, which had functioned for many years, but in July 1936 a separate Ministry of In-

dustry was established and took over the inspection and control of the mining industry.

The mining industry's principal organization is the Magyar Bánya és Kohóvállalatok Egyesülete (Hungarian Mining and Smelting Association), which represents the private mine owners and is their officially accepted advisory council. It is a social and scientific organization represented before the Ipari Tanács (Industrial Council), subject to the approval of the Royal Hungarian Ministry of Industry, therefore it is considered a semiofficial organization.

The Industrial Council is a legally established advisory board of the Ministry of Industry, where it is maintained as a separate mining section and acts in an advisory capacity on all mining and smelting questions submitted by the Ministry of Industry.

All regulations relative to mines are executed by the Mining Inspection Division of the Ministry of Industry, in section V (Bánya Felügyelőség) and the divisional offices at Budapest (maintained outside of the Ministry of Industry), Miskolc, Salgotarjan, Pecs, and Rozsnyo. The last is in the territory annexed to Hungary in October 1938.

The divisional inspection offices are the first-stage authority and the mining inspection division in the Ministry of Industry the second- and last-stage authority in all disputes.

Section X in the Ministry of Industry has charge of the business-management control of private oil prospecting and full control and business management of the treasury oil prospecting at Bükkszek and other State-owned fields. The gold, silver, and copper mines at Reesk and the coal mines at Komlo are also controlled by this section of the Ministry.

MINISTRY OF INDUSTRY

The organization of the Ministry of Industry is as follows:

GENERAL DIRECTION BRANCH	PRODUCTION BRANCH
<p>Sections:</p> <ol style="list-style-type: none"> 1. Administration. 2. Preparation of laws. 3. Direction of industry. 4. Supervision of industry. 5. Inspection of mines; divisional inspection at: <ol style="list-style-type: none"> (a) Budapest. (b) Pecs. (c) Miskolc. (d) Salgotarjan. (e) Rozsnyo. 6. Public control office. 	<p>Sections:</p> <ol style="list-style-type: none"> 7. Industrial policy. 8. Large industries. 9. Small and home industries. 10. Power production and distribution control. 11. State mining and mine prospecting. 12. Supervision of State mines and plants. 13. High construction. 14. Labor problems; local offices: <ol style="list-style-type: none"> (a) Coal mine at Pereces. (b) Coal mines at Mussony and Ormospuszta. (c) Iron mines at Tornaszentandras. (d) Diösgyör iron works. (e) State railway machine shops at Budapest and Györ.

Through this organization the Hungarian Government is expanding its activities and acquiring greater national control, particularly of the iron and steel industry.

BULGARIA**GENERAL STATEMENT**

Bulgaria is not an industrial nation and has no plants for the production of iron, steel, or even nonferrous metals. It has, however, important mines producing various grades of coal and iron ore, some copper, and small amounts of lead and zinc ores. With the exception of coal all of these products are exported.

The lack of transportation facilities to many of the known mineral deposits and of capital for their development, as well as the absence of domestic demand for mineral products, has deterred extensive mine developments in Bulgaria.

IRON-MINING DISTRICTS

Iron ore production in Bulgaria has been limited to a few thousand tons a year, all from the mines near Monastir, 12 miles south of Yambol on the railroad line to Bourgas. The ore at these mines is magnetite containing 60 percent iron and low in phosphorus and sulfur. All of the ore is exported to Hungary. The ore reserves of the known deposits are estimated at 60,000 tons of positive and 300,000 tons of probable ore.

Another important deposit is that at Kremikovtzi near Sofia, where a bedded deposit of hematite occurs. This bed is 6 to 15 feet thick and the ore contains 40 to 50 percent iron. Its lateral dimensions have not been determined. In the Strandja district a number of small magnetite deposits of high grade occur near Krumovo but have not been explored enough to permit tonnage estimates to be made. According to the *Statistisches Jahrbuch für die Eisen-und Stahl-Industrie* the total reserves of developed iron ore in Bulgaria are 1,400,000 tons averaging 58-percent iron content.

ALLOY METALS**MANGANESE ORE**

There are several mining concessions for manganese ore in Bulgaria from which the small tonnage exported is produced. The most important deposit is at Pozharovo-Kostinbrod about 15 miles west of Sofia, which is owned by the State. The deposit consists of irregular masses of manganese-iron ores. Thus far over 9,000 tons of ore has been mined and stocked pending eventual exports.

Another deposit owned by a private company is near the coast of the Black Sea 45 kilometers northeast of Bourgas. In 1936, 500 tons was produced containing 45 to 50 percent manganese and 30 percent iron. Operations at this mine were discontinued in 1937.

The regular export markets for Bulgarian iron and manganese ores are Germany, Czechoslovakia, and Hungary.

CHROMITE

There is a group of chromite deposits reported to include important reserves in the Rhodope Mountains in the southern part of Bulgaria near Mastanli. Here occur numerous small masses several feet wide and 30 to 60 feet in length and depth. Considerable interest has been taken in these deposits, and explorations are now in progress, particu-

larly at the Krumovgrad mine. In 1936, 270 tons containing 40 percent chromite were produced, and in 1937 the output was 1,745 tons. The transportation problem is the greatest handicap, owing to the poor roads to the railway station at Mastanli. The freight rate from this place to the seaport of Bourgas is about \$3.00 a ton.

IRON AND STEEL REQUIREMENTS

There are no blast furnaces in Bulgaria, and for the local foundries and machine-construction works pig and steel bars and ingots are imported.

Since the country is not highly industrialized most of the imports are semifinished. Owing to the industrial relations between the two countries and the facilities for cheap shipping on the Danube, a large percentage of the raw-iron imports originates in Germany. Other countries furnishing the remainder of this incoming metal are England, the U. S. S. R., and the Netherlands. Scrap-iron exports are sent to Hungary, Rumania, Germany, Yugoslavia, the Netherlands, and Belgium. These imports have been as follows:

Import and export statistics for Yugoslavia, 1932 and 1935-38

[In metric tons]

	1932	1935	1936	1937	1938
Imports:					
Pig iron.....	4, 119	5, 707	7, 189	4, 947	(¹)
Raw steel.....	723	925	1, 854	2, 068	3, 796
Iron and steel products, semifinished.....	32, 044	37, 986	34, 501	48, 156	(¹)
Railway steel.....	15, 672	5, 755	9, 070	11, 015	(¹)
Sectional steel.....	2, 065	1, 621	2, 529	1, 676	(¹)
Bars and bands.....	4, 944	6, 012	7, 110	7, 304	(¹)
Sheets.....	6, 012	5, 837	7, 363	14, 689	(¹)
Wire.....	1, 062	368	595	727	(¹)
Piping.....	1, 289	3, 250	5, 414	1, 268	(¹)
Exports: Scrap iron.....	1, 096	1, 970	1, 024	5, 088	(¹)

¹ Data not available.

FOREIGN TRADE RESTRICTIONS

The chief obstacle to trade in mineral products, as in other goods, is the lack of foreign exchange for the payment of accounts abroad. The system of clearing agreements with Central European countries regulates the reciprocal trade; and the accumulation of blocked credits in these countries, particularly in Germany, is an inducement to make additional purchases to utilize funds that otherwise would be frozen. Along with these clearing agreements, and even more important in the relations with nonclearing countries, is the system of private "compensation" trade. By this method exporters who accumulate credits abroad may sell their foreign exchange to Bulgarian importers, who, however, usually must pay a considerable premium for the use of these funds. Thus, a Bulgarian importer desiring to import goods from the United States may be required to wait many months for foreign exchange allocated by the national bank, at the official rate of exchange, and in settlement of a duly authorized transaction under a regular quota. By a "compensation" transaction, however, he can obtain the foreign exchange without delay but must pay for a draft on New York a premium that may amount to as much as 35 percent, according to the market, to the trader from whom he buys his exchange. Since Bulgarian exporters regularly have a large credit balance in Germany, reichsmarks can

be bought without a premium or even at a discount. The advantage in favor of Germany, from the point of view of competition in Bulgarian trade, is obvious. By special agreements made from time to time the surplus credits in Germany sometimes are used in indirect trade, as in the purchase, through Germany, of American cotton and copper, paid for in reichsmarks on better terms than if imported direct from the United States.

An important increase in the volume of imports of mineral products is hardly to be expected, but recent purchases of munitions and equipment will be reflected in the annual statistics. The uncertain political situation throughout Europe has led the Bulgarian authorities to study the country's needs in machinery and supplies of raw materials, and special appropriations have been made for financing purchases of these requirements. Budgetary receipts have increased somewhat in the last year, but they would not suffice to finance a heavy armament program. Except for this emergency, it is still the Government policy not to encourage rapid industrial expansion.

GOVERNMENT CONTROL

One of the important Government departments is the Ministry of Industry, Commerce, and Labor. This ministry includes a bureau for the mining industries, which corresponds to an inspectorate of mines. This Mines Bureau functions in three divisions—(1) Mines and quarries; (2) safety; and (3) mining permits and concessions.

Division (1) is divided further into five sections—(a) coal mines; (b) metal mines; (c) quarries; (d) State mine explorations; and (e) metallurgical research.

The State actually operates most of the coal mines that supply the State railways and is conducting some prospecting for iron, manganese, lead, and zinc ores. The State also has laboratories for analytical work and metallurgical research. However, economic difficulties during the last few years have so impoverished the country that the State budget has been unable to provide funds for mineral exploration by the Mines Bureau. As in most of the Balkan States, the mining industry in Bulgaria is being financed by foreign capital, largely French and Swiss. In 1938, however, the Government itself became actively engaged in prospecting for oil, as well as for iron ore and the nonferrous metals. The Mining Commission is doing what it can to interest foreign mining companies and extend to them the facilities to encourage such undertakings.

LABOR

There are about 7,500 workmen and employees in Bulgaria's mines and quarries, including those in the coal and salt industries. The State coal mines at Pernik alone employ about 4,000 workmen.

Labor is plentiful, and the average daily wage is 40 to 50 leva (1 lev=1.2 cents) for unskilled labor and 60 to 80 leva for skilled labor. From this wage there is a deduction for insurance against accident and sickness, half of which is paid by the employer.

Bulgaria also has a system of compulsory labor for young men (troudovaks). These men, under army supervision, are formed in groups for highway work, drainage, flood control, and reforestation. It is a cheap form of labor, and has reduced unemployment. For budgetary reasons it has not been possible to utilize all those eligible for conscription to this service.

The reform legislation has provided a very good basis for labor relations, but so many reforms were considered necessary that the administration sometimes finds it difficult to keep pace with enactments. Since the country has no large industrial centers or floating labor population, strikes and disorders are rare; and the Government encounters little opposition to the program, which after all is clearly designed to improve the lot of the workmen.

The Collective Labor Contract Law (Official Gazette 214, September 22, 1936) provides for labor agreements between an employer, or a representative of the employers' professional organization, and representatives of the workers' professional organization.

Collective labor contracts must be in writing and be duly registered and approved by the Labor Inspectorate. Appeals may, if necessary, be made to the central conciliation committee of the Labor Administration, to the Minister of Commerce, Industry, and Labor, or as a last resort, to the Council of Ministers. Such a case must have the support of more than half the workers in the enterprise in question.

Strikes and lock-outs are forbidden, and strikers are punished by loss of the rights and benefits acquired by virtue of the labor laws. An employer resorting to a lock-out is liable to a fine of 20,000 to 100,000 leva. Persons convicted of agitating labor to strike or employers to engage in lock-outs are liable to prison sentences of 1 to 3 years.

GREECE

GENERAL STATEMENT

Greece has no iron- and steel-producing plants but is becoming more important each year as an exporter of iron, nickel, and chrome ores. This increase in output is due to greater demand and higher prices on foreign markets. The production and export statistics are as follows:

Greek production and export statistics, 1929, 1932, and 1935-37

[In thousands of metric tons]

	1929	1932	1935	1936	1937
Iron ore:					
Production.....	253	46	204	280	300
Exports.....	206	91	271	186	403
Nickel ore:					
Production.....	4.3	20	23.7	50.2	39
Exports.....	20.1	16	23.5	20.5	56
Chrome:					
Production.....	24.2	1.6	29.8	47.3	53
Exports.....	21.6	1.1	33.0	47.5	50
Manganese ore:					
Production.....			.4	1.7	1.4
Exports.....			.4	1.7	1.4

There is virtually no State aid to encourage mine developments and no large exploration companies with Greek capital and technical men to undertake large-scale operations. The State mining laws are liberal, and both Greek and foreign companies are treated alike. The State realizes the need of foreign capital and technical assistance in the development of its mineral resources and is trying to encourage outside investors.

Greece's requirements of iron and steel products during the last few years have been supplied largely by Germany, according to the

terms of the Greco-German clearing agreement, and are paid for in frozen reichsmark credits as a result of German buying of Greek products. During the last few years the difficulty of getting shipments became serious because of Germany's domestic demand for iron and steel and her preference for shipping her exportable surplus to countries where more favorable trade agreements exist. Greece has thus been obliged to import iron and steel products from France and Belgium against payments in cash; due to restrictions on such payments, there has been a notable reduction in iron and steel imports.

IRON-MINING DISTRICTS

The principal iron ore operations on the mainland are the Larymna and Loutsis mines of the Société Internationale des Mines and the Tsouka mine of the Société des Mines d'Atalanti, all within a radius of 10 miles. The deposits are characteristic because of their chromite content; the ores average 48 to 50 percent iron, 1 to 3 percent chromite, 1 to 2 percent manganese, 6 to 8 percent silica, and 10 to 14 percent alumina and are low in sulfur and phosphorus content. They occur along a serpentine belt, are relatively flat with dips up to 30°, range from 300 to 1,000 feet in length and 25 to 60 feet in width, and are developed to 800 feet in depth. The ore is mined principally by underground workings, using the open-stope method without filling. This ore sells for about 6 shillings a ton f. o. b. steamers at ports near the mines, the freight rate being 12 to 14 shillings to north European ports. Germany is the principal purchaser of this product. This same type of deposit occurs on the islands of Euboea and Skiros, about 120 kilometers to the east, where a small tonnage is mined each year. The reserves of iron ore in this district are estimated at 10,000,000 tons.

Iron ore deposits also occur on the Islands of Serifos, Skiros, Ikaria, Cythos, Grammatico (Marathon), and Crete; on the mainland at St. Elisse in the south; at Laurium southeast of Athens; and at Cassandra in Macedonia.

Of these the principal iron ore producers are mines of the Société Française Seriphos-Spiliazaza on the Island of Serifos, where deposits of hematite, limonite, and magnetite occur. These are developed by open-cuts and adits and the individual deposits range in size from a few thousand to 50,000 tons, being 30 to 130 feet in width, several hundred feet in length, and a few hundred feet in depth. This ore contains 52 percent iron, 9 percent silica, and 1 percent manganese and is low in phosphorus and sulfur. The present output is about 150,000 tons a year.

The ore is mined for the most part underground, but about 30 percent is obtained by surface mining. The average output for all labor is 1 ton per man-shift and for underground labor from 2 to 3 tons per man-shift. The ore is transported by small cars, gravity trams, and trucks to the bays of Koutalas and Mega Livadion, which are near the mines on the southern part of the island. Loading docks have been built in these bays.

The total iron ore reserves for Greece, according to the *Statistisches Jahrbuch für die Eisen-und Stahl-Industrie*, 1937, are given as 100,000,000 tons of developed ore and 50,000,000 tons of probable ore, with an average content of 49 percent iron.

ALLOY METALS

MANGANESE ORE

The principal deposit of manganese ore in Greece is near Messenie on the Peloponnesus Peninsula, and outcrops have been traced from the port of Kalamata on the south to Patira on the north. The manganese deposits occur in beds of a metamorphosed hornstone or jasper and limestone as irregular impregnations and masses and in narrow beds averaging 8 feet in width. These deposits usually are small, but there are many of them, the ore being a high-grade pyrolusite particularly good for use in dry batteries. Small shipments have been made, and in addition to extensive development work an ore-dressing plant is under construction.

The most productive mines at present are those at Zirnovon and Nevrokopi near the Bulgarian border northwest of Drama. These yield a product containing 41 to 47 percent manganese.

Present production of manganese ore is about 1,500 tons a year, most of which is exported to Great Britain. The annual output probably will be increased to several thousand tons within a few years.

NICKEL MINES

The mining of nickel ore in Greece was begun in 1910 and reached an output of 20,500 tons in 1915 but was suspended in 1919. During recent years this ore has been of special interest to Germany. The principal nickel mine, the property of the Société Internationale des Mines, with headquarters at Athens, is situated east of Atalanti at Larymna, where the deposit has been developed for about 3,000 feet in length and ranges from 0 to 30 feet in width. The nickel ore occurs in small concentrations of garnierite in an argillaceous gangue along the footwall of the iron ore deposits; these concentrations range from narrow seams up to masses 6 to 10 feet wide and many meters long. The ore mined is carefully sorted at the mine, and from 5 tons of ore 1 ton of concentrates is derived containing 2.5 percent nickel, 47 percent iron, 3 percent chrome, 14 percent alumina, and 8 percent silica. The output per man-shift is 0.25 ton. The average grade of the product shipped in 1935 was 4.5 percent nickel, but in 1937 the grade was only 2.5 percent nickel, while the annual production was much higher. The reserves of this grade of nickel ore are estimated at 500,000 tons.

Up to June 1939 all the ore is to be sold to the firm of Friedrich Krupp under contract. It is being shipped to Oslebshausen near Bremen, where it is treated in rotary furnaces by the Renn method and a product containing 90 percent iron and 10 percent nickel is made. The possibility of introducing a method for reducing the nickel-iron ore in Greece and thus permit lower freight charges is being considered. The present freight rate from Greece to Germany is 12 to 14 shillings a ton.

A new company is now being formed to exploit the iron and nickel mines of Karditsa and Ptoon, both in the Larymna district. The exports go entirely to Germany.

CHROMITE MINES

The production of chromite in Greece has increased from 15,000 tons in 1933 to about 60,000 tons in 1937. Deposits of chromite ore are widespread in Greece and occur in the serpentine areas as irregular

masses of high-grade ore, from a few feet to 80 feet in width and up to 1,000 feet in length. The principal mines are the Domokos mine of the Société Union Minière at Xinias, northwest of Lamia, and the Tsagli mine, west of Volos. Another producing mine at Vavdos south of Salonika is leased by the State to P. D. Vryonis. Lately new mines have been under exploitation along the railway line from Veria to Kozani in Macedonia.

The deposit at the Domokos mine, the largest deposit in Greece, is 30 to 100 feet wide and 1,000 feet long, and the shaft has been developed to a depth of about 170 feet. The ore body dips about 45° and is irregular both in length and depth.

The ore reserves between each 50-foot level are estimated at 50,000 tons. In 1936, 24,000 tons was produced; this was increased to 30,000 tons in 1937.

There are 200 workmen at the mine and a number of women on the sorting floor; the output of ore mined per man-shift is less than 1 ton.

The chromite is hauled 8 miles from the mine by a Decauville railway with a gasoline locomotive to the main railway line, which transports the ore to the port of Aghia Marina. Ships of 12,000 tons can enter the port, and it is possible to load 600 tons a day. The cost of railway transportation and loading is about \$2 a ton, and the freight rates to Baltimore and Philadelphia were increased to \$5.50 a ton in 1938. Of the total shipments in 1936, 20,000 tons was exported to the United States and the balance to Germany, except for a small shipment to Austria.

The product averages 40 percent chromite, 22 percent alumina, 10 percent magnesia, 12 percent iron oxide, and 5 percent silica. The present selling price is \$18 a ton, f. o. b. Aghia Marina. The property is owned by the Société Union Minière of Athens.

At the Tsagli mine a chromite deposit containing about 30,000 tons of ore has been developed to a depth of about 150 feet, principally by adits. The ore is sorted on the surface, and a product with 37 to 40 percent chromite and 4 to 5 percent silica is recovered. A Decauville railway 4 kilometers long connects the mine to the State railway line, which transports the ore to the port of Volos. This mine is owned by A. Apostolides, of Volos, who ships most of his product to New York and Philadelphia. The annual output of this mine is 15,000 tons.

The Vavdos mine southeast of Salonika has also begun to yield an output of 2,000 to 3,000 tons per year. The product contains 45 to 50 percent Cr_2O_3 and 4 to 5 percent silica. The positive ore reserves are only a few thousand tons, but the probable reserves are estimated at 50,000 to 100,000 tons.

GOVERNMENT CONTROL

The General Inspectorate for Mines is under the Greek Ministry of National Economy. It is responsible for the granting of prospecting rights and mining concessions, the investigation of mining operations relative to safe practice, and the collection of statistics. The State does not favor or subsidize mining operations by tax reductions or exemptions or subsidized exports of mineral products. Bills and invoices for minerals exported must be paid through the Bank of Greece, and the exporter receives drachmas. It has become more and more

difficult to transfer these payments back into foreign currency because of Greece's unfavorable trade balance. It is also becoming almost impossible for a mining company to get a permit to pay for its purchases of supplies or mining machinery in any foreign country except Germany because of Greece's obligations to Germany.

LABOR

There seems to be a good supply of workmen in Greece and little trouble from strikes. Labor laws applying to mines are the general labor-protection laws requiring an 8-hour working day, especially for those working underground or doing other unhealthful work, and prohibiting women and minors from working underground or doing night work. There are also laws regulating the responsibility for accidents. Half of the accident indemnity allowed to mine workers is paid by the owner of the mine and half by the miners' fund. Every mining enterprise must establish a miners' fund in favor of the workmen or employees. To this fund, a contribution equal to 2 percent on the total wages paid is contributed by the owner of the mine. The products of mines also are subject to small provincial and port taxes, which vary according to the section in which the mine is situated.

CONCLUSIONS

POLITICAL ASPECTS

No nation in Europe possesses all of the essential minerals needed by its iron and steel industries. Germany, Italy, and Poland lack iron ore, while France, Italy, and Yugoslavia lack coking coal, and most of the nations are deficient in ferro-alloy metals. To meet this lack of mineral raw materials Germany and Italy and, less actively, the other European nations started several years ago to estimate their mineral resources and to draft plans for self-sufficiency to be carried out by Government-financed companies.

Mines formerly abandoned were reopened, and large-scale operations were started on iron ore deposits formerly considered worthless, from which iron could be extracted, with little regard to production costs.

These Governments have been exerting themselves to the utmost to meet their increasing requirements by a comprehensive search and exploitation of domestic iron ore, coal, manganese, and other mineral deposits, by improved methods of exploitation, and by developing satisfactory substitutes for imports. These less-privileged nations believe that greater capacity to produce metals for domestic use as well as for armament means more industrial as well as political power. To make these plans more effective tariff barriers were set up, followed by import-export license requirements, foreign-exchange control, and subsidies to domestic producers. Such regulatory measures are more drastic in Germany and Italy than in other European countries, and the main reason for them is the lack of adequate foreign credit or exchange. As the number of State-financed mining and metallurgical companies in Germany and Italy expands the desire to nationalize the entire industry becomes greater and the actual control by private interests is replaced by Government control. Such control, however, often results in decreased efficiency, higher production costs, and inferior quality of products, as competition is eliminated. This tendency toward nationalization of the industries is causing a gradual

break-down in the heretofore balanced economic set-up. Although the idea of autarchy seemed to be the only solution for these countries several years ago, it has failed thus far to give the desired results. There is, however, a factor favorable to industry that helps to account for the increased annual output of minerals in recent years—that is, labor. The laborers in Germany still have a 48-hour week and in Italy a 40-hour week, but as many work overtime, the average weekly wage per worker is relatively high, and so is the output per man shift. Social legislation provides for old-age pensions, paid vacations, and job security, and labor appears satisfied even though strikes are prohibited.

Economic as well as political penetration in the Central European states and barter trade agreements with South American and other countries are also being made to obtain the required raw mineral products.

STRATEGIC ASPECTS

It is a well-known fact that the desire for mineral resources plays an important rôle in international relations, and in an emergency a nation's capacity to produce the necessary mineral products may throw the balance toward ultimate success or failure. Another important factor is the maintenance of communications with available foreign or colonial sources. With steady increase in consumption of metals and coal in Germany and Italy has come the desire for control of additional sources of supply beyond their borders by acquisition of territory.

The nations rich in these mineral resources—the British Empire, the Soviet Union, and France—are thus confronted by the threat that their strategic position in relation to Germany and Italy may be affected if these countries acquire control of the Central and Southern European countries. It is quite evident, however, from a study of the mineral resources in these countries that even with the mineral resources in Central and Southern Europe to draw from, both Germany and Italy will lack many vital raw mineral products for which substitutes cannot be found.

COMMERCIAL ASPECTS

Political penetration by Germany and Italy in the Central and South European countries has been accompanied by a drive for commercial control of their mineral output. These two nations are competing with one another in this field, as both have a surplus of manufactured products to exchange for the raw mineral products that they lack. This commercial penetration is being effected by barter trade, blocked exchange, and bilateral treaties. These trade arrangements have not been as satisfactory to the Balkan States as was anticipated, and eventually they may react.

On the other hand, Great Britain and France are confronted with the loss of trade with the Central and South European countries and the strategic advantage both Germany and Italy will attain by their drive toward commercial domination of this part of Europe. The foreign trade of the United States with the Central European nations will be similarly affected. More serious, however, to the United States is the drive by Germany and to a smaller degree by Italy to dominate trade in the South American countries by barter trade agreements and other methods.

PRINCIPAL SOURCES OF INFORMATION; ACKNOWLEDGMENTS

Much of the information in this report was obtained from personal contacts with officers of local mining bureaus and mining companies, who were most generous and cordial in supplying technical and statistical details to the writer. These contacts usually were made through the American consular officers who are keeping the Bureau of Mines informed on progress and changes in the mining industries through their voluntary reports.

The writer is particularly indebted to Joseph S. McGrath, chief of the Foreign Minerals Division, Bureau of Mines, for his timely help while in the field and advice in the preparation of the report, also to J. W. Furness and C. K. Leith for their counsel as to the contents of the report. To Walter S. Tower, secretary of the American Iron and Steel Institute, K. Headlam-Morley, secretary of the Iron and Steel Institute of Great Britain, R. Picard, secretary of the Comité des Forges, France, and to F. Blondel, Director of the Comité d'Études des Minières de France d'Outre Mer, the writer is most grateful not only for many letters of introduction to mine operators in Europe but for supplying data and reviewing parts of the report. Robert Miller, M. T. Latus, and E. Thorne of the Foreign Minerals Division have contributed largely in the preparation of the statistical data.

GERMANY

Statistisches Heft, Verein für die bergbaulichen Interessen, Essen. (Statistical review of mines production and mineral reserves.)

Special consular reports to Bureau of Mines by F. B. Atwood and A. W. Kleiforth, American consulate, Cologne.

Zeitschrift für das Berg-, Hütten- und Salinenwesen, Berlin. A monthly mining journal.

Montanistische Rundschau, Vienna. A bimonthly mining journal.

Stahl und Eisen, Zeitschrift für das deutsche Eisenhüttenwesen. Iron and steel weekly magazine.

Weltmontanstatistik, by M. Meisner, Prussian Geological Survey.

Deutsches Bergbau Jahrbuch, Halle. (Mines Yearbook.)

Die Produktion der Kohlen, Eisen, und Hüttenwesen, Berlin.

Vierteljahrshefte zur Statistik des deutschen Reichs.

ITALY

Relazione sul Servizio Minerario, Statistica delle Industrie Estrattive in Italia, Rome. (Italian Mining Bureau Yearbook.)

Gazzetta Ufficiale del Regno d'Italia. (Official Gazette.)

Special consular reports to Bureau of Mines by Lester Schnare, American consulate general, Milan.

La Metallurgia Italiana. (Monthly review published by the National Association of Italian Metallurgical Industries, Milan.)

Statistica di Importazione e di Esportazione. (Monthly foreign trade statistics, Rome.)

GREAT BRITAIN

Statistics of the Iron and Steel Industries by the British Iron and Steel Federation, London.

Annual Report of the Secretary of Mines, London.

The Mineral Industry Statistical Summary and Manganese, issued by the Imperial Institute, London.

Consular reports to Bureau of Mines from American consular officers in Great Britain.

Iron and Coal Trades Review, London.

Annual Statement of the Trade of the United Kingdom with British Countries and Foreign Countries.

FRANCE

Annuaire Comité d'Études Minières pour la France d'outre-mer, Paris.
La Chronique des Mines Coloniales, Paris, issued monthly.
Bulletin du Comité des Forges de France, issued monthly.
Statistique de l'Industrie Minérale en France by Minister des Travaux Public.
(Annual.)
Statistique mensuelle du commerce extérieur de la France.
Consular reports by B. M. Hulley and other consular officers in France.

BELGIUM

Annales des Mines by Administration of Mines.
Statistique des Industries Extractives et Metallurgiques.
Reports by Consular officers at American consulate, Bruxelles.

LUXEMBURG

Reports by International Steel Agreement, Luxemburg.
Annales des Mines, by Administration of Mines, Luxemburg.
Les industries extractives du Grand-Duché de Luxemburg.

SWEDEN

Industri och Bergshantering Berättelse av Kommerskollegium.
Sveriges Handel, Stockholm.
Reports by consular officers at American consulate, Stockholm.
Reports and maps by Geological Survey of Sweden.

NORWAY

Norges Bergverksdrift, Oslo.
Norges Industrie u. Handel, Oslo.
Reports on Norway's Mining Industries, by A. J. Drexel Biddle, American minister to Norway.
Reports by consular officers, American consulate general, Oslo.

POLAND

Annuaire du Commerce Extérieur de la République Polonaise et de la Ville Libre de Dantzig, Warsaw.
Consular reports to Bureau of Mines by M. E. Malige, American consulate general, Warsaw.

CZECHOSLOVAKIA

Zprávy statního úradu statistického Republiky Československé.
Foreign trade statistics of Czechoslovakia, Prague.
Reports by J. H. Bruins and other consular officers, American consulate general, Prague.

RUMANIA

Consular reports to Bureau of Mines by S. T. Mills and others of American consulate general, Bucharest.
Statistica Miniera a Romaniei, production statistics.
Comertul Exterior al Romaniei, foreign trade statistics.

YUGOSLAVIA

Consular reports to Bureau of Mines by R. B. Macatee, American consulate, Belgrade.
Statistique du Commerce Extérieur du Royaume de Yougoslavie.

HUNGARY

Reports by consular officers, American consulate general, Budapest.
Commerce Extérieur de la Hongrie.
Bulletin Statistique Mensuel Hongrois.

BULGARIA

Consular reports by Cavendish W. Cannon, American consulate, Sofia.
Statistique du Commerce du Royaume de Bulgarie avec les pays Etrangers,
Sofia.

GREECE

Tableaux Statistiques du Mouvement Minière de la Grèce.
Monthly Statistics of Foreign Commerce.
Consular reports by H. A. W. Beck and others, American consulate general,
Athens.
Reports by G. L. Jones, asst. commercial attaché, Athens.

UNITED STATES

Minerals Yearbook, Bureau of Mines.
Rice, G. S. and Hartmann, Irving, Coal Mining in Europe, Bureau of Mines
Bull. 414, 1939, 369 pp.
Iron and Steel, U. S. Tariff Commission Report 128.



After this publication has served your purpose and if you have no further need for it, please return it to the Bureau of Mines. The use of this mailing label to do so will be official business, and no postage stamps will be required

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, \$300

—
OFFICIAL BUSINESS

RETURN PENALTY LABEL

This label can be used only for returning official publications. The address must not be changed.

BUREAU OF MINES,
WASHINGTON, D. C.

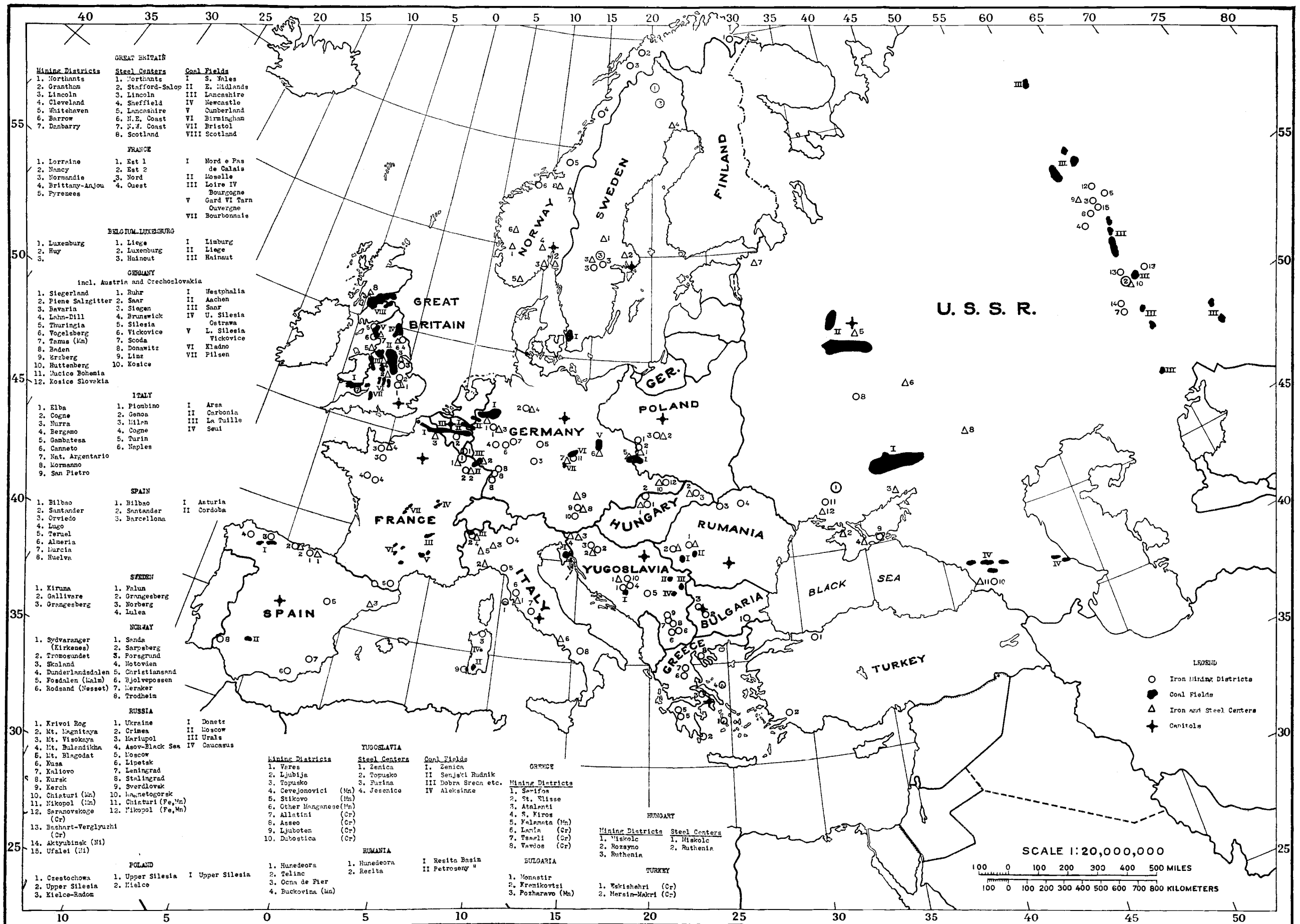


FIGURE 1.—Iron-mining districts, steel centers, and coal fields of Europe.