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ECONOMIC INTELLIGENCE REPORT

THE DEVELOPMENT OF THE MACHINE-BUILDING INDUSTRY IN COMMUNIST CHINA 1949-62



**CIA/RR ER 60-8
April 1960**

**CENTRAL INTELLIGENCE AGENCY
OFFICE OF RESEARCH AND REPORTS**

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FOREWORD

This report examines the development of the machine-building industry of Communist China, with particular attention to the period of the First Five Year Plan (1953-57). The report reviews allocations of investment, growth of production, expansion of the product mix, and effects of the application of Soviet industrial experience. In connection with the application of Soviet experience, the report draws attention to the manner in which Communist economic decisions have been affected by political ideology.

The analysis of the difficulties of applying a highly capital-intensive technology to a country suffering from chronic overpopulation sheds light on the Soviet claim that Soviet industrial experience can be exported anywhere. The analysis is suggestive of certain cautions for underdeveloped countries of Free Asia that also suffer from overpopulation.

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THE DEVELOPMENT OF THE MACHINE-BUILDING INDUSTRY IN COMMUNIST CHINA*
1949-62

Summary and Conclusions

The machine-building industry** of Communist China made impressive advances under the First Five Year Plan (1953-57). With the help of the USSR, and to a much lesser extent the European Satellites, new industries have been established so that Communist China can now produce some large-scale precision machine tools, simple equipment for mining and metallurgical processing, electrical equipment for medium-size power stations, trucks, aircraft, and large locomotives. The total gross value of production by the machinery and equipment manufacturing sector increased at an average annual rate of about 34 percent in 1953-57, almost double the rate of growth for industry as a whole. Rates of growth in machinery and equipment manufacturing were extremely uneven, however, reaching a peak of 90 percent in 1956 and falling to about 4 percent in 1957. In fact, the machine-building industry expanded at such a rapid pace that by 1957 it had outstripped production of raw materials and power, thus necessitating cutbacks in production and underutilization of capacity in many branches of the industry. In 1957 the metal-processing sector of the machine-building industry accounted for about 16 percent of the total gross value of Chinese industrial production and about 3 to 4 percent of gross national product in terms of value added. Nevertheless, China remains significantly dependent on foreign sources for machinery and equipment to support the growth of heavy industry.

Under the First Five Year Plan, approximately 7.2 billion yuan*** were invested in the machine-building enterprises of Communist China. This amount is about 26 percent of estimated total investment in

* The estimates and conclusions in this report represent the best judgment of this Office as of 1 February 1960.

** For a definition of the machine-building industry and its sub-categories, see Appendix A.

*** Unless otherwise indicated, yuan values are given in current yuan, ruble values in current rubles, and dollar values in current US dollars throughout this report. Yuan values may be converted to US dollars at the standard rate of exchange of 2.46 yuan to US \$1, which is not necessarily an accurate reflection of the dollar value, and ruble values may be converted to US dollars at the official rate of exchange of 4 rubles to US \$1, which probably represents a substantial overvaluation of the ruble.

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capital construction for industry and is the largest allocation of investment to any single branch of industry. Investment was very uneven during the period, with severe cuts occurring in early 1957, when many plants were made idle by shortages of raw materials. Somewhat less than 3.8 billion yuan are believed to have been invested in plants producing military hardware and civilian goods with military applications under the former Second Ministry of Machine Building. Of the 7.2 billion yuan allocated to capital investment, additions to fixed assets absorbed slightly more than 6.0 billion yuan. A total of 89 machine-building projects were undertaken during 1950-57, of which 47 projects were completed by the end of 1957. Projects performed with aid from the Soviet Bloc accounted for the largest and most outstanding plants in the industry. Although some new plants have been dispersed in the interior, one-half of the Chinese capacity for producing machinery is concentrated in the northeast.

At the outset of the First Five Year Plan the Chinese Communists placed faith in the broad application of Soviet industrial experience and technology to their own economic conditions. As a result, the growth of the Chinese machine-building industry was closely patterned after that of its Soviet counterpart. Toward the end of the plan period, however, it became apparent to the Chinese that a number of objectives toward which the industry was progressing were unsuitable for Chinese economic conditions and that the manner in which the program of industrialization was being carried out under Soviet guidelines had certain detrimental effects on economic growth, stemming largely from the failure to take maximum advantage of the abundant manpower in Communist China. Development had been unbalanced, wasteful, and costly, although any program for the development of an industrial base carried out on such a large scale and with such haste was almost inevitably bound to incur high costs. Therefore, the Peking regime was forced to reappraise the relevance and applicability of Soviet experience to China. Accordingly, in 1958, drastic readjustments of priorities for production and investment were made to support lagging agricultural growth, and technological policy was revamped to harmonize with the superabundance of labor in China. Except, perhaps, in mechanization of agriculture the Chinese departures from Soviet experience do not imply abandonment of such fundamental objectives of a Communist regime as preferential development of heavy industry, but rather a choice of different means to the same end. Having an economy poor in capital with an oversupply of labor, the Chinese Communists were forced to find new approaches to (1) optimum allocation of the factors of production, particularly labor; (2) the choice of the best technology in the short run; and (3) consequent differences in vertical and horizontal integration of plants and production processes.

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Under the Second Five Year Plan (1958-62), more emphasis will be given to supporting agricultural growth through the programs for irrigation and chemical fertilization. Large-scale mechanization to solve the problem of increasing agricultural production has been rejected as economically unsound because of chronic overpopulation. More investment is required in the raw materials and fuels industries to insure adequate quantities and variety of special steels and supplies of electric power to the machine-building industry. Any slowdown in the expansion of the industry that might be caused by bottlenecks in raw materials, however, would be temporary. The Peking regime is deeply committed to base future economic development increasingly on the foundation of its own machine-building industry, and this foundation, generally speaking, is still weak. Large investments must be made to correct present deficiencies in heavy machinery, precision machine tools, and instruments.

Machinery and equipment constituted between 40 and 60 percent of all imports into Communist China under the First Five Year Plan (1953-57). In 1957, China imported nearly \$580 million worth of capital equipment, almost one-half of which was supplied by the USSR. The contribution of the USSR to imports of machinery by Communist China has decreased somewhat in recent years, whereas that of the Free World has increased. Communist China can now supply about 60 percent of its requirements for machinery and will attempt to attain self-sufficiency of from 70 to 80 percent during the Second Five Year Plan, in spite of a limited capacity for producing complete sets of equipment. Imports of machinery will be restricted to the maximum extent consistent with rapid growth. So far, Chinese Communist exports of selected items of machinery have been insignificant and apparently politically inspired. A slight increase in exports of machinery by 1962 is anticipated.

Communist China continues to depend on foreign sources for specialized equipment, heavy and precision machine tools, measuring instruments, and some other types of equipment. Although steps have been taken to reduce the role of advisers and technicians from the Soviet Bloc, their influence will probably remain strong in electronics, synthetic fibers, metal-forming machinery, and heavy machinery. The dependence of Communist China on the USSR during the formative stages of its industrial development will have long-run effects because of the need for replacement of equipment and for compatibility of design and because of the general technical orientation toward the USSR, particularly on the part of recently trained Chinese engineers. At the same time, these engineers will be expected to adjust their technical standards and specifications to Chinese capacity for production and to take account of the pressing need to utilize abundant manpower.

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I. Investment

A. Priorities

1. Basic Aims

The general aims of the First Five Year Plan (1953-57) of Communist China were very similar to those of the USSR: increased national power, rapid growth, economic independence, and the elimination of capitalistic elements in society. Priority was given to the development of heavy industry, whereas relatively little attention was given to the investment needs of light industry and agriculture. These sectors were looked on primarily as sources of capital accumulation for the further expansion of heavy industry.

Some of these aims had the following direct implications for the development of the machine-building industry: the supplying of military hardware to enhance the military power of the state, the attainment of self-sufficiency at a rapid rate, and the transformation to socialized agriculture through large-scale mechanization. In the USSR, however, investment priorities had not been firmly fixed but were altered rather flexibly as disproportions in growth developed. The necessity for such shifts reflected in part internal contradictions in the basic aims. For example, the emphasis on military power and self-sufficiency was not entirely consistent with the goal of maximum growth.

Although the USSR employed a variety of means to achieve its objectives, the Chinese Communists clearly assumed that the means and the technology employed by the USSR were directly applicable to their program for industrializing the backward and overpopulated areas of China. Moreover, after 1950 the Soviet approach to economic development was inculcated through intensive indoctrination of Chinese cadres. 1/* The Peking regime was particularly anxious for industrialization to bring about a change in the class structure of Chinese society. Industrialization was thought necessary to achieve two aims: the enlargement and collectivization of farms and the transfer of rural population to cities, where the people could be more easily managed. 2/

2. Leading Role for the Machine-Building Industry

Communist theory assigns great importance to the active development of machine building at the initial stages of economic development. According to Stalin, "The core of industrialization,

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its foundation, lies in the development of heavy industry ... or, in the final analysis, in the development of industry which creates the means of production -- in the development of its own machine building." 3/ This attitude was echoed by the Chinese Communists, who asserted that the industrialization of China could not be effected without an independent and integrated machine-building industry.

3. Specific Tasks

To achieve its basic mission, certain broad tasks were assigned to the machine-building industry of Communist China. These tasks included the following:

a. To supply equipment for industrial projects. Although the USSR was to supply 50 to 70 percent of the equipment for the construction projects that were to receive Soviet aid, which were the core of the plan, the remainder of the equipment was to be produced domestically. Other projects were to depend more on domestic sources of equipment. 4/

b. To increase military strength. In order to establish a modern army, navy, and air force, industries for producing armored vehicles, aircraft, and ships needed to be developed. Previously, Chinese arsenals could produce only small arms and munitions and not planes or armored vehicles. The First Five Year Plan called for the establishment of automobile plants and shipyards as well as aircraft plants.

c. To provide a material basis for the collectivization of agriculture. It was planned that by the end of 1957 there would be more than 3 million cooperative farms under unified management. The cooperative farms could not be consolidated, it was believed, without the benefit of tractors and modern agricultural machinery. 5/ It was reported that in 10 years the production of Tractor Manufacturing Plant No. 1 at Lo-yang, which is designed to produce 15,000 tractors -- of 54 horsepower (hp) -- annually, could mechanize one-third of the farmland of Communist China. 6/

To carry out these tasks the plan called for the construction of new plants to produce machinery and equipment for metallurgy, power, mining, transportation, and agriculture. There was also to be some investment in the development of facilities to produce equipment for the petroleum-refining and chemical industries.*

* For the principal projects that were to be undertaken by the machine-building industry to support growth in various industries and sectors, as outlined in the plan, see Table 6, Appendix B, p. 88, below.

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B. Capital Investment*

1. Estimated Investment in the Machine-Building Industry

a. Period of Restoration (1950-52)

During the period of restoration the total industrial investment in capital construction in Communist China amounted to about 2.6 billion yuan,** of which about 14 percent was allocated to the metal-processing sector. Most of this amount was spent for re-equipping old plants, and very few new projects were undertaken. During 1950-52, complete plants constituted a minor portion of the total imports of machinery and equipment from the USSR.***

b. First Five Year Plan (1953-57)

Investment in the machine-building industry under the First Five Year Plan is estimated at 7.2 billion yuan, which was 4 percent more than the 6.93 billion yuan originally planned. Investment in machine building drew 26 percent of the total investment in industrial capital construction, the largest share of any branch of industry.

Investment in the nonmilitary sectors of the machine-building industry rose steadily through 1956 but declined by 30 to 35 percent in 1957 compared with 1956. (See Figure 1.****) This cutback was due to the fact that in 1957 the machine-building industry was unable to operate at capacity because of serious shortages of raw materials.† Consequently, it was decided to give more emphasis in 1957 to investment in the coal, power, and metallurgical industries. 7/

2. Allocation of Investment, by Ministry††

Of the 7.2 billion yuan invested in the machine-building industry under the First Five Year Plan, about 3.4 billion yuan, or 47 percent, were allocated to the metal-processing sector and 3.8 billion yuan, or 53 percent, were allocated to production of military goods. These categories correspond roughly to the First Ministry of

* All investment figures are given in current prices throughout this report.

** See Table 7, Appendix B, p. 90, below.

*** See Table 23, Appendix B, p. 111, below.

**** Following p. 6.

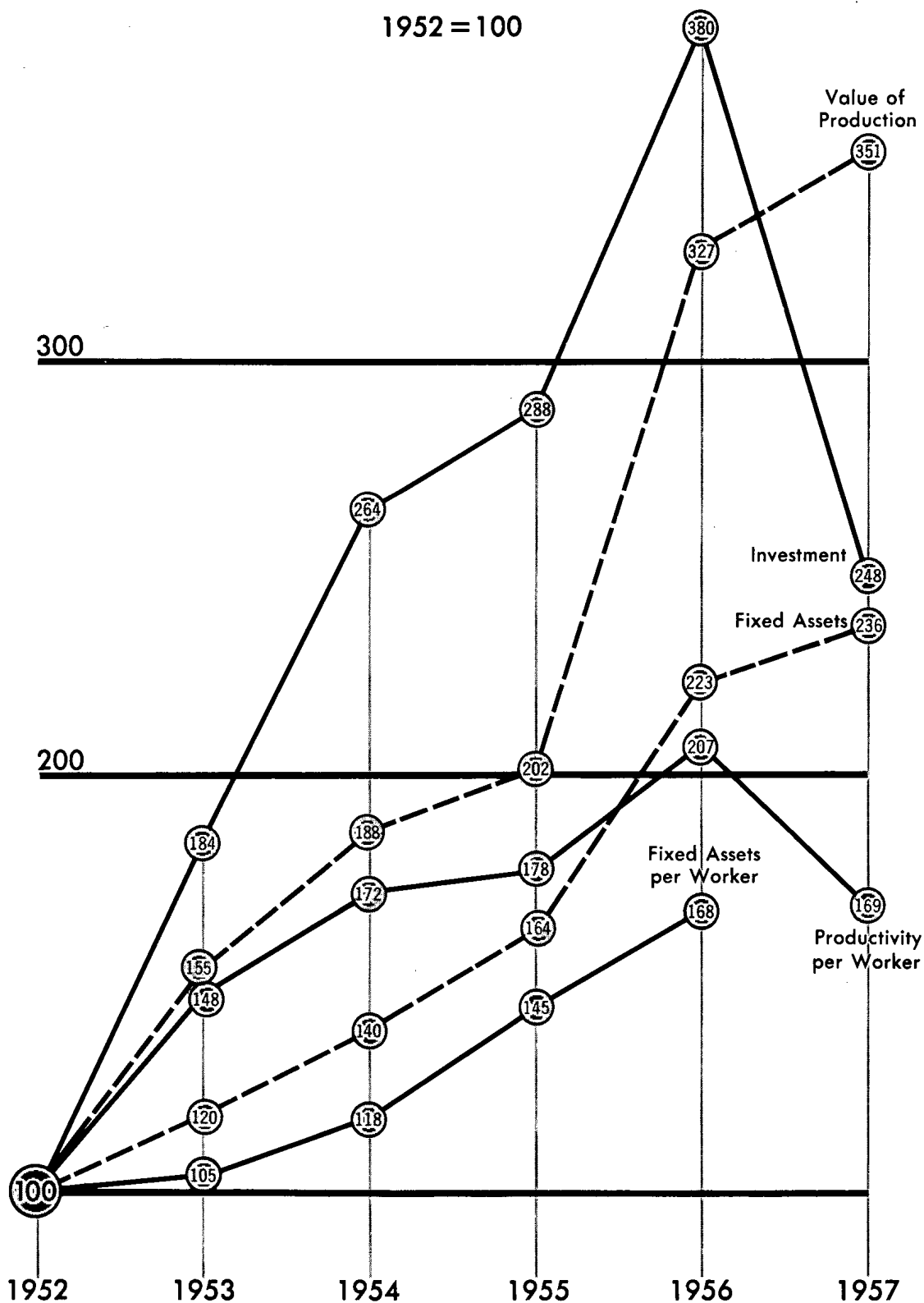
† See II, H, 2, p. 45, below.

†† For a discussion of the ministerial organization of the machine-building industry, see Appendix C.

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Figure 1

Communist China: Indexes of Changes for Selected Functions in the Metal-Processing Sector, 1952-57



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Machine Building, including electrical equipment, and the Second and Third Ministries of Machine Building as these ministries were constituted in 1957.

Lack of specific data does not permit separate estimates for the Second and Third Ministries of Machine Building. Throughout the First Five Year Plan, however, the Second Ministry was responsible for production of weapons and ammunition and probably received the major portion of investment in the military sector. Some of the plants affiliated with the Second Ministry, although engaged in producing equipment closely connected with military production, did actually produce for civilian use such goods as telecommunications equipment and light bulbs. Moreover, production of civilian as well as military aircraft came under the Second Ministry.*

Of the total investment by the First Ministry of Machine Building and the Ministry of the Power Equipment Industry in facilities for production during 1953-56, 91 percent was allocated to above-norm projects** and 77 percent to newly constructed enterprises.*** Relatively little investment in existing facilities was undertaken after 1953.

3. Allocation of Investment, by Type of Product

The largest allocations of Chinese Communist investment in the metal-processing sector during 1953-56 went to communications and transportation equipment, electric power equipment, machine tools, and measuring and cutting tools.**** Construction or reconstruction of 19 machine tool plants, 32 electrical equipment plants, 11 locomotive and rolling stock plants, and 12 automotive transport equipment plants was undertaken or completed during the period January 1950 - January 1958. Most of these plants were actually constructed during 1953-57.

Moderate amounts were allocated for investment in tractors, agricultural machinery, power-producing equipment (excluding electrical equipment), and other branches.

* See Appendix A.

** The term above-norm project as used in the machine-building industry of Communist China refers to a project requiring an investment ranging from more than 5 million yuan, such as machine tool plants, to more than 10 million yuan, such as shipbuilding, tractor, and locomotive plants.

*** See Table 8, Appendix B, p. 91, below.

**** For investment in various types of machine building during 1953-56, see Table 9, Appendix B, p. 92, below.

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Compared with the ambitious programs for construction carried out in those branches of the machine-building industry producing machine tools, electrical equipment, and transportation equipment, the branches producing heavy machinery (metallurgical, mining, and oil-drilling equipment) and chemical equipment received a relatively small share of the funds for investment. Under the First Five Year Plan, however, some investment was allocated to heavy machinery and chemical equipment plants that would come into operation in a later period. Among these plants are the T'ai-yuan Heavy Machinery Plant, the Fu-la-erh-chi Heavy Machinery Plant, and the Lan-chou Petroleum and Chemical Machinery and Equipment Plant. It is probable that investment in the heavy machinery branch was accelerated in 1957, when the equipping of some of these plants began, and that the amount of investment that is allocated to the heavy machinery and chemical equipment branches will be substantial until these plants are fully equipped, probably by the end of 1960.

During 1952-56 a total of 66.55 million yuan was invested in textile machinery plants under the Ministry of the Textile Industry. 8/

4. Allocation of Investment to Equipment and Construction*

In general, the Chinese Communist practice is to expend approximately 40 percent of the capital investment in a machine-building plant for machinery and equipment and approximately 60 percent for plant construction. 10/ This distribution of investment to equipment and construction corresponds generally to Soviet practice. In the USSR, approximately 60 percent of the total capital investment is expended for construction, 30 percent for machinery and equipment, and 10 percent for instruments, supplies, and other minor items. There are, of course, certain variations in these proportions, depending on the type of project and when it was constructed.** Statistics for the allocation of investment to equipment and construction for a comparable group of US industries are not available. Nevertheless, the allocation of investment to equipment and construction for certain manufacturing industries in the US is roughly similar to the Chinese and Soviet allocations.***

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*** In 1956 the allocation of investment for the equipment and construction of new enterprises in the US was as follows 12/:

Branch	Percent	
	Equipment	Construction
Machinery, except electrical	23.3	76.7
Electrical machinery	41.6	58.4
Transportation equipment	51.8	48.2

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C. Growth of Fixed Assets

Of the 7.2 billion yuan invested in capital construction in the machine-building industry of Communist China, additions to fixed assets absorbed about 84 percent, or slightly more than 6.0 billion yuan in 1952-57.* Because of greater investment the growth of fixed assets in production by the military goods sector is estimated to have exceeded the growth of fixed assets in production by the metal-processing sector, but precise figures are not available.

At the end of 1958 the fixed assets of the metal-processing sector amounted to 6.5 billion yuan, of which about 20 percent were nonproductive fixed assets.** About 42 percent of the fixed assets of the metal-processing sector belonged in 1957 to nonelectrical enterprises of the First Ministry of Machine Building.

Corresponding to the increase in the value of fixed assets was a considerable increase in the amount of installed production equipment. During 1952-56 the number of metal-cutting machine tools in the metal-processing sector increased from 80,000 to 157,000. ^{15/} In addition, there were rather impressive gains in newly added capacity for production in operation, particularly during 1956-57, as can be seen from Table 1.***

* See Table 10, Appendix B, p. 93, below. Investment in capital construction becomes an addition to fixed assets when the plant in which the investment is made goes into operation. In any one year, therefore, many investments in capital construction are made that do not become additions to fixed assets until a later year. In an industry that is expanding as rapidly as the machine-building industry of Communist China, there is a tendency for investment in capital construction in a relatively short period to be greatly in excess of additions to fixed assets. [redacted]

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** The term productive investment as defined by the Chinese Communists and as used in this report refers to investment allocated to the construction of plant buildings and machinery and equipment for the purpose of production; to railroads, highways, seaports and wharves, and other means of transport; and to warehouses for commercial and financial enterprises. The term nonproductive investment (or investment in consumer construction) refers to investment allocated to construction for such material and cultural needs of the population as housing, schools, hospitals, cinemas and theaters, nurseries, clubs, dining halls, and public office buildings. ^{14/}

*** Table 1 follows on p. 10. (Text continued on p. 12.)

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Table 1

Additions to Capacity for Annual Production by the Machine-Building Industry
 of Communist China a/*
 1953-57

<u>Period and Commodity</u>	<u>Unit</u>	<u>Additional Annual Capacity in Operation <u>b</u>/</u>
1953-56		
Metal-cutting machine tools	Number Tons <u>c</u> /	4,270 20,079
Turbogenerators		
Steam	Kilowatts	240,000
Hydraulic	Kilowatts	204,000
Turbines		
Steam	Kilowatts	276,000
Hydraulic	Kilowatts	204,000
Boilers	Tons Steam output in tons per hour	6,050 45,218
Trucks	Number	30,000 <u>d</u> /

* Footnotes for Table 1 follow on p. 11.

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Table 1

Additions to Capacity for Annual Production by the Machine-Building Industry
of Communist China a/
1953-57
(Continued)

<u>Period and Commodity</u>	<u>Unit</u>	<u>Additional Annual Capacity in Operation <u>b/</u></u>
1953-57		
Metal-cutting machine tools <u>e/</u>	Number	8,704
Turbogenerators <u>f/</u>	Kilowatts	540,000
Electric cable and wire	Tons	12,000
Electric motors	Kilowatts	350,000
Switchgears <u>g/</u>	Number	8,000
Transformers	Kilovolt-amperes	390,000
Precision meters	Number	1,035,000

b. At end of period.

c. Tonnages are given in metric tons throughout this table.

d. For a discussion of estimated capacity in the motor vehicle industry, see II, F, below.

e. This estimate overlaps the data given for 1953-56.

f. This estimate overlaps the one given for 1953-56 and should be compared with the combined production of turbogenerators listed separately for that period.

g. Including both high-voltage and low-voltage types of switchgear.

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D. Loans for Industrial Projects

Soviet assistance to industrial construction projects has been one of the most significant factors in the rapid industrialization of Communist China since 1949.* This assistance has taken the form of two economic credits totaling 1.72 billion rubles, against which the Chinese Communists have drawn to help pay for imports from the USSR. These imports include equipment for the construction of the 166 major projects that the USSR promised to help China construct. The equipment, which the USSR agreed to deliver during 1949-62, is valued at 8.1 billion rubles, including all the technical assistance involved. 17/

Assistance from the European Satellites for construction projects in Communist China has not been given in the form of loans but has been financed out of current trade. Each of the Satellites has established a special ministry within its administrative structure that handles trade involving complete installations or projects. This trade has been quite distinct from incidental trade in machinery, which in some cases has been quite extensive. As of early 1958 the Satellites had furnished China with about 27 complete installations.** The estimated cost of these complete installations is about US \$1 billion, of which about 40 percent represents plant equipment.

E. Problems of Investment

1. Misallocation of Investment

As previously noted, the Chinese Communists apparently assumed that the Soviet experience in development would suit their conditions. This assumption proved to be wrong in many cases, and, as a result of having followed Soviet precedents closely, much of the development of the Chinese machine-building industry was misdirected. One of the most notable mistakes that resulted from the indiscriminate application of Soviet experience was the costly failure of the program for the large-scale mechanization of Chinese agriculture. Of the Chinese investment in new machinery plants, the Peking regime spent at least 6 percent to build plants for producing tractors and heavy implements until, when the plants were nearly completed, it was discovered that such tractors and implements were almost entirely unsuitable to Chinese conditions. The tractors were very expensive to build, consumed large quantities of scarce steel materials, and required an advanced productive technique. Moreover, this machinery would strain the limited Chinese facilities for production of oil and would displace

* For a discussion of industrial projects, see II, B, p. 17, below.

** See Table 2, p. 19, below.

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farm workers who could not be absorbed in other sectors of the economy. ^{18/} Agricultural machines were produced in large numbers in 1956, but many of them, such as double-wheel, double-share ploughs, lay idle because they were not suited to Chinese conditions.

Moreover, Chinese Communist investments in the machine-building industry were too widely diffused. This diffusion is explained at least in part by the fact that the regime followed Soviet experience too closely in pursuing the aim of self-sufficiency. Chinese leaders became imbued with the intense Soviet zeal for economic independence from the West and regarded dependence on imports of capital goods from capitalist countries as a fundamental structural weakness in their economy that had to be eradicated as soon as possible. Particularly under the impetus of the Korean conflict, the Chinese were impressed by the need for rapid improvement in the industrial support for national defense and emphasized a broad approach to the development of the machine-building industry. As a result, they dispersed their investments in an attempt to create simultaneously a number of new branches of machine building instead of concentrating on certain branches the development of which would have contributed most to a balanced economic growth. Such action led to further autarky in the industrial growth of the Sino-Soviet Bloc. In this respect, Chinese mistakes in planning tended to follow the pattern of a number of the European Satellites during the early 1950's. The law of comparative advantage and specialization in intra-Bloc trade was sacrificed for the political objective of self-sufficiency.

2. Excessive Cost of Investment

In the First Five Year Plan (1953-57) Chinese Communist leaders enunciated strong aspirations to reach the most advanced level of technology in a short time with the help of the USSR. Soviet technology was extensively but rigidly and indiscriminately applied in the reconstruction and development of the machine-building industry. By 1957 the unfortunate results of this policy had become strikingly apparent. Much industrial investment was wasted in excessive non-productive investment. Moreover, rigid adherence to Soviet design specifications and the overemphasis on modernization demanded very heavy investments and a technical level which was extremely difficult for the Chinese machine-building industry to attain. This policy caused underutilization of existing capacity and helped to create an excessive demand for foreign equipment.*

The tendency of Soviet industrial plans to require a high proportion of nonproductive investment is believed to be a source of

* See II, H, 1, p. 44, below.

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considerable dissatisfaction on the part of the Chinese Communists. The Chinese commented with a trace of bitterness that nonproductive investment took up 24 percent of total investment under the First Five Year Plan. 19/ The rate of nonproductive investment declined from 22.4 percent in 1956 to 20 percent in 1957. 20/ The Chinese have admitted that in numerous cases they tried to copy the most modern industrial and municipal designs of the USSR, which called for housing and other facilities on a scale that was lavish by Chinese standards. 21/ This fact is well illustrated in the construction of some of the largest machine-building plants at Ch'ang-ch'un, Lo-yang, T'ai-yuan, Fu-la-erh-chi, and other centers. A vice minister of the First Ministry of Machine Building complained that investments by certain enterprises of the industry were too broad in nature, often including roads, bridges, antiflood work, water supply, schools, and even banks, post offices, department stores, and co-operatives. 22/ Thus the Chinese apparently borrowed from the USSR the highly integrated and detailed plans for "industrial cities," which provided for every facility from industrial plants to schools, hospitals, and bus stations to be established at a new location. 23/

Excessive nonproductive investment has a retarding effect on economic growth, for when too many factors of production are channeled into nonproductive work, the absolute growth of production is reduced. Moreover, imbalances in raw materials are aggravated as large proportions of scarce resources flow into nonproductive assignments. These effects combine to raise the cost of investment per unit of increased capacity for production and thus to reduce the productivity of industrial investment. The result is to hinder the improvement of living standards by delaying the realization of higher employment and possibly per capita national income. An awareness of such effects of nonproductive investment is believed to have resulted in several corrective measures that were written into the proposals for the Second Five Year Plan: (1) greater use of medium-scale and small-scale plants that can be located at established centers of population and (2) rigorous scrutiny of plans for construction borrowed from the USSR and the European Satellites to eliminate nonessential items.* The Chinese Communists, it is interesting to note, have had some sobering experiences with the high cost of investment in new industrial areas such as Sian and Lan-chou. The rapid influx of population into these areas has involved considerable outlays for urban public utilities, residential housing, and other nonproductive facilities. 24/ In an effort to economize on investment and eliminate as much nonproductive investment as possible, the Chinese may have reconsidered some of their plans for locating industries away from the strategically vulnerable coastal regions.**

* See IV, B, 5, p. 71, below.

** See IV, B, 6, p. 73, below.

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3. Failure to Seek Quick Returns on Investments

When Soviet technical assistance and aid for Chinese Communist industrialization was announced in September 1953, an important role for existing plants was clearly intended. 25/ According to the official plan issued in 1955, 70 percent of the increase in the total value of industrial production between 1952 and 1957 was to be derived from existing enterprises. 26/ Of the new plants under the First Ministry of Machine Building that were scheduled to be constructed under the First Five Year Plan (1953-57), only 24 percent were to start operation by the end of 1957, and 38 percent were expected to start operation in the early years of the Second Five Year Plan (1958-62).

Under the First Five Year Plan, 85 percent of the investment in machine tool plants was scheduled to be devoted to the construction of new facilities and 15 percent to the reconstruction of old facilities. Reconstructed plants, however, were to account for 52 percent of the total production of machine tools. 27/

The task assigned was formidable, and the existing plants were not markedly improved and remained a weak link in the production force during the plan period. For example, Automobile Plant No. 1 at Ch'ang-ch'un, although a wholly integrated plant for major components, is dependent on 42 outside plants that make one-third of the parts which go into the vehicles produced, and 40 of these 42 plants are outmoded. This fact indicates that the problem of raising the technical standards and expanding old plants must be faced if the old plants are to work in cooperation with newly constructed plants that operate at high technical levels. The improvement of the old plants means further exploitation of their potentials by increasing the utilization factor of their equipment. The Shanghai Boiler Plant was remodeled between 1954 and 1956 to increase its capacity for production considerably, but it has been stated that a further investment of 10 million yuan could raise its capacity for production by 150 percent. Investment of 3.8 million yuan in remodeling the Tungyung Machinery Plant in Canton reportedly would increase its capacity for production by 83 percent. 28/

It was admitted that, in spite of the early resolve to exploit possibilities for investments yielding quick returns, this goal had not been sufficiently emphasized during 1953-57. There was considerable latent capacity in existing industrial enterprises, particularly those in coastal areas. 29/ An investigation of 22 state and public-private machine-building enterprises in Shanghai (mostly electrical equipment plants) concluded that, with an investment of only slightly more than 42 million yuan, the total annual production

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by the rebuilt plants could be raised to 220 million yuan. 30/ Mao Tse-tung himself, in his famous speech on "contradictions," stated in effect that even by 1957 full use had not been made of the industrial capacity that had existed before 1949. 31/

These experiences indicate that the Chinese Communists lost an outstanding opportunity to get the maximum effect from funds accumulated at great sacrifice from the populace. Small investments in reequipping of existing plants could have yielded relatively large gains in production. For instance, reconstructed machine tool plants required 30 percent less investment per ton of products than did new plants. 32/ This course of action, however, was not without its drawbacks. Conceivably, if the Peking regime had concentrated on fast-yielding investments in machine building, it might have hastened or aggravated short-run economic imbalances due to lagging growth in the industries producing raw materials. This effect could have been somewhat mitigated, however, because a smaller construction program would have been needed to achieve the same levels of output. In deciding to build spectacular modern plants in the interior to "catch up with the West" in the shortest possible time, Chinese Communist leaders undoubtedly were influenced by the desire for prestige as well as the desire not to increase reliance on vulnerable coastal areas. Moreover, the failure to exploit latent capacity in the smaller plants was partly political. The regime was reluctant to build up these enterprises, particularly in the coastal cities, until transformation to socialization had been accomplished by the end of 1956. 33/

II. Production

A. Machine-Building Industry in 1949

The machine-building industry that the Chinese Communists inherited in 1949 was disorganized and in disrepair. Most of the machinery had been dismantled by the USSR, and without large-scale reconstruction the industry could not support the ambitious goals for industrialization of Chinese Communist leaders.

1. China Proper

In 1949 the machine-building industry of China proper was virtually nonexistent, most of the firms consisting only of small repair shops. Although some development of the machine industry had taken place in the interior under the impetus of wartime conditions, the industries of China proper had largely stagnated during 1930-49. Capital stock in the relatively developed coastal cities had been largely depleted before World War II. 34/ Further deterioration took place during the war and the economic chaos that followed.

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2. Manchuria

Most of the development of the machine-building industry in China before 1949 had been concentrated in Manchuria. During the 1930's the development of the machine-building industry in Manchuria lagged because of restrictive Japanese policies, but the advent of World War II altered the development of the industry. After 1942, most of the machine building plants in Japan were forced to switch to armaments, and it became difficult to supply Manchurian needs for machinery. Consequently, the expansion of such production in Manchuria was accelerated, and development proceeded according to a clearly defined outline. In spite of this development, Manchurian machine building remained weak. The industry was limited to the assembly and installation of communications equipment and motor vehicles and was unable to produce large machines, precision machines, and many types of spare parts. 35/ According to the Pauley Reparations Commission Report, Soviet removals of machinery and equipment from Manchuria reduced by 80 percent the capacity for production by metalworking shops (excluding the railroad repair shops). 36/

B. Plants

1. Number

During the period of the Chinese Communist First Five Year Plan (1953-57), it was stated that the construction of more than 80 principal machinery and equipment plants would be undertaken during 1953-61. 37/ These plants were to serve as the foundation for building a modern, independent machine-building industry for Communist China.

It was reported that 33 major machine-building plants were put into operation during the first 4 years of the First Five Year Plan. 38/ Later, it was claimed that by the end of 1957 more than 39 above-norm machine-building projects had been completed. 39/ In general, an analysis of available plant data supports this reported information.*

* There are numerous difficulties in determining the exact number of plants completed. For example, the Chinese Communists often speak of "above-norm machine-building plants" or "major machine-building plants" without giving precise definition of meaning. Consequently, although an analysis of information on plants shows that 47 machine-building plants were completed by 1957, it is possible that only 39 of these are considered by the Chinese to be "above-norm" projects. Moreover, it is not known whether or not a plant is considered completed after first phase construction is finished and partial operation commences, with the second phase of construction set for a later date. A third difficulty derives from the fact that construction dates for all the plants are not available.

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The USSR and the European Satellites have assumed an important role in the construction of industrial plants in Communist China. As shown in Table 2,* the USSR committed itself to assist China in the construction of 166 major industrial projects.** The importance of these projects can be seen in the fact that the plants built with Soviet assistance are scheduled to account for nearly 60 percent of planned production in 1962. 41/ Although Table 2 shows that only 28 of the 89 machine-building projects started by the end of 1957 had received aid from the Soviet Bloc, these projects were the outstanding machine-building projects undertaken during the First Five Year Plan. Among them were such projects as the Ch'ang-ch'un Automobile Plant No. 1, the T'ai-yuan and Fu-la-erh-chi Heavy Machinery Plants, the Lo-yang Tractor Plant No. 1, and the Ch'eng-chou (Ch'eng-hsien) Grinding Machine Plant, which represent the largest, most advanced, and most modern plants in their respective sectors of the machine-building industry.

2. Description

To transform the weak and backward machine-building industry, the Chinese Communists established large installations with the most modern machinery and techniques. It was impossible for Communist China, with its low technological level and scarcity of mechanical skills, to construct modern machine-building plants without the massive foreign assistance that the USSR provided. In spite of the abundance of labor in China, few labor-intensive investments were undertaken in this industry. Instead, the large-scale, modern plants undertaken by the Peking regime were based on advanced labor-saving technology. Undoubtedly the decision to invest in this fashion was based in part on noneconomic motives: the desire to achieve self-sufficiency, greater military power, and international prestige, all within the shortest possible time.

This pattern of investment is reflected in the general characteristics prevalent in Chinese Communist plants constructed with Soviet assistance -- that is, high building costs, large investments in nonproductive aspects of the plants, large size, complex and specialized equipment, and highly mechanized production techniques. For example, the Fu-la-erh-chi Heavy Machinery Plant,

* Table 2 follows on p. 19.

** For 3 years following April 1956 the number of Soviet aid projects was reported as 211. Of this number, only 205 were considered by the Chinese Communists to be industrial construction projects. The remaining six involved the construction of research institutes and the renovation or expansion of previously constructed projects. In April 1959 it was reported that the number of projects had been reduced from 211 to 166 as a result of the merging of some of these projects during their construction. 40/

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Table 2

Number of Industrial and Machine-Building Projects in Communist China
Performed with Aid from the Soviet Bloc
1950-58

<u>Project</u>	<u>Soviet Aid Projects</u>	<u>European Satellite Aid Projects</u>	<u>Chinese Projects ^{a/}</u>	<u>Total</u>
Industrial projects				
Planned ^{b/}	166	68	460	694
Begun by end of 1957 ^{b/}	135	64	722	921
Completed by end of 1957 ^{b/}	68	27	333	428 ^{c/}
Machine-building projects				
Begun by end of 1957	23 ^{d/ e/}	5 ^{d/}	61 ^{f/}	89 ^{d/}
Completed by end of 1957	11 ^{d/ e/}	3 ^{d/}	33 ^{f/}	47 ^{d/}
Other machine-building projects				72 ^{g/}

a. Above-norm projects only. The term above-norm project as used in the machine-building industry of Communist China refers to a project requiring an investment ranging from more than 5 million yuan, such as machine tool plants, to more than 10 million yuan, such as shipbuilding, tractor, and locomotive plants.

b. 42/

c. In addition, 109 projects had begun partial operation.

e. These data do not agree with the Soviet statement that 28 machine-building enterprises that had been constructed with Soviet assistance went into full or partial production during 1953-57. 44/

f. Data derived by subtracting from the total number of projects the number of projects undertaken with aid from the Soviet Bloc.

g. Including plants that were in existence before 1950, plants for which construction dates are not available, and plants the construction of which commenced after 1 January 1958.

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which is under construction, will be highly mechanized and automatic. 45/ Reportedly its 16 shops will be equipped with remote control instruments and other automatic devices as well as highly efficient machinery to permit production of such products as steel rolling and smelting equipment, blooming machines, open hearth furnaces with capacities of 500 tons each, and blast furnaces with capacities of 1,500 cubic meters each. 46/ The recently completed Ch'eng-tu Measuring Instrument Plant is also of modern design and is equipped with the most up-to-date equipment. 47/ The workshops are equipped with pushbutton and semiautomatic tools and automatic controls for temperature, humidity, and dust. 48/ These highly mechanized methods, which are characteristic of the machine-building plants built with Soviet aid, are clearly illustrated in photographs of the interiors of these plants. The accompanying photographs of various shops of Automobile Plant No. 1 at Ch'ang-ch'un show automatic transfer lines in production of engines and the extensive mechanization of materials-handling operations, as shown in Figures 2 through 5.*

A large portion of the equipment for these new, modern plants was imported from the USSR. According to the Chinese Communist First Five Year Plan the USSR was to supply 50 to 70 percent of the equipment for the projects constructed with Soviet aid, and the remainder was to be domestically produced. Other projects were to depend more on domestic sources of equipment. 49/ Because these large plants using modern production techniques required modern and complex machinery that the Chinese Communists could not produce themselves, the Chinese depended primarily on the USSR for equipment to outfit these plants.

Another characteristic of many of the new machine-building plants in Communist China is specialized production. For example, several of them were designed to make only one type of machine.** 50/

As a result of emphasis on large-scale projects, there has been a substantial increase in capital investment per worker in the metal-processing sector of the Chinese Communist machine-building industry, as shown in Table 3.***

C. Reliance on Technical Aid from the Soviet Bloc

Following the outbreak of the Korean conflict and the imposition of the Western embargo, the foreign trade and aid of Communist

* Following p. 20.

** For a discussion of the problems resulting from specialized production, see IV, B, p. 76, below.

*** Table 3 follows on p. 21.

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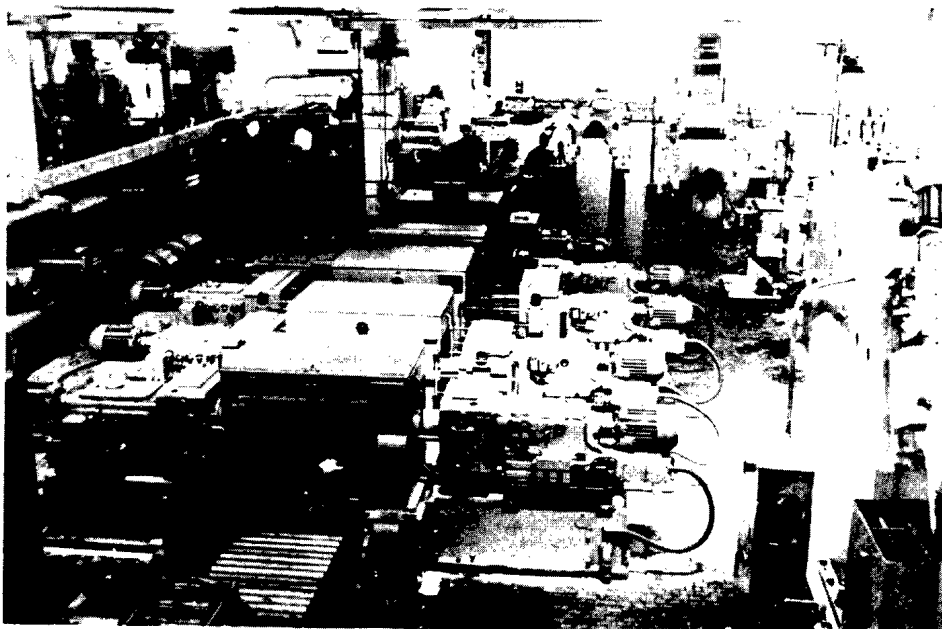


FIGURE 2. Communist China: Machining of Cylinder Blocks by Automatic Transfer Machines in the Ch'ang-ch'un Automobile Plant No. 1

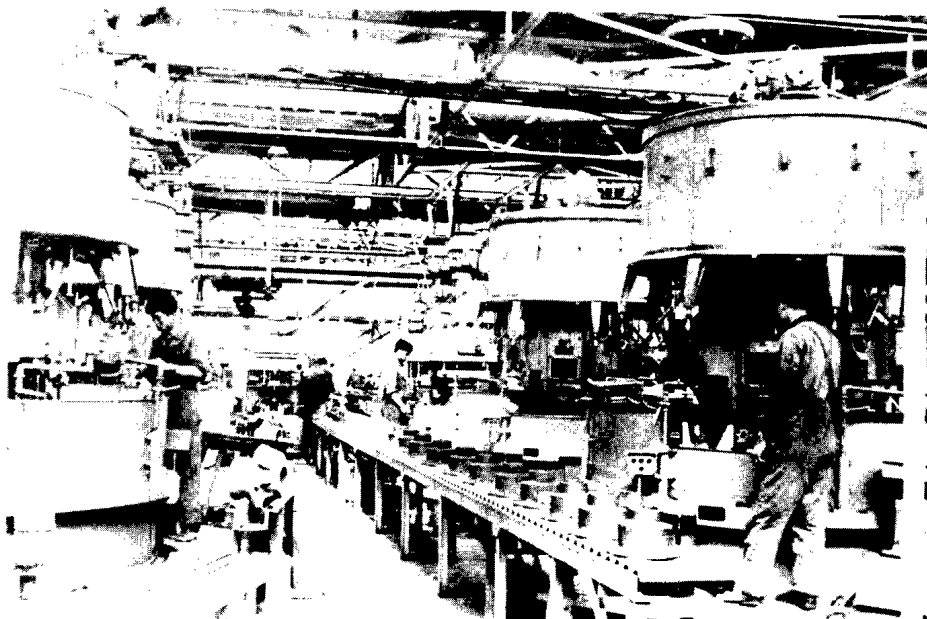


FIGURE 3. Communist China: Machining of Transmission Parts by Multiple-Spindle Vertical Semiautomatic Lathes in the Ch'ang-ch'un Automobile Plant No. 1

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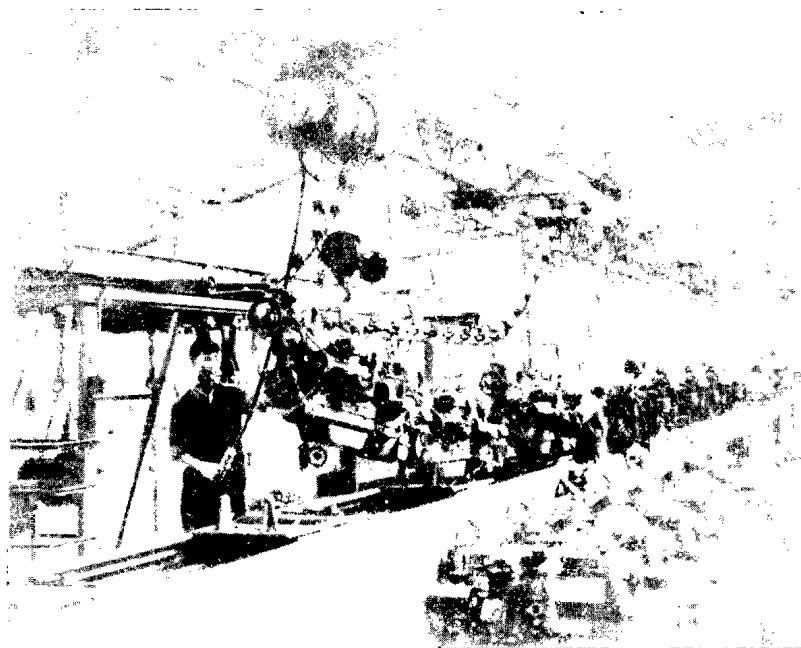


FIGURE 4. Communist China: Mechanized Handling Equipment in the Ch'ang-ch'un Automobile Plant No. 1

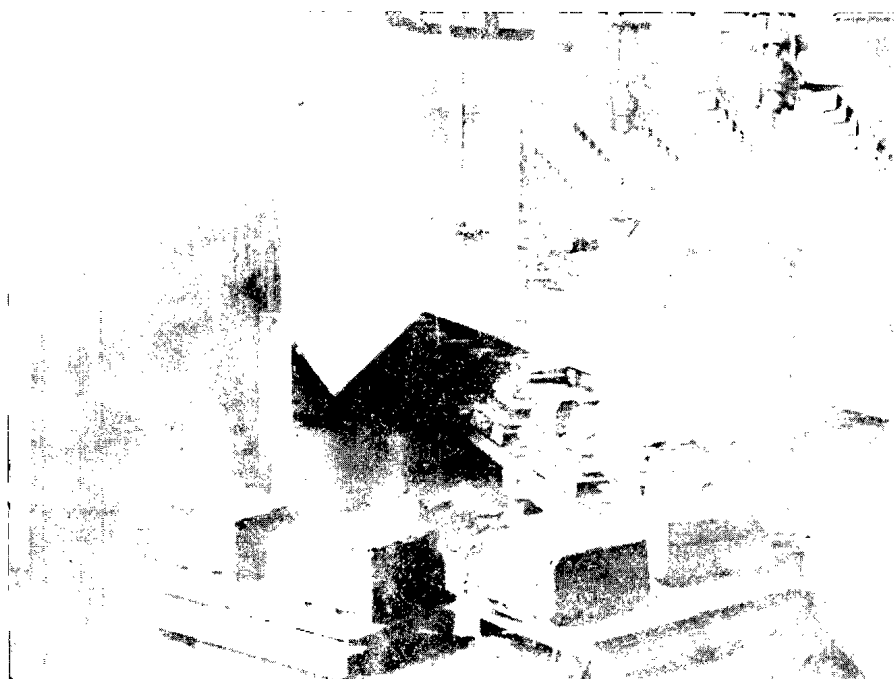


FIGURE 5. Communist China: Mechanized Carrying Line in Foundry Operations in the Ch'ang-ch'un Automobile Plant No. 1

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China was reoriented toward the Soviet Bloc. Not only because of necessity but undoubtedly also because of ideological compatibility, the Chinese wholeheartedly welcomed Soviet assistance in their development program. Under these circumstances, Soviet influence spread rapidly throughout the Chinese economic system. The Chinese enthusiastically studied Soviet experience as a model for their own development, diligently and, as it later became apparent, often uncritically applying it to their own planning.*

Table 3

Fixed Assets per Production Worker in the Metal-Processing Sector
of the Machine-Building Industry of Communist China a/
1952-56

<u>Year</u>	<u>1952 Yuan</u>
1952	2,996
1953	3,139
1954	3,538
1955	4,357
1956	5,037

a. The fixed assets include plant buildings and installed capital equipment used in industrial production and do not include facilities for housing and welfare or land used for nonproductive purposes. Valuations probably were computed by the Chinese Communists on a gross rather than net basis, without regard to depreciation. Production workers include workers actually engaged in production and such auxiliary workers as porters in the enterprises and loaders in warehouses but exclude such employees as engineers, technicians, and administrative personnel.

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1. Period of Restoration (1950-52)

Technical plans and materials as well as the services of competent advisers were apparently invaluable to the Chinese Communists, in restoring levels of production after 1949. The first 3 years, which were described by the Peking regime as a "rehabilitation period," were characterized by a stabilization of the economy, an

* See III, p. 55, below.

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extension and consolidation of political controls, and the expansion of production with relatively little fixed capital investment. That the economy, which had been depressed and fragmented by a decade of war and civil war, responded favorably was caused primarily by the restoration of political stability, better distribution of raw materials, and other similar factors. Insofar as economic recovery depended on technical assistance, however, Soviet technicians and advisers made an important contribution. 52/ Most of the Soviet machinery imported during this period apparently was allocated to existing machine-building facilities, and imports of complete plants were a comparatively minor factor until 1953.* A considerable amount of Soviet aid was expended, however, in preliminary survey and design of new projects the actual construction of which began under the First Five Year Plan (1953-57). There were no known machine-building projects undertaken with aid from the European Satellites during the period of restoration.

2. First Five Year Plan (1953-57)

The first of several Sino-Soviet agreements on scientific and technical cooperation was announced on 11 October 1954. By its terms the USSR agreed to furnish to Communist China the following items: (a) plans and blueprints for industrial construction, including metallurgical and machine-building plants, power stations, and other projects; (b) blueprints for machinery and equipment; (c) data on techniques and methods for producing many types of industrial goods; and (d) scientific, technical, reference, and training materials. Pursuant to such agreements the Chinese received designs and technical data for a large number of engineering projects, including Automobile Plant No. 1 at Ch'ang-ch'un and locomotive and railroad passenger car works as well as blueprints for machine tools of many kinds, mining machinery, and other products. ** 53/

Soviet advisers assisted the Chinese Communists in the actual formulation of plans as well as the execution of plans. The Chinese Communists had modeled their economic administration on Soviet prototypes, a move which facilitated liaison with planning groups in Soviet ministries. 54/ Soviet advisers were believed to have been assigned to all levels in the Chinese Communist economic ministries, administrative organs, and industrial organizations.

Soviet technical aid covered the whole process of construction from the selection of plant sites, collection of basic data required for purposes of design, formulation of the task of

* See V, A, 2, p. 81, below.

** See II, F, p. 31, below.

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designing, making designs, supply of equipment, and direction of building and safe operations to production of new products, training of talents capable of mastering new technology, and supply of technical data required for making new products. 55/ Soviet advisers at construction sites and at ministerial planning levels thus had extensive technical authority until the actual turning out of products, when complete responsibility devolved on the Chinese Communist technicians and managers. 56/

The influence of technical advisers from the European Satellites at the higher levels of planning and administration has been less pervasive than that of Soviet advisers. The influence of the Satellites was felt more directly in plant layout, product design, and production techniques in connection with specific projects for which these countries had supplied equipment. In this sense, certain fields of machine building reflect substantial Satellite technical influence -- for example, Czechoslovak influence in diesel engines and steam turbines; East German influence in telecommunications equipment, electrotechnical apparatus, synthetic fibers, and abrasive products; and Hungarian influence in electronics. Polish influence has been slight, being significant only in machinery for refining sugar beets.

Engineering projects carried out with assistance from the Soviet Bloc provided opportunities for Chinese Communist engineers and technicians to gain experience under the supervision of Soviet personnel in the design, construction, and operation of plants. Moreover, during 1953-57, some 7,000 Chinese engineers, administrators, and skilled workers were sent to the USSR to acquire experience in plants and other industrial institutes. 57/ For Automobile Plant [] at Ch'ang-ch'un, 500 Chinese were trained at the ZIL (Zavod imeni Likhachev) Motor Vehicle Plant in Moscow and other Soviet automobile plants. On their return to Communist China, these trainees set up training programs based on the knowledge they had acquired in the USSR. 58/

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In addition, Soviet influence became very prominent in formal technical education. Soviet professors of engineering occupy a number of important positions in the new engineering institutes of Communist China. In the rapid expansion of engineering curricula the technology of the manufacture of machinery and tools has been strongly emphasized. It is not unusual for a Soviet professor to be concurrently an adviser to an industrial ministry or a major plant. 59/

Most of the gains in efficiency and productivity in various Chinese Communist plants have been attributed in press reports to the suggestions of Soviet technicians or of Chinese who have

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received training from Soviet technicians. It was reported that a group of workers at the Mukden (Shen-yang) Machine Tool Plant more than quadrupled their working efficiency by adopting an advanced Soviet method of high-speed metal cutting demonstrated by a Soviet lathe turner. 60/ Soviet high-speed metal-cutting methods, as well as Soviet techniques for metal drilling, metal casting, and metal rolling are said to have been adopted extensively with good results in the Chinese engineering industries. 61/ Such examples involve extremely specialized techniques, however, and are of little consequence in any over-all measure of increased productivity. In addition, there are some technical problems in high-speed cutting that make the attainment of greater productivity somewhat questionable. Probably the real gains in productivity were accomplished primarily through the application of general industrial engineering technique with little additional investment in equipment. The Chinese Communists could and probably did learn most from Soviet technicians in such fields as plant layout, preventive maintenance and repair, methods and motion study, and simplification of design. Thus the greatest benefits derived by the Chinese Communists from such technical assistance were a considerable improvement in the technical level and some increase in productivity, as well as the opportunity to imitate on a massive scale the machinery imported from the Bloc.

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D. Location*

1. Development of Industries in the Interior

Before 1949 the machine-building industry, such as it was, and most of the other industries of China were concentrated in a few coastal cities such as Tientsin and Shanghai and in Northeast China, where supplies of raw materials, a trained labor force, and transportation had been developed, largely by foreigners. The Chinese Communists inveighed against this pattern of location as irrational and the result of "imperialist encroachment and Kuomintang domination." Their First Five Year Plan (1953-57) set forth a program designed to bring about a satisfactory location of industry in three 5-year plans. The planned location of new industries was to be based on certain general principles, including the development of industrial productive capacity in all regions of the country, the location of industry near sources of fuels and raw materials, dispersion to meet defense requirements, and the gradual improvement of economic standards of backward areas. To implement these principles the First Five Year Plan called for the utilization and expansion of existing industrial bases, especially in Northeast China (Region I),** to

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** The economic regions referred to in this report are those defined and named on Map 25561 (5-57), Communist China: Economic Regions, inside back cover.

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support national construction and accumulate capital; the construction of new industrial bases in North China (Region III), Northwest China (Region VIII), and Central China (Region V) centering around the two new iron and steel combines to be established in Pao-t'ou and Wu-han; and the carrying out of preparatory work for the construction of a new industrial base in Southwest China (Region VII). 63/

The First Five Year Plan envisioned the shifting of the center of the machine-building industry toward the interior of Communist China by construction of new enterprises. It called on the First Ministry of Machine Building and the Ministry of the Power Equipment Industry to engage in construction of new large-scale enterprises, of which 24 percent were to be located in maritime areas and 76 percent in the interior.* Of the projects in machine building carried out with Soviet aid, 16 percent were to be built in maritime areas and 84 percent in the interior. The Peking regime aimed to increase the share of production by metal-processing enterprises located in the interior from 20 percent in 1952 to 62 percent in about 1960-61, following the completion of new enterprises on which construction was scheduled to start during 1953-57.

Although the Chinese Communists undertook considerable new construction of machine-building plants in the interior, the geographical location of production was not altered appreciably by the end of 1957. The limited progress between 1952 and 1955 is indicated by percentages in terms of value in the following tabulation:

<u>Area</u>	<u>Percent</u>			
	<u>Metal-Processing Sector</u>		<u>Machinery and Equipment Manufacturing</u>	
	<u>1952</u>	<u>1955</u>	<u>1952</u>	<u>1955</u>
Interior	19.9	24.7	18.0	24.2
Maritime	80.1	75.3	82.0	75.8
Total	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

* The maritime area is defined officially as including the seven coastal provinces of Liaoning, Hopeh, Shantung, Kiangsu, Chekiang, Fukien, and Kwantung and the three independent municipalities of Shanghai, Tientsin, and Peking. All the remaining provinces of Communist China comprise the interior.

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Further details of the location of total production and of production of machinery in 1955 are available on such items as boilers, machine tools, and electrical equipment.* Although new bases for machine building have been established at inland points such as Ch'ang-ch'un, Harbin, Ch'i-ch'i-ha-erh, Lo-yang, Sian, and Lan-chou, a substantial portion of total production still is concentrated in Shanghai and Mukden. However, the construction of many such important inland machine-building plants as those in T'ai-yuan, Fu-la-erh-chi, Wu-han, Lan-chou, Lo-yang, Ch'eng-tu, and Sian, which was undertaken during 1953-57, will be completed under the Second Five Year Plan (1958-62).

The development of inland industrial bases has certain disadvantages, both economic and military. Although, in some instances, there may be compelling economic reasons for the choice of more costly sites in the interior, these sites require the investment of large amounts in such nonproductive construction as housing, transportation, and welfare facilities. In fact, statements emanating from the Eighth Chinese Communist Party Congress in 1956 complained that inadequate attention was given "to the full, rational utilization of coastal industry." 64/ Current plans pay more attention to older industrial areas as centers for machine building.** Moreover, the development of machine-building plants away from vulnerable coastal areas does not represent an unqualified gain in terms of security from air attack. There are some factors which partly offset the advantages of defense in depth. A number of machine-building plants, particularly some of the newest and largest, are located far from their sources of raw materials and are, therefore, vulnerable to disruption and congestion in surface transportation. In addition, electric power grid systems are not well developed in the remoter regions, and so plants tend to depend on a single source of power.

2. Economic Regions***

a. Northeast China (Region I)

Pursuant to the principle of expanding existing industrial bases the Chinese Communists undertook the construction of new plants and reconstruction and expansion of older plants in Northeast China. About 30 percent of all machine-building plants started or completed during 1950-57 were constructed in this region, which accounts for 50 percent of the Chinese capacity to produce machinery. 65/

* See Table 11, Appendix B, p. 94, below.

** See IV, B, 6 and 9, pp. 73 and 75, respectively, below.

*** The economic regions are discussed in this section in order of economic importance to Chinese Communist machine building. For the numbers and types of machine-building plants in each of the economic regions, see Table 12, Appendix B, p. 95, below.

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Within Northeast China the heaviest concentration of machine building is in Mukden. Mining machinery, metallurgical equipment, construction equipment, electrical equipment, machine tools, and other types of general industrial equipment all are being produced here. The importance of Mukden is due largely to its initial development under the Japanese in an area where abundant supplies of raw materials had promoted the development of the steel and aluminum industries and to a relatively adequate transportation system.

Under the First Five Year Plan (1953-57), however, the center of gravity of machine building in Northeast China started to move northward as the result of a conscious effort to shift industry inland and avoid overconcentration in the south. 66/ A large motor vehicle plant and a railroad equipment plant were established at Ch'ang-ch'un in Kirin Province. Farther north, at Harbin in Heilungkiang Province, is located the new Harbin Measuring and Cutting Tools Plant and the huge Harbin electrical equipment complex. Heilungkiang Province is also the site of the new Fu-la-erh-chi Heavy Machinery Plant.

b. North China (Region III)

North China, which has the second largest number of machine-building plants, is also rich in mineral resources. Most of the machine-building plants are located in Peking and Tientsin, the two major cities of the region. Radio equipment, electronic tubes, machine tools, and agricultural equipment are produced in Peking. Tientsin is the site of a tractor plant and of plants producing air compressors, diesel engines, mining machinery, textile machinery, and machine tools. Present plans call for even greater development of Peking and Tientsin. By 1962, Tientsin is to become the site of a heavy industrial complex concentrating on production of high-grade, precision, and heavy industrial products 67/ but will continue to stress production of internal combustion engines, machine tools, and electrical instruments. 68/

One of the largest machine-building centers in the interior of Communist China is being developed at T'ai-yuan. Here is located the new large T'ai-yuan Heavy Machinery Plant, which is scheduled for completion in 1960 and will be one of four major plants in China producing metallurgical equipment. A reconstructed mining machinery plant is also located in T'ai-yuan.

Tsinan is an important center for production of diesel engines and machine tools. Lo-yang, a new city, is now the foremost producer of tractors, mining machinery, and antifriction bearings in Communist China. Ch'eng-chou (Ch'eng-hsien) is the site of a textile machinery plant and a new grinding machinery plant.

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c. East China (Region IV)

Before 1956 the Peking regime looked on this region mainly in terms of its capacity for supporting industrial development in the interior and had little inclination to aggravate what the regime considered to be the irrational overconcentration of industry in this vulnerable area. 69/ Because of its past associations with foreigners and capitalist elements, Shanghai was long regarded with suspicion, and the full development of the potential of existing enterprises was neglected until state control had been effected. Recently, however, new industrial areas have been established on the outskirts of Shanghai, and current plans call for the development of this city as a leading center for production of heavy machinery and precision tools. 70/ A heavy machinery plant was started in August 1958.

Shanghai accounts for a large proportion of the major commodities produced in Communist China, including one-quarter of the total value of production of the machine-building industry in 1957. During 1950-57, Shanghai produced 28,000 machine tools, or 22 percent of total production during this period. In 1957-58, Shanghai accounted for the following percentages of total production: 30 to 50 percent of diesel and gasoline engines, 10 to 30 percent of electric motors, and 10 to 20 percent of machine tools. 71/ Four plants in Shanghai making power equipment, steam turbines, boilers, and switchboards account for about one-half of the power generating equipment produced in China. 72/ This proportion will diminish considerably because of the increasing prominence of the heavy electrical equipment complex in Harbin. [redacted]

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50X1

[redacted] the machine-building industry is still dependent to a considerable extent on this highly vulnerable target area.

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At Nanking, another important machine-building center in East China, radio equipment, trucks, and several varieties of machine tools are produced. Ho-fei, in Anhwei Province, is slated to become a new machine-building center. [redacted] construction of four large machine-building plants, which will produce tractors, motor vehicles, machine tools, and ball bearings, was to be undertaken in Ho-fei. 74/

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* Tonnages are given in metric tons throughout this report.

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d. Central China (Region V)

The First Five Year Plan called for the construction of two new industrial bases in Central China. A new iron and steel combine second only to that at An-shan will be established at Wu-han. Here is located Communist China's new Wu-han Heavy Machine Tool Plant, which is in partial operation. A motor vehicle plant, possibly to have a capacity larger than that of the Ch'ang-ch'un Automobile Plant [] is scheduled for location at Wu-han. The second new industrial zone in this region is in Hunan Province and is centered about the machine tool and electrical equipment industries of Ch'ang-sha and Hsiang-t'an.

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e. Southwest China (Region VII)

Because Southwest China was lacking in adequate transportation facilities and supplies of iron and coal, it did not receive much emphasis in the industrialization program of the First Five Year Plan. 75/ Whatever machine building took place in this region under the First Five Year Plan was confined primarily to Ch'eng-tu and Chungking. The largest measuring and cutting tools plant in Communist China was constructed at Ch'eng-tu in Szechwan Province, 76/ as were two radio equipment plants and a ball bearing plant. In Chungking, the center of a small munitions industry during World War II, a reconstructed machine tool plant was put into operation in 1953 with Soviet assistance. Recent plans call for the development of Chungking into a modern industrial city with iron and steel, machine-building, and electrical machinery enterprises. Investments in capital construction in Chungking in 1958 are to be double those of 1957. 77/ Machine tools are also being produced at K'un-ming in Yunnan Province.

f. Northwest China (Region VIII)

Machine building in Northwest China, the largest of the economic regions, was rather limited under the First Five Year Plan. As in Southwest China, attention during this period was devoted primarily to the development of transportation facilities and to prospecting for mineral resources. Machine-building construction has been largely confined to the cities of Lan-chou and Sian. The development of machine building in Lan-chou, which is the capital of Kansu Province and the railroad hub of Northwest China, is closely related to the importance of the region in production of petroleum. A new petroleum-drilling equipment plant and an oil-refining and chemical industry equipment plant, the first of its kind in China, are being constructed in Lan-chou.

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Sian, another rising industrial center in Northwest China, is slated to become an important base for production of electrical equipment. Recently completed in Sian is the new Sian Electric Capacitor Plant, the first modern power capacitor plant in Communist China. 78/ A new high-voltage switch plant will soon be put into operation in Sian, which will also become a center for production of instruments. A plant which will produce apparatus and meters to control and measure temperature and various types of thermo-technical apparatus and meters for the artificial and synthetic fiber and the chemical fertilizer industries is being built in Sian with East German aid. 79/ Various types of geological surveying instruments are being produced at the new Sian Geophysical Instruments Repair and Manufacturing Plant.

g. South China (Region VI)

Until 1958, production in South China was limited almost entirely to consumer goods, the handicraft industry accounting for a major share of total production. What little machine building took place was confined largely to Canton in Kwangtung Province. Sugar-refining equipment, necessary for the sugar refineries in this area, was produced in Canton, along with agricultural equipment. Now more attention is being given to production of heavy machinery in this region, the completion of a heavy machinery plant in Shao-kuan (Ch'u-chiang) being scheduled for 1960.

h. Other Regions

There was virtually no development of the machine-building industry in the Inner Mongolian Autonomous Region (Region II), the Sinkiang Uighur Autonomous Region (Region IX), and Tibet (Region X) under the First Five Year Plan. There are no major machine-building plants in Tibet, and only a few agricultural equipment plants in the Inner Mongolian and the Sinkiang Uighur Autonomous Regions.

E. Value of Production

1. Total Industry

Communist China made impressive progress in total industrial production under the First Five Year Plan (1953-57), the gross value of such production (excluding the handicraft industry) increasing about 133 percent. In 1957 the gross value of total industrial production reached 62.8 billion yuan,* an increase of 9.25 billion yuan above the goal of 53.5 billion yuan set by the First Five Year

* See Table 13, Appendix B, p. 96, below.

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Plan. The average annual rate of growth in total industrial production under the plan was 18.4 percent, or 3.7 percent higher than the target of 14.7 percent. Although the average annual rate of growth of total industrial production was high, it was uneven, increasing sharply in 1956, the year of the high tide of industrialization, and declining to about 7 percent in 1957, a year of consolidation and restoration of balance.

2. Machine-Building Industry

Under the First Five Year Plan, there was a large increase in gross value of production by the metal-processing sector, including machinery and equipment manufacturing. The value of production by the metal-processing sector in 1957 reached 10 billion yuan and accounted for about 3 or 4 percent of the gross national product on a basis of value added. Machinery and equipment manufacturing, the most important component of the metal-processing sector, attained a value of production slightly less than 6 billion yuan, representing more than 5 percent of the gross national product. From 1952 through 1957 the gross value of production of machinery and equipment manufacturing increased approximately 326 percent. This gain exceeds the planned increase of 250 percent for the 5-year period. 80/ The share of the metal-processing sector in total industrial production increased from 11 percent in 1952 to about 16 percent in 1956-57, and the share of machinery and equipment manufacturing increased from 5 percent in 1952 to almost 10 percent in 1956-57.

The average annual rate of growth in machinery and equipment manufacturing under the Five Year Plan was approximately 34 percent. This rate of growth was uneven, increasing to about 90 percent in 1956 but declining to about 4 percent in 1957. Such unevenness was due to the fact that the ambitious surge forward in industry in 1956 necessitated some consolidation in 1957 to smooth out imbalances.

F. Volume and Types of Production

1. General

Considerable increases in the volume of production were made in several branches of the machine-building industry of Communist China under the First Five Year Plan (1953-57).^{*} Most noteworthy were the increases in production of machine tools, agricultural equipment, textile machinery, locomotives and rolling stock, and electrical equipment. Production of some types of heavy equipment, such as metallurgical equipment, mining equipment, and oilfield

^{*} For the estimated production of selected machinery and equipment items, see Table 14, Appendix B, p. 97, below.

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and exploratory equipment, was limited under the First Five Year Plan, but capacity to produce will be increased considerably under the Second Five Year Plan. In spite of the advances made in production by the machine-building industry under the First Five Year Plan, Communist China still lags far behind the advanced industrial nations in production of most types of machinery.* Moreover, production of most types of machinery in Communist China at the end of the First Five Year Plan was considerably lower than that in the USSR at the end of the Soviet First Five Year Plan in 1932, although this difference was due primarily to the fact that Communist China started its First Five Year Plan with a much smaller production base than did the USSR.**

The projects of the machine-building industry of Communist China actually constructed under the First Five Year Plan were designed not only to augment capacity for production but also to provide a greater diversity of products. Under the plan both trial production and actual production of a considerable number of new types of products were undertaken. It should be noted, however, that the increase in the number of products manufactured was due in large measure to the completion of projects undertaken with aid from the Soviet Bloc and, moreover, that the designs for many of the new products were supplied by the Bloc. Approximately 90 percent of the 3,000 new products that the Chinese Communists claim have been produced by the machine-building industry since 1953 are based on designs provided by the USSR. 81/ As production expanded, the technical capabilities of Chinese machinery increased.***

2. Machine Tools

The increase in production of machine tools during 1953-57 was largely due to expansion and reequipping of existing facilities. Of the 19 major machine tool plants established by the end of 1957, only 3 have been identified as new plants. Other factors contributing to higher production were improvements in the productivity of labor and Soviet technical assistance. Before 1953, Communist China produced only a few types of general-purpose machine tools, most of which were obsolete. In 1954 and 1955, production in terms of units was cut back, and plants shifted to production of heavier and more modern types.**** This change in emphasis brought about considerable

* See Table 15, Appendix B, p. 99, below.

** See Table 16, Appendix B, p. 100, below.

*** See Table 17, Appendix B, p. 101, below.

**** See Table 14, Appendix B, p. 97, below.

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diversification of production by the end of 1957, when the industry was producing a few automatic and precision machine tools. These new types include single-spindle automatic lathes, transfer machines, precision surface-grinding machines, automatic centerless internal grinding machines, multitool semiautomatic lathes, and universal tool grinders. ^{82/} Semiautomatic gear shapers, ball bearing grinding machines, single-purpose machine tools for production of locomotives and for the metallurgical industry; multispindle lathes; double-column vertical lathes; and double-housing planers were successfully trial produced but had not entered serial production by the end of 1958.

The simultaneous export and shortage of machine tools indicates an insufficient range of types and slowness of the industry to expand product mix. ^{83/} Thus the overabundance of machine tools experienced by the Chinese Communists in 1957 did not constitute an oversupply of all machine tools but only of the limited variety that they produced.*

The machine-building industry registered few gains in heavy machinery. The heaviest machine tool produced in Communist China in 1956 weighed about 100 tons. ^{84/} Production of heavy machine tools can increase considerably, however, because of the completion of the Wu-han Heavy Machine Tool Plant in 1958. Closely related to this shortcoming is the lag of the industry in production of metalforming machinery. Production of 2,500-ton presses was only at the trial stages in 1958. Because metalforming machinery is an essential requirement for metalworking processes, it is believed that the Chinese Communists will place greater emphasis on this category under the Second Five Year Plan (1958-62). Most of the machine tools produced in Communist China in 1953-58 were copies of Soviet or European Satellite models. Toward the end of the First Five Year Plan, however, Chinese engineers were attempting some degree of independent designing. ^{85/}

3. Electrical Equipment

Production of various types of electrical equipment increased considerably under the First Five Year Plan. From 1952 to 1955, such gains depended for the most part on the greater utilization of existing plant facilities. ^{86/} By contrast, additions of new capacity were responsible for the rapid advances in production after 1955. This new capacity, including both new construction and renovation, permitted the goals of the First Five Year Plan for turbines, generators, motors, and transformers to be met a year ahead

* See II, H, 4, p. 52, below.

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of schedule. Large investments in capacity for production of heavy turbogenerators were completed in Harbin in 1956 and 1958. The construction and renovation that were completed in 1956 at the Harbin Power Equipment Plant and the Shanghai Electrical Machinery Plant brought the combined annual capacity of these two plants alone to 240,000 kilowatts (kw) of generators, or double the total capacity in 1955. 87/ Marked increases in production of switchgear and wire and cable in 1956 were due primarily to the completion of the Mukden Low Voltage Switchgear Plant and the Mukden Electric Cable Plant.

Since 1952, there has been an impressive rise in the rated capacity of the most important categories of electrical equipment, as shown in Table 4.* Production is planned for both steam and hydraulic turbogenerators with capacities of up to 100,000 kw each in the recently expanded Harbin Power Equipment Plant. High-tension transformers with a maximum load of 40,000 kilovolt-amperes (kva) were being produced in 1957. 88/

On completion of expansion about the end of 1959 the Mukden Transformer Plant is expected to produce 123,500-kva transformers. 89/ Communist China produces a fairly wide range of electric motors, including some as large as 1,900 kw for heavy steel rolling mills and special types that operate under water and in combustible and humid atmospheres. 90/ Numerous types of electric instruments now are produced in Communist China. These instruments include fuel gauges, water temperature and oil pressure gauges, speedometers, and ammeters used by the Ch'ang-ch'un Automobile Plant 91/ A limited variety of circuit breakers and switchgear was turned out in 1953-57. Nearly all the new models of electrical equipment introduced during this period were copied from the Soviet or the Satellite models.

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In spite of considerable development in the electrical equipment industry, Communist China supplies a relatively low percentage of its own requirements.** Moreover, the program for construction of power stations was greatly accelerated in 1958 compared with the rate which prevailed under the First Five Year Plan (1953-57). 92/ It is expected that production of heavy electrical equipment will lag behind these increasing demands for power generation under the Second Five Year Plan (1958-62). Plans call for domestically produced electrical equipment to fulfill about one-quarter of the requirements for new hydroelectric capacity and about one-half of the requirements for new thermal electric capacity during this period. 93/ Although the outlook for the supply for power

* Table 4 follows on p. 35.

** See Table 24, Appendix B, p. 112, below.

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Table 4

Increase in Rated Capacity of Electrical Equipment Produced in Communist China a/
1952 and 1955-59

Commodity	Unit	1952	1955	1956	1957	1958	January-June 1959
Hydroelectric turbogenerators	Kilowatt	1,000	10,000	15,000	15,000	N.A.	72,000 <u>b/</u>
Thermal electric turbogenerators	Kilowatt	<u>c/</u>	6,000	12,000	12,000	25,000 <u>b/</u>	50,000 <u>b/</u>
Electric motors, alternating current	Kilowatt	940	1,900	N.A.	N.A.	N.A.	N.A.
Electric motors, direct current	Kilowatt	300	1,343	N.A.	N.A.	N.A.	2,800 <u>b/</u>
Transformers	Kilovolt-amperes	15,000	31,500	N.A.	40,500	N.A.	75,000 <u>b/</u>

b. 95/

c. No production of a complete turbogenerator.

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generating equipment with high capacity improved considerably as the result of the expansion of the Harbin Power Equipment Plant in 1958, it would require 3 to 5 years to build additional plants to manufacture high-temperature and high-pressure generators of 25,000 kw and thermal electric powerplants of more than 500,000 to 700,000 kw. 96/

4. Other Power-Producing Equipment

Moderate improvements have been made in increasing volume and variety of production of nonelectrical power-producing equipment, which includes basically diesel engines and boilers. In 1953, Communist China began to produce 40-hp, high-speed, small-scale diesel engines. By the end of 1955, 25 types of diesel engines ranging in size from 8 to 400 hp were being produced. There was also successful trial production of 165-hp, GM-71 type, high-speed diesel engines for both marine and land use. 97/ Although successful trial production of a 600-hp marine diesel engine, the largest diesel engine made in Communist China, was reported in 1956, serial production of this type of engine has not been confirmed. 98/ In 1958, trial production of the first 450-hp diesel engine produced in Communist China was completed. It is now planned that both 1,200-hp and 2,000-hp diesel engines will be produced by 1961. 99/

Most of the diesel engines produced in Communist China were patterned after Soviet or European Satellite models. For example, the designs for the 600-hp marine diesel engine were based on Czechoslovak and other data. 100/ The 90-hp diesel engine produced at the Tsinan Diesel Engine Plant is a copy of the Czechoslovak Skoda model 4S160. 101/ In spite of the use of foreign technical designs, the performance of Chinese engines has not always been up to standard. Moreover, the Chinese have encountered serious problems with regard to adequate fuel supplies.*

New types of boilers also were produced under the First Five Year Plan. Late in 1956 the major producing plant at Harbin successfully produced a boiler with a steam-raising capacity of 35 tons per hour. 102/ A year later, this plant completed a medium-pressure boiler with a capacity of 130 tons per hour.

5. Agricultural Machinery

The Peking regime placed considerable emphasis on increasing production of agricultural machinery to supply the material basis for the implementation of collectivization. Increases in production during 1952-56 were based on a fairly sizable program of

* See II, H, 3, b, p. 50, below, and IV, B, 7, p. 73, below.

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reconstruction and expansion. In addition to the major agricultural equipment plants, numerous handicraft cooperatives and small work-shops made an important contribution. Production by individual plants was small but loomed large in the aggregate, especially in the production of traditional types of such hand implements as spades, rakes, scythes, picks, and hoes. Included in the total number of units produced during 1950-57 were 2,023,000 two-wheel, one-bottom and two-bottom plows; 1,950,000 walking plows; 1,790,000 waterwheels; 85,000 discs; 43,000 rollers; 64,000 drills; 457,000 cultivators; 19,000 horse-drawn harvesters; 454,000 rice threshers; 3,200,000 hand sprayers; more than 530,000 hp of irrigation pumps; and other items.

Drawing heavily on Soviet experience, the Chinese Communists pressed the development of equipment for use with tractors before 1958. Such tractor-drawn machines included five-bottom and three-bottom plows, cotton seeders, 24-row and 48-row seed drills, cultivators, grain combines, disc harrows, three-bar mowers, and fertilizer spreaders. Besides being heavily dependent on a high level of mechanization that did not materialize during 1953-57, a number of these Soviet types of machines proved to be entirely unsuitable to Chinese soil and topographical conditions. This factor, combined with overproduction in 1956 and inadequate attention to the popularization of the new equipment, led to severe cutbacks in production in 1957.

In its effort to supply machinery suitable to the agricultural conditions in all areas, the Peking regime continues to develop new varieties of products. 104/ These products include paddy-rice harvesters, cotton-planting machines, fertilizer-spreading carts, and new models of combine grain harvesters. 105/ The "leap forward" campaign of 1958 stressed the stimulation of initiative to turn out simple agricultural equipment suitable for local needs. Current plans call for a shift in emphasis from mechanized farming to production of drainage and irrigation equipment, along with the rapid expansion of production of chemical fertilizers. With some rearrangements of facilities, production of pumps can be increased considerably. The main problem is the motive power to be used for the pumps. Electrical equipment plants can turn out numerous light electric motors for irrigation, but this approach requires vast improvement in rural electrification. Because of limitations in fuel supply, diesel engines cannot be used extensively. Production of coal-gas and other engines using local fuels, now being rushed, probably will have significant effects in a relatively short time.

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6. Tractors

Extensive investments in new facilities for production of tractors were made under the First Five Year Plan. These facilities comprise the large, new Lo-yang Tractor Plant [] completed in 1959, and the expansion, begun in 1957, of the Tientsin Tractor Plant. The Lo-yang plant, although still unfinished, with less than 40 percent of its equipment installed, turned out its first prototype 54-hp diesel crawler tractor in July 1958.* 107/ The Tientsin plant produced the first Chinese Communist tractor, the T-240, patterned after the Soviet "Belarus," in April 1958. 108/

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No tractors were produced until 1958, when 957 units were produced. Plans for 1959 call for production of 3,000 tractors. 109/ The Tientsin plant was scheduled to produce 150 tractors in 1958 and may have a maximum capacity of 13,000 units per year. 110/ Originally designed to produce only the 54-hp crawler tractor at the rate of 15,000 units annually, the Lo-yang plant now is said to have the capacity for producing annually 30,000 units of various types, including smaller multipurpose types. 111/ During the hectic "leap forward" campaign of 1958, it was reported that tractors were being produced at numerous smaller plants throughout China. This claim is highly suspect. Only a few of these tractors are believed to be genuine Chinese products, the others probably being superficially altered foreign tractors or tractors hastily assembled from parts of inoperative machines.

7. Automotive Transport Equipment

Production of trucks began in 1956 with the completion of the gigantic Ch'ang-ch'un Automobile Plant [] which is still the only important producer in Communist China. This plant produces the 4-ton, 6-cylinder, 90-hp, "Liberation" model** patterned after the Soviet ZIL-150. During the first 2 years of operation of the plant, only a stake-body type of truck was produced, but during 1958 several new versions were introduced. These versions included 4-ton cross-country trucks, model SA-40 dump trucks, and trucks equipped with gas-generator units as substitutes for gasoline engines. In addition, "Liberation" chassis have been fitted with bus bodies to produce buses of roughly the same configuration and capacity as US school buses.

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* A copy of the Soviet DT-54 model. []

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** Various referred to as the CA-10 or CH-10 truck.

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The production capacity of the Ch'ang-ch'un plant was originally rated at 30,000 trucks annually on a two-shift basis, according to Soviet planning norms. In April 1958, as the "leap forward" campaign gathered momentum, capacity was determined to be 70,000 units. 112/ Finally, it was reported in November 1958 that capacity for annual production could be raised to the fantastically high level of 150,000 vehicles in 1959 with an additional investment of 40 million yuan. 113/ Apart from this investment, which appears to be extremely small, the foundation of the claim of 150,000 trucks per year is not known. Although the maximum capabilities of the plant are believed to have been considerably underestimated by Soviet engineers, 114/ its known machinery park, particularly the 3,500-ton press imported from the USSR, suggests an annual capacity of not more than 60,000 vehicles.

The Ch'ang-ch'un plant has experienced continued difficulty in procuring adequate supplies of materials. During 1957 and most of 1958, there were critical shortages of cold-rolled steel and steel alloys. 115/ In early 1957 the plant was operating only in the morning on less than one shift a day. 116/ At that time, 46 percent of the steel required for production of trucks could not be produced domestically. 117/ The Chinese Communists, therefore, attempted to remedy the situation by importing cold-rolled steel from the West and by experimenting with substitute materials which could be produced domestically. Because only a few of the approximately 200 types of metal needed to produce a truck were available in Communist China, the regime has depended on the USSR to supply most of the remainder. It is believed that Soviet deliveries have been irregular and at high prices. 118/ That the goal of producing 7,000 trucks in 1957 was fulfilled may indicate that the regime incurred further financial loss to increase imports of the necessary materials rather than suffer the "loss of face" resulting from failure to meet the goal for this important item. By the end of 1958 the shortages of rolled steel and alloys were still restricting the rate of production at the Ch'ang-ch'un plant, but the situation probably was less critical than in the early months of 1957. 119/ Nevertheless, the plant remains completely dependent on foreign sources for at least a few essential materials.*

Production of other types of motor vehicles is not of great significance. About 500 three-wheel trucks with a capacity of 1 to 1.5 tons each were produced in Shanghai in 1958. Shanghai also turns out a number of jeeps similar to those produced in the US.

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A few trial models of passenger automobiles were produced in 1958. A trial model of the "East Wind" six-seater passenger automobile, which bears a striking resemblance to the Soviet "Volga" model, was assembled at the Ch'ang-ch'un plant. The sudden appearance in 1958 of a passenger automobile industry, which as of 1957 was not scheduled to produce its first automobile until about 1962, is regarded with suspicion. It is believed that these automobiles were produced mainly for purposes of prestige, with little prospect for serial production in the near future. Designs for a second large motor vehicle plant, to be located in Wu-han, were completed in 1958, but construction has not yet been undertaken.

Chinese Communist capabilities for producing motor vehicles are reasonably satisfactory. There is capacity available at the main truck plant for large increases in production, so that by 1962 Communist China should be able to fill a large share of its requirements.*

8. Railroad Transport Equipment

There were sizable increases in production of locomotives and rolling stock under the First Five Year Plan of Communist China.** These increases resulted from the reconstruction and expansion of existing facilities and from increased efficiency. Since 1950 the number of plants engaged in production of railroad equipment has varied from year to year, depending on the needs of the economy. The main producing plants, which were under the jurisdiction of the First Ministry of Machine Building, accounted for all the locomotives and about 70 percent of the freight cars produced during 1949-57. The remaining freight cars were produced by various repair plants subordinate to the Ministry of Railroads.

Cumulative production of mainline steam locomotives and freight cars in 1953-57 fell slightly below the planned levels of 571 locomotives and 35,000 cars. Existing locomotive plants are being expanded, however, and a new one under construction at Ta-t'ung has a capacity of 400 units, which is more than twice the total national production in 1956. Reconstruction and expansion will increase the capacity of the Dairen Locomotive and Rolling Stock Plant to 270 units. Thus by 1960 these two plants alone will have a minimum capacity for annual production of 670 units, more than enough to meet estimated requirements for mainline steam locomotives through 1962. Two plants producing freight cars are being expanded and production is expected to increase substantially thereafter. A new plant that can produce

* See V, B, p. 82, below.

** See Table 14, Appendix B, p. 97, below.

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500 railroad passenger cars per year is under construction at Ch'ang-ch'un. The Chinese Communists consider passenger traffic of minor importance, however, and it is believed that they do not intend to produce passenger cars on a significant scale in relation to production of freight cars.

Communist China produces a considerable variety of mainline railroad equipment. In 1956 the following types were being produced: Mikado No. 1 freight steam locomotives, soft-seat and hard-seat passenger and sleeping cars, mail cars, 50-ton gondolas, boxcars, hopper cars, oil-tank cars, acid-tank cars, and refrigerator cars. During 1956, production of 1-5-1 freight steam locomotives and Pacific-6 passenger steam locomotives was undertaken.

The Chinese produced their first mainline diesel locomotive in 1958. Plans call for production of 200 diesel locomotives, as well as 2,000 steam locomotives, during the period 1958-62. No data is given for the planned production of electric locomotives. Although such locomotives could be used profitably in Northwest and Southwest China, they probably will be produced only to a limited extent during 1958-62. During this period, Communist China will produce most of its steam locomotives, while importing some diesel and electric locomotives from the Soviet Bloc and the West. Imports of passenger cars, special-purpose freight cars, particularly refrigerator cars, and narrow-gauge equipment probably will continue but will become less significant as domestic production increases.

9. Metallurgical Equipment

Production of metallurgical equipment under the First Five Year Plan of Communist China was very small and the range of products limited. Some progress was made in producing equipment for ore crushing and ore dressing, iron and steel smelting, and coking. ^{121/} The first blast furnaces with capacities of 1,000 cubic meters each and open hearth furnaces with capacities of 185 tons each were turned out by the end of 1957. ^{122/} Although Communist China was able to meet about 40 percent of its requirements for smelting equipment, rolling mill equipment remained a critical deficiency.* By the end of the Second Five Year Plan (1958-62), when heavy machinery plants at T'ai-yuan and Fu-la-er-chi are to be completed, the prospects for supplies of rolling mill equipment are expected to be improved considerably. For the immediate future, Communist China cannot produce oxygen-making equipment or the necessary power equipment for the oxygen-smelting process of converter furnaces.

* See Table 24, Appendix B, p. 112, below.

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10. Mining Machinery

Starting with production of small, simple mining machinery in 1952, the Chinese Communists have gradually progressed to the production of more complicated types. Various types of machinery produced under the First Five Year Plan include a Soviet model of a coal-loading machine, mechanical conveyors, coal-washing equipment, and drilling machines. 123/ Trial production of such heavy mining machinery as "Donbass" coal combines, rock loaders, and electric coal loaders reportedly took place during 1952-55, but it is doubtful that serial production was undertaken by the end of 1957. 124/

Neither the volume of production nor the range of products was adequate for the extensive mining operations of Communist China. In October 1956, Chen Yu, Minister of the Coal Industry, complained that the country had neither sufficient large electric shovels and electric locomotives for open-cut coal mines nor other types of equipment needed for coal shafts. 125/ Although trial production of the first Chinese electric mine locomotive took place in 1958, Communist China must rely on imports of this commodity for some time. Very significant improvement in the volume and variety of production of heavy mining machinery is expected by the end of the Second Five Year Plan as a result of the completion of the Lo-yang Mining Machinery Plant in 1958.

New hydraulic mining techniques, which are now being promoted, may require new types of machinery. The T'ang-shan Coal Science Institute is designing special water pumps and studying needs for new machinery for water removal.

11. Oilfield and Exploratory Equipment

Under the First Five Year Plan, Communist China depended heavily on the USSR and Rumania for oil-drilling equipment.* Although several plants in Shanghai were organized to produce drills, roller bits, sets of joints, and gate valves for oil pipelines and an oil-drilling machine capable of boring 1,200 meters, the level of production was not significant.** 126/ Since the completion of the Sian Geophysical Instruments Repair and Manufacturing Plant in 1956 the supply of geological surveying equipment for the petroleum industry probably has been fairly adequate. A new petroleum machinery plant in Lan-chou, which was to be completed in 1959, will enhance the presently limited capacity of China for producing drilling and refining equipment*** to support the present extensive

* See V, A, 2, p. 81, below, and Table 24, Appendix B, p. 112, below.

** See Table 14, Appendix B, p. 97, below.

*** See Table 24, Appendix B, p. 112, below.

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exploration for oil. Because of Chinese inexperience, however, several years must elapse before the new capacity is fully exploited. It is estimated, therefore, that a significant increase in production will not be realized before 1961.

12. Textile Machinery

The development of the textile machinery industry to the point of making Communist China virtually self-sufficient in such equipment represents a notable achievement in machine building. Although there were a number of plants in operation before 1949, the machine-building industry succeeded in turning out many new types of machinery, the more significant advances occurring since 1953. 127/ Substantial gains in production were obtained by consolidating small machine shops into state-owned or state-managed plants.* Moreover, the effort to increase production was greatly facilitated by the availability of a labor force familiar with the repair and production of textile machinery. Production was uneven during 1952-57, having increased sharply in 1954, when the new Ching-wei Textile Machinery Plant, the largest and most modern in China, went into operation, and declined about 38 percent in 1955 because of a poor cotton crop. A similar decline occurred in 1957, probably because of overproduction in 1956 that satisfied a portion of the needs for new construction in 1957.

Although Communist China has achieved self-sufficiency in most cotton textile machinery and has exported complete sets of this machinery to underdeveloped countries, it continues to import other types of textile machinery. 128/ For example, during 1957-58, Communist China ordered dyeing and finishing machines and wool textile equipment from the UK. 129/ Present plans call for the attainment of self-sufficiency in all types of textile machinery in 1960-61. 130/ Substantial progress has been made in producing automatic silk looms, but there has been little development of machinery for production of fabrics from artificial fibers. 131/

G. Labor Force and Productivity

By the end of 1957, there were 1,760,000 workers and employees in the metal-processing sector of the machine-building industry of Communist China. This number is roughly 27 percent of the labor force employed in machine building and metalworking in the USSR. 132/ Under the First Five Year Plan (1953-57), more than 900,000 new

* The development and production of textile machinery is under the jurisdiction of the Ministry of the Textile Industry rather than the First Ministry of Machine Building.

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workers were employed in the metal-processing sector, a doubling of the worker force,* and the relative importance of metal processing as an employer of industrial labor increased significantly. Nevertheless, nonagricultural occupations, including machine building, absorbed only a small part of the total increase in population during 1953-57.** 133/

Under the impetus of general economic recovery and accelerated investment, productivity per worker nearly doubled between 1952 and 1956.*** However, because of short-run cutbacks in production and underutilization of capacity resulting primarily from shortages of raw materials, productivity declined in 1957. (See Figure 1.****)

H. Problems of Production

1. Underutilization of Capacity -- Symptoms and Causes

By the end of 1957, grave disproportions had developed in the economic growth of Communist China. These disproportions were particularly accentuated after the upsurge of production in 1956. The extremely rapid development of machine building in relation to other industries and sectors created imbalances in the demand for products and the supply of raw materials that intensified the problem of underutilization in 1957 in such industrial sectors as those producing trucks, locomotives, freight cars, small and medium diesel engines, machine tools, deep-drilling machines, agricultural machinery, textile machinery, steam boilers, electric motors, and transformers. The First Ministry of Machine Building† planned production valued at 2.31 billion yuan in 1957, but production valued at 3 billion yuan could have been attained, according to official statements, if plants had been able to operate at full capacity. Thus about 23 percent of the capacity for production of these sectors of the machine-building industry was not utilized in 1957. 134/ Accentuation of the problem of latent capacity is illustrated in the rate of utilization of metal-cutting machine tools in enterprises of the First Ministry of Machine Building, as shown in the following tabulation 135/:

* See Table 18, Appendix B, p. 102, below.

** The failure of the development policies of the Peking regime to maximize employment is discussed below, III, B, p. 55.

*** See Table 19, Appendix B, p. 103, below.

**** Following p. 6, above.

† The First Ministry of Machine Building as it was constituted before the reorganization of 1958. See Appendix C.

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<u>Year</u>	<u>Percent of Utilization</u>
1953	61
1954	58
1955	59
1956	75
1957	65

Factors which contributed to these difficulties are discussed in the following sections.

2. Shortages of Raw Materials

One of the most serious manifestations of disproportions in the industrial growth of Communist China was the widespread shortage of raw materials. In 1955, about 66 percent of total machine stoppage time was attributable to "no work," meaning lack of raw materials for the most part. The comparable figure for 1956 was 61 percent. 136/ An even higher rate of stoppage because of shortages of materials in 1957 is probable. In addition, shortages of electric power appeared in a number of important industrial areas. Such shortages of materials and power were caused by errors in planning connected with the speed-up in the program for construction in 1956. The planners apparently failed to recognize the full impact on resources that would come about as construction was accelerated and as 140 new plants and mines began operation in 1956. The target for capital construction had been set too high in 1956, calling for excessive investment expenditures of 1.5 billion to 2.0 billion yuan, which required additional supplies of 375,000 to 500,000 tons of steel. In addition, about 150,000 tons of steel were wasted in 1956 in the overproduction of farm implements that were not suited to Chinese agriculture. 137/

The basic reason for these shortages of raw materials was the fact that the new machine-building plants which emerged toward the end of the period 1953-57 caused a shift in the pattern as well as an increase in the volume of demand. The inadequate development of facilities for mining and dressing ore acted as a brake on further expansion of production in the iron and steel industries. Although significant advances had been made in production of rolled steel, the iron and steel industry was unable to supply the increasing variety of steel required by the advancing technological level of Chinese Communist industry. 138/ For example, there were particularly acute shortages of boiler steel plates, cold-rolled steel plates, large steel products, and alloy steel products. 139/

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Thus the shortage of raw materials was not of a temporary nature. Moreover, trade adjustments could not cope with the problem adequately, although they could have been better managed. Under the First Five Year Plan (1953-57), it was possible in many instances to satisfy demand for steel by supplementing domestic production with imports. During 1953-55 the supply and demand for steel generally was balanced through large imports of both steel materials and machine equipment; and although supplies of some goods (for example, medium plate) did not satisfy demand in these years and there were slight surpluses of certain goods (for example, small-scale steel materials), both state reserves and stockpiles increased each year. In 1956, however, shortages of raw materials became extremely critical because of the particularly rapid increase in machine building and in investment in capital construction. The result was a greater increase in the demand for steel than in production of steel, while at the same time imports of steel dropped and exports increased. 140/

The machine-building industry of Communist China accounted for approximately 25 percent of the total demand for steel in 1953-55 and approximately 30 percent in 1956-57. This percentage is very low compared with that of industrially advanced countries and is perhaps typical for an underdeveloped country beginning the process of industrialization. In the USSR the machine-building industry for many years has accounted for about 40 percent of the total demand for steel. In the US this percentage was between 35 and 37 percent annually from 1947 to 1954, and in Japan it was about 39 percent from 1936 to 1940. The main reason for the lower percentage in China is that under the First Five Year Plan a great deal of machinery was imported, while at the same time large basic construction resulted in relatively large allocations of steel for building and installation and a correspondingly low allocation of steel for processing in the machine-building industry. 141/ As more industrial projects for the machine-building industry were brought to completion in 1956-57, the demand for steel for actual processing increased rapidly.

The abrupt changes in the balance between the machine-building industry as a consumer of raw materials and those segments of the economy producing raw materials and power are reflected in the comparative rates of growth for the machine-building, steel, and electric power industries. Indexes of production by these industries in 1952-57 are shown in Table 5.*

* Table 5 follows on p. 47.

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Table 5

Indexes of Production by Selected Industries of Communist China
1952-57

	1952 = 100					
<u>Industry</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>	<u>1957</u>
Machinery and equipment						
manufacturing a/	100	154	189	216	411	426
Finished steel b/	100	134	157	200	353	403
Crude steel b/	100	132	165	212	331	396
Electric power b/	100	126	151	169	227	264

a. Data are based on value of production, as shown in Table 13, Appendix B, p. 96, below.

b. Data are based on volume of production

50X1
50X1

As shown in Table 5, the growth of the machine-building industry of Communist China was in fairly even balance with that of crude steel and finished steel through 1955, which coincided with a fairly even distribution of steel products between transportation, construction, and machine building. The disproportionate advance of machine building in 1956 disturbed this balance and caused widespread shifts in the allocation of steel products. As a consequence, investment in the machine-building industry was cut back in 1957. It was also planned to cut back production somewhat, but this plan did not materialize. The rapid expansion of machine building, however, was brought practically to a standstill, thus affording time for the iron and steel industries to catch up partly, so that by the end of 1957 a better balance was restored. The disproportionate increase in production by the machine-building industry in 1957 was greater when compared with that of crude steel and less when compared with that of finished steel.*

The index of production by the electric power industry of Communist China shows a consistent lag behind that for the major

* Because finished steel includes some recirculated scrap, it is believed that the comparison between machine building and crude steel is more meaningful. Moreover, there is firm evidence from official sources that figures for finished steel involve some double-counting of billets and therefore show an unduly favorable comparison with machine building. 143/ The extent of the distortion is not known.

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consuming industries. It was reported that in 1956 a total of 23 industrial districts were not receiving adequate power, the more important districts being Peking-Tientsin-T'ang-shan, Tsinan, Sian, Cheng-chou, Ch'eng-tu, Chungking, and Canton. ^{144/} For strategic reasons the Chinese decided to build up industries in the interior and, according to a Communist economic journal, it was expected that one-half of the country would be faced with a shortage of power by the end of 1957. ^{145/} At the end of 1958 the shortage of power in industrially important Northeast China was severe. The iron and steel industry and the machine-building industry, followed by the chemical industry, were given priority in the consumption of electricity. Nevertheless, in spite of strict rationing, these same industries suffered reductions in production. ^{146/}

50X1
50X1

many of the older and most important industrial areas, where shortages of power have been acute and where there is the greatest capacity for adjusting power load through grid systems. The shortages, however, have not been quite uniform throughout China. In some inland areas, for example, the expansion of electric-generating capacity has actually kept ahead of industrial requirements, and there is concern that a shift in economic policy toward greater dependence on existing industrial bases will result in underutilization of this capacity. Nevertheless, shortages of power in the major industrial areas remain one of the most serious hindrances to economic growth.

50X1

According to official statistics, several bureaus under the First Ministry of Machine Building consumed the following amounts of iron and steel for each 10,000 yuan value of production in 1955 ^{148/}:

Bureau	Average per 10,000 Yuan	
	All Ferrous Metals	Finished Steel
All machine building	5.33 tons	1.4 tons
Second Machine Bureau (lathes and tools)	3.7 tons	0.1 ton
Third Machine Bureau (heavy-duty and mining machinery)	13.0 tons	1.9 tons
Locomotive Engine and Vehicle Bureau	8.6 tons	3.5 tons
Bureau of Electric Appliance Industry	1.1 tons	0.3 ton

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The estimates of 5.33 tons and 1.4 tons in this tabulation imply an annual requirement for the machine-building industry as a whole of 1,615,000 tons of ferrous metals, including 424,000 tons of finished steel products.* Statistics for the latter part of the First Five Year Plan indicate that the machine-building industry required 1.5 tons of rolled steel per 10,000 yuan of finished machinery products, or about 450,000 to 900,000 tons annually. 149/

The critical shortage of raw materials has had significant repercussions in plans for the machine-building industry and is believed to have caused the reduction of investments in certain less essential machine-building plants in early 1957. For example, investments in the construction of the Tientsin Tractor Plant and the Peking Lathe Plant were suspended, and those in the Lo-yang Tractor Plant and Wu-han Heavy Machine Tool Plant were reduced. 150/ During 1953-56, more investment had been allocated to machine building than to the steel industry. In view of the scarcity of iron and steel and the existence of considerable latent capacity in the machine-building industry, it was decided that in the plans for 1957 the allocation of investment should favor production of steel at the expense of machine building. 151/

50X1

Shortages of raw materials persisted in 1957 in spite of these corrective measures. In August 1957, it was announced that investments in capital construction in the machine-building industry would be reduced in 1958 compared with 1957 and that the vigorous development of industries producing raw materials, fuel, and electric power would be stressed.**

3. Limitations in Capacity to Absorb Domestically Produced Machinery

Underutilization of productive capacity in the machine-building industry of Communist China also was caused by the inability of the economy to absorb the maximum production of some machinery products. Plants producing lines such as small- and medium-size diesel engines, some types of metal-cutting machine tools, deep-drilling machines, agricultural machinery, textile machinery, steam boilers, and electric motors and transformers either did not operate at capacity or, as a consequence of overproduction, were forced to curtail production. 152/ Factors which contributed to this development are discussed below.

* For the value data for the machine-building industry on which this estimate was based, see Table 13, Appendix B, p. 96, below.

** For further details, see the discussion of the Second Five Year Plan in IV, B, 1, p. 65, below.

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a. Limitations in Product Mix

The capacity of the machine-building industry to produce ordinary low-grade equipment is comparatively large and, in some instances, actually exceeds national requirements. At the same time, Chinese plants are weak in the techniques and facilities necessary for production of the large, complicated machinery required for the program of capital construction. As a result, the economy was unable to utilize fully the existing capabilities of the industry, while the industry could not meet the requirements of the industrialization program, thus necessitating heavy imports to supply the shortage. For the most part, the development of new products was slow under the First Five Year Plan (1953-57).

b. Low Priority for Agriculture and Light Industry

In the formulation of the First Five Year Plan, Chinese Communist planners paid lip service to the interdependence of heavy industry, light industry, and agriculture. Relatively little investment, however, actually was allocated to these sectors during the plan period. Consequently, the Peking regime made only limited concessions to the needs of agriculture and light industry for machinery and equipment. Notwithstanding the fact that the economy was nearly totally planned and therefore had complete control of supply and demand, the policy of slighting investment in agriculture and light industry may have been somewhat self-defeating. In view of the economic importance of these sectors, their potential as outlets for machinery is considerable. There might have been less of a problem of overproduction in certain low-grade lines of products if agriculture and light industry had been allocated more investment to absorb machinery under the First Five Year Plan. In 1957 the Peking regime became genuinely concerned about the lag in agricultural growth. In a general reaffirmation of the importance of agriculture, the regime rediscovered (1) its heavy dependence on this slowly growing sector, both as a source of capital for investment and as a market for the products of heavy industry, and (2) the necessity of accelerating the development of agriculture in order to avoid retarding the program for industrialization. 153/ These points were stressed by Mao Tse-tung in his famous speech on "contradictions." 154/

In some cases, declines in the demand for machinery reflected not a reduction in the absolute level of production in consuming industries but rather a cessation or decline in the rate of growth of these industries. For example, periodic failures of crops necessitated a reduction in the rate of increase in production of textiles. The decline in production of textiles, in turn, reduced

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the demand for textile machinery for purposes of expansion. In 1953, 1955, and 1957, production of cotton-spinning machinery actually fell below the level of the previous years, and in 1955 and 1957 the same was true for production of cotton looms.* Diesel engines are a somewhat analogous case. Because of the shortage of diesel fuel and the high cost of imported fuel, diesel engines cannot be widely used. 155/

The Peking regime has shown a marked tendency to export capital equipment that cannot be absorbed readily by the economy. That Communist China, a country poor in capital, should export machinery produced at a high cost and sell it probably at a loss is a measure of the fundamental dislocations and failures of planning within its economy.

c. Excessive Use of Foreign Equipment

The considerable underutilization of capacity in the machine-building industry of Communist China during 1957 was attributed in part to discrimination in favor of foreign equipment, which resulted in an insufficiency of orders for domestic plants. 156/ Since early 1957 the Chinese Communists have expressed increasing dissatisfaction with the results of heavy dependence on Soviet advice and rigid adherence to Soviet designs. This policy caused excessive demand for imported equipment, which placed an additional strain on the Chinese balance of payments. Toward the end of the First Five Year Plan, reliance on imported capital goods actually conflicted with the development of markets for domestic machinery. 157/

A number of factors contributed to the excessive demand for Soviet capital equipment. The very fact that the Chinese Communists sought a rapid advance to the highest technical levels meant that the productive possibilities of the existing plants, most of which were at a very low technical level, were neglected. 158/ Moreover, the Chinese Communists themselves admit that they "over-stressed specialization and regularization," 159/ indicating that the failure to make full use of domestic machinery was attributable in part to rigidity in the application of Soviet industrial specifications, which called for highly specialized techniques and standardized equipment. In addition, the presence of Soviet advisers throughout the planning hierarchy naturally encouraged the use of Soviet machines and techniques. Another factor tending to increase the use of Soviet capital equipment is the fact that Chinese planners borrowed such Soviet planning aids as productivity norms for machinery. Because these indexes were based on Soviet equipment, the Chinese

* See Table 14, Appendix B, p. 97, below.

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probably desired that Soviet equipment be used for the sake of standardization. 160/ Finally, there was a strong preference on the part of some Chinese planners for foreign, particularly Soviet, equipment and a lack of faith in the quality of the domestic substitute. 161/

4. Limited Capability for Independent Designing

The effects of limitations in the product mix were aggravated because of the inability of the machine-building industry of Communist China to respond to changing needs for new types of equipment. It is also possible that Chinese Communist planners overestimated the capacity of agriculture and light industry to absorb the types of machinery and thus could have selected too large a scale of production. Much inflexibility, however, was built into facilities for production as the result of too much stress on specialization, adherence to Soviet designs, and reliance on Soviet specialized equipment. A number of machine-building plants were designed to produce only one product or a limited range of products. It was found, however, that a considerable variety of such items as agricultural machinery and machine tools were needed to satisfy the diverse needs of such a large area as mainland China and that the limits of the market for any one type soon were reached. A major problem in production arose because the Chinese went directly into large-scale production of certain items before they had improved their capabilities for independent designing. Otherwise, their production system would have had greater flexibility, which would have permitted, as a matter of course, shifts from model to model or even to production of other items as temporary imbalances occurred.

Before 1949, both the level of production and the technology of the machine-building industry were low. As the result of extensive aid from the Soviet Bloc, however, Chinese technical capabilities have gradually improved. One of the goals of Communist China was to manufacture machinery suitable to the land and people. Insofar as possible, this goal was to have been accomplished by using materials produced by the Chinese in machinery designed by themselves. In practice, however, the Chinese produced or designed important machinery and equipment by adopting the specifications established by the Soviet Bloc or requested these countries to do the designing. Not only was time wasted but also very often the equipment was unsuited for conditions in China.

50X1

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50X1

The machine-building industry of Communist China is not in a satisfactory position with respect to designing its own machinery and adapting foreign machinery to Chinese conditions. Technical designing has begun to emerge from a period of imitation, but the process is a slow one. The present limited capability for independent designing constitutes a serious handicap in undertaking production of heavy and precision machinery. Furthermore, the transition is made more difficult because confidence in the previous guide to technical progress, the example of economic development in the USSR, has been shaken by the difficulties experienced in applying Soviet techniques to the peculiar conditions in China.

5. Shortage of Skilled Labor

When the Peking regime launched the program of industrialization, it was immediately apparent that one of the most serious obstacles would be the shortage of skilled workers and technicians. Plans for large-scale economic construction demanded technical skills that were extremely scarce. The rapid influx of new workers into the machine-building industry during 1953-57 presented a very serious training problem.* The Chinese Communist stress on advanced technology required highly skilled workers -- although in relatively small numbers -- and training was facilitated by wholesale imitation of Soviet technology.

To overcome the general shortage of skilled and technical manpower, the Chinese Communists used foreign technical assistance, a system of strict allocation of available technicians, intensive on-the-job training, and a greatly expanded educational program. ^{164/} The First Five Year Plan (1953-57) called for an admittedly inadequate but relatively ambitious increase of 174,000 in the number of specialists and skilled workers in machine building. ^{165/} In spite of these measures, however, the level of technical experience was still low at the end of 1957. This problem is one of the main factors restricting the expansion of production of heavy-duty and precision machinery. ^{166/} Moreover, the inexperience of the labor

* See II, G, p. 43, above.

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force -- along with poor management and excessive pressure on plant personnel to reach and exceed the high goals for production -- has contributed to the faulty maintenance of equipment observed in many machine-building plants. 167/

6. Low Quality

Although the Chinese Communists achieved noteworthy increases in the volume of production of machinery and equipment under the First Five Year Plan, the quality of production often was below standard. This is not to say that all the machinery and equipment produced in Communist China during this period was of poor quality, but the need to improve quality was so great that it was often stated by the Chinese themselves to be one of the most serious problems in the machine industry.

The inferior quality of machinery and equipment may be attributed to the following factors:

a. Lack of emphasis on quality. Much emphasis was given to the fulfillment of quotas for volume and value of production and to production of new types of machinery and equipment, but very little emphasis was given to the quality of products.

b. Lack of standards for quality. In many instances, there was a failure to specify accurately and clearly the standards and technical requirements for the products.

c. Insufficient research. Many plants allowed full-scale manufacture of products without adequate research and development, with the result that products failed to meet standard specifications.

d. Poor inspection. Although there are inspection sections in the plants, there has been a serious shortage of qualified inspectors. 168/

e. Poor quality of raw materials. In some cases the raw materials used were of poor quality and resulted in inferior finished products. 169/

The Chinese Communists have become increasingly aware of the need for improving the quality of the machinery and equipment that they produced. Numerous statements have been made by Chinese leaders on the importance of improving quality. In 1957 it was reported that the idle time of workers resulting from the shortage of raw materials would be spent on improvements in quality. 170/ Moreover, it is

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reasonable to assume that the experience gained in machine building under the First Five Year Plan will aid in improving quality in future production. On the other hand, serious shortages of raw materials and the use of inferior substitute materials probably will continue to be a major problem in any attempt to improve the quality of machinery and equipment.

III. Evaluation of the Machine-Building Industry (1953-57)

A. Progress Toward Chosen Objectives

In terms of the objectives to which Chinese Communist leaders dedicated themselves,* the progress of the machine-building industry under the First Five Year Plan was gratifying. Through heavy investments in large, modern plants the Chinese Communists had greatly enhanced their prestige and military power, had accelerated economic growth, had markedly improved their economic independence, and had provided a stronger material base for the consolidation of political controls over Chinese society. Although the Chinese mainland still was predominantly agrarian, the advance toward an industrialized society in the short span of 5 years was unprecedented. Thus the decision to give priority to the development of heavy industry appeared to be amply vindicated. Even though this investment policy has been largely responsible for the lag in agricultural growth, it remains a firmly fixed principle of the regime. Recently, however, adjustments have been made to increase support to agriculture by heavy industry.**

B. Detrimental Effects of the Pattern of Development

Notwithstanding the positive results of Chinese Communist decisions on investment, the manner in which the development program was carried out had certain detrimental effects on the economy as a whole. These effects are particularly noteworthy because they reveal important reasons for the drastic shifts in economic policy under the Second Five Year Plan.***

Instead of allocating adequate resources for investment in quick-yielding projects, the Chinese concentrated almost entirely on slow-yielding investments in large-scale heavy industrial plants.**** In addition, uncoordinated planning of the timing of the completion of investment projects in subsidiary and related industries often made it impossible to make full use of completed

* See I, A, p. 4, above.

** See IV, B, 1, p. 65, below.

*** See IV, p. 63, below.

**** See I, E, 3, p. 15, above.

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facilities. Such uncoordinated planning has taken place in the machine-building industry of Communist China, where, for example, Ch'ang-ch'un Automobile Plant No. 1, which cost 600 million yuan to build, operates at a fraction of its rated capacity because of insufficient supplies of critical materials.

Another effect of slow-yielding investments is the slower increase in industrial employment. By emphasizing modern, large-scale, capital-intensive plants, Chinese Communist industrial planners used the bulk of their scarce capital in investments that made relatively little use of the enormous supply of manpower in production, as distinguished from construction. The machine-building industry became increasingly capital-intensive under the First Five Year Plan (1953-57). Most of the new plants were highly mechanized.* There is evidence that greater employment could have been obtained by the investment of the same amount of capital in small-size and medium-size plants. 171/

In addition, as a consequence of the inability of the machine-building and other industries to absorb the increase in manpower, the Chinese Communist economy experienced a slower rise in national income. An article in a Chinese magazine contained the following illuminating statement:

According to statistical data, the per capita equipment of the workmen in our country in terms of fixed assets is assessed at [an average of] 4,000 to 5,000 yuan; in the case of modernized, big industry, it is around 10,000 yuan, while in medium and small industrial undertakings where light machines are used, each workman is equipped to the extent of 2,000 to 3,000 yuan. The average value produced by each workman annually is 14,000 to 15,000 yuan in modernized, big industry, or 7,000 to 8,000 yuan in medium and small industry. However, as in big industry the capital of 10,000 yuan is just enough to equip one workman and in medium and small industry the same amount can equip three to five workmen, every 10,000 yuan of fixed assets in modernized big industry nets 14,000 to 15,000 yuan in terms of values produced annually, whereas the same amount of fixed assets in medium and small industry nets 20,000 to 30,000 yuan annually in terms of values produced, small

* See II, B, 2, p. 18, above.

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industry faring a little better than medium industry. Under the present conditions in our country, apart from building a few technically advanced large enterprises, we must therefore launch more small enterprises that require small investment and produce quick results in order to bring about an effective increase of the national income. 172/

This quotation strongly suggests that the increase in national income could have been greater if the newly created plants had been less capital-intensive. Although the state would have realized a lesser improvement in labor productivity per industrial worker than with larger concentrations of capital, larger over-all gains in production and in productivity would have resulted from the larger number of workers employed in industry. This fact follows from the markedly higher productivity of workers in industry compared with those of agriculture. 173/ A Chinese writer for a Soviet economic journal in 1957 made the statement: "In such a country as China the most important factors for increasing social accumulation are maximal absorption of labor resources into production and the regime of the economy." 174/ Plans for the development of the machine-building industry announced since 1957 have emphasized increased inputs of labor.*

In summary, the patterns of investment in the machine-building industry under the First Five Year Plan, by following closely the Soviet model and by adopting Soviet technology wholesale, hindered full use of economic resources, particularly labor. As a result, national income and accumulation of capital for further investment were lowered to the extent that it would have been feasible to invest in a less concentrated fashion in development of the industry. Given the overriding goals of rapidly establishing a large, heavy industrial base and assimilating advanced technology, substantial reliance on large-scale modern enterprises was indispensable. Nevertheless, in retrospect it appears that this policy was pursued to excess, and it is clear that by the end of 1957 the Chinese Communists saw the need for some modifications.

C. Applicability of Soviet Technology

As production technology in the machine-building industry of an underdeveloped country advances and the product mix expands, increased importance is placed on the casting, fabrication, and machining of large work pieces that will satisfactorily meet the design

* See IV, B, 5, p. 71, below.

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specifications. As the technological progress continues, higher standards of precision are attained; parts of both very small and large dimensions are finished to increasingly close tolerances, and the use of more specialized metals and alloys is mastered.

Although historically the initial emphasis in technical improvements has been on increasing the variety and complexity of products, technology in machine building is concerned also with development of more efficient methods of production. This search for efficiency has been essentially oriented toward saving labor, particularly in areas where wages are high, but other important cost factors, such as the reduction of inputs of materials, have figured prominently.

In Communist China, which has started the process of widespread industrialization at a relatively late period, technological advancement is occurring in a number of areas simultaneously -- for example, in production of models of greater capacity, in production of products requiring much greater precision, and in the introduction of more efficient techniques and processes of production. Chinese Communist experience suggests that Soviet technology is not always appropriate for an economy with surplus labor. Sweeping generalizations in this field tend to be somewhat hazardous because various levels of technology are found in the Soviet economy, and technology that is advanced by Soviet standards may be more appropriate under Chinese conditions in one industry than in another. The existence of technological alternatives between labor and capital, however, now is recognized by Chinese planners.

In attempting to make greater use of their labor resources, the Chinese Communists can control both the range of products and the processes of production. In some cases, advanced technology may be linked so intimately with a more efficient and sometimes unique process of production that the choice of means to achieve this process may be very limited, and neither the required quantity nor the quality can be obtained by cruder methods of production.* Therefore, rolling mills, for example, must be imported or produced when Chinese goals call for expanding production of iron and steel. In addition, Communist China has decided to produce at an early stage of its industrial development most of the common types of machinery and equipment such as machine tools, trucks, tractors, and

* The difficulties experienced by the Chinese Communists with the extremely low quality and usability of pig iron produced by crude "native-style" blast furnaces are instructive in this respect. The regime now speaks of "small, modern furnaces," indicating that their range of technological choices lies mainly in scale.

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electrical machinery. China retains the option, however, of emphasizing the fairly simple type and sizes that can be produced with minimum amounts of capital equipment and the lower skill levels that are characteristic of its labor force. Such a policy economizes on equipment, labor skills, and, probably more important, on scarce designing and engineering talent. Moreover, the Chinese Communists face important choices as to complexity and specialization in machine building. Much of the equipment that they need does not require great precision in production and can be produced in batches. Other types of equipment require too much precision or are so specialized that only small quantities are required. In either case it probably would be worthwhile for China to import such types rather than to expend a disproportionate effort in attempting domestic production.

At the same time, Communist China can economize on the use of complicated capital equipment in all of the industrial processes associated with machine building. The most obvious area for saving is in the use of labor instead of equipment for the intraplant transfer of all raw and semifinished materials except very heavy items. Increased employment of labor could also be achieved by redesigning the product to permit the greater use of labor in performing more of the simple industrial operations, by using less machinery in production, and at the same time, using general-purpose machinery to reduce the requirements for complicated specialized and automatic machinery and auxiliary equipment, which often has a high rate of obsolescence.

The recognition of these alternatives by Chinese planners is indicated in the following statement:

The most advanced equipment, it is true, has the advantage of high efficiency, better quality of products, low cost and less manpower employed, but such equipment calls for a highly developed machine-building industry and more investments and takes more construction time. The present conditions of our country are such that our capital is limited, abundant manpower remains to be utilized, and the technical level of the machine-building industry is too low to make such advanced equipment. To adopt too much of the most advanced and automation equipment will, on the one hand, call for imports of more equipment and, on the other, prevent the production capacity of our machine-building industry from being exploited and its technical level from being rapidly elevated. 175/

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The problem of technological alternatives is closely linked with the problems of scale and obsolescence. The use of simpler techniques permits considerable freedom to vary the scale of production. In market economies a reduced scale of production may be the only one which is economically feasible, as shown by the following statement:

Modern technology ... tends to be designed for large-scale production units, whereas the narrower market in poor countries dictates small-scale operations; this may require that the large-scale production process be broken down into smaller scale and simpler procedures which involve a reduction in the degree of mechanization. 176/

Similar choices of scale of production may also be necessary for underdeveloped countries, even though they operate under a planned economy. The inability or unwillingness of Communist China to spread investments broadly in agriculture and light industry has had effects similar to market restrictions, which confront certain branches of the machine-building industry with difficult problems of selecting the optimum scale of production. The same principle does not necessarily apply to all consumer goods merely because per capita purchasing power is low. Countries with a large population may be able to sustain mass production of certain consumer necessities, in spite of widespread poverty, by tapping the large aggregate purchasing power of small individual consumers who are attracted by goods of suitable quality at low prices.

Moreover, large-scale production and a high degree of mechanization are associated with a high rate of obsolescence. It is interesting to contrast the Chinese Communist experience with Soviet technology in this respect with the plan for Chinese industrialization after World War II that was drawn up by the former US Foreign Economic Administration. Taking account of the problems of scale and obsolescence, the US plan proposed that -- although in the US, where all factors favor large-scale production, the average investment required per man employed was \$10,500 (in wartime prices) -- the average investment in China should be only \$6,000 per man employed. In scale of operation, China and the US were compared to the Studebaker and Ford corporations, respectively.

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The Studebaker organization is tremendous by non-American or even by non-Detroit standards. But, alongside the Ford organization, it is small. The Ford Company has a production volume large enough to make the cost of new equipment nominal; it puts a premium on the value of specialized, single-purpose machines and accelerates the rate of obsolescence of entire batteries of mutually supplementary machines. Studebaker, on the other hand, with less than 25 percent of Ford's production, needs much less automatic and specialized tooling than Ford Each organization uses the type of equipment that is most efficient for its purpose and that involves the most satisfactory rate of obsolescence. 177/

Accordingly, the US plan emphasized those types and sizes of equipment the obsolescence of which could be controlled most easily until China could acquire the facilities for replacements and the maintenance of which was simple enough to offset the lack of repair facilities and skilled labor.

D. Implications of Chinese Experience for Communist Economic Theory

From the point of view of the Chinese Communists, rapid economic development, although the main consideration, was not the only one. It may be tempting to judge Chinese performance by Western standards, but such procedures are to a large extent invalid, because Western concepts are often irrelevant to the totally planned economy. Western judgments of performance require reference to economically rational criteria for the selection of the most efficient or productive of alternative choices for investment. In the Communist economy, however, the scope for the application of strictly economic criteria is very limited because overriding state objectives, which are decided essentially by a political process, invariably predetermine the broad outlines of development. Whereas Western theory stresses immediate productivity of investments without regard for the type of investment, Communist economic criteria are allowed, for example, to suggest no more than the most productive means to fulfill set plans for expanding production. Nevertheless, there is usually some room for the application of economic criteria, for economic policymakers of the higher echelon cannot make all the decisions pertaining to choices for investment in a complex economy. A planning bureaucracy must step in at some point to develop specific and detailed plans for implementing the directives of higher authority. In this sense, then,

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it may be asked whether or not investment choices in the machine-building industry were made wisely under Soviet guidance.

By both Western and Communist standards, Communist China undertook prematurely too many new projects that could become productive only after several years, whereas a number of investments in the reconstruction of existing facilities, which could have yielded relatively quick returns in higher productivity, were overlooked. Moreover, criteria that took account of the abundance of labor in China would have dictated more labor-intensive projects and fewer capital-intensive projects. Although no orthodox Chinese Communist would permit such considerations to place light industry above heavy industry, it is very significant that there is considerable latitude for the application of labor-intensive techniques in heavy industry, as the present plans for small and medium-size plants now show.

The necessity of foregoing a wholesale advance to the highest level of technology may make it exceedingly difficult for the Chinese Communists to adhere to certain aspects of orthodox Soviet economic theory. According to Marxist theory, all value is created by labor, and capital does not create value, as such, but merely represents past or "stored up" labor. As a corollary to this principle, the relative effectiveness of investment projects is measured in terms of improvements in labor productivity or, more precisely, in savings of inputs of labor value. ^{178/} Thus, in theory at least, there is an inherent bias toward a high degree of mechanization in the Soviet economic system.* ^{179/} Emphasis on mechanization suits conditions in the USSR reasonably well, inasmuch as industrial labor tends to be relatively scarce. In China, however, where labor is super-abundant and capital is relatively scarce, the drive to achieve savings in labor value, in the Marxist sense, need not be pressed for the sole purpose of conserving manpower. Therefore, theory in the Chinese context should provide criteria for economizing the use of

* That Soviet leaders do not rigorously apply this theory in actual practice should not necessarily be construed from their present deficiencies in mechanization and automation. They readily admit that they lag behind the US in many fields of automation, that their ambitious plans for introducing new equipment have not been fulfilled, and that there are certain heavy restraints in the economy which militate against the rapid elevation of the technical level of industry. In relation to the former state of development of Soviet industry, however, considerable progress toward automation has been made. Moreover, current Soviet policy places great emphasis on mechanization and automation, which was one of the main topics of the Plenum of June 1959.

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capital. The attempt to grapple with the economic facts of life within the framework of orthodox Marxist theory has forced the Chinese into such tortuous paths of reasoning as the following:

In suggesting that in certain fields we do not need to try to attain a high level of mechanization and should not merely consider the improvement in labor productivity, we do not mean to say that we do not need to raise labor productivity. What we mean is that, in making arrangements for construction projects, we cannot merely consider the improvement of labor productivity, although the existing and the newly-established enterprises should retrench personnel and make efforts to increase labor productivity. 180/

There is also evidence that the Chinese have started a campaign to convince Soviet economists that a more labor-intensive approach geared to Chinese conditions and based on smaller-scale undertakings is not in conflict with Lenin's theories that large-scale industry must form the material-technical basis of socialism. 181/

IV. Development Under the Second Five Year Plan (1958-62)

A. Foreign Economic Assistance and Its Implications

At the end of the First Five Year Plan (1953-57) the foundation of the Chinese Communist machine-building industry was, generally speaking, still weak. In spite of the construction projects that had been undertaken, some important sectors of the industry were not developed. Among these sectors were those producing heavy-duty, forge-press equipment; steel-rolling equipment; nitric fertilizer equipment; cement equipment; diesel and electric locomotives; equipment for making artificial and synthetic fibers; precision lathes and measuring instruments; scientific instruments; and instruments for automatic control. In order to correct these deficiencies, as presently intended, substantial investments are required, particularly in heavy and precision machinery and chemical-engineering equipment, during the remaining period of the Second Five Year Plan. Although medium and small machines were overproduced in 1957, the plants turning out this equipment cannot easily be diverted to production of heavy and precision machinery, because of restrictions in equipment and technical force. The lack of heavy machinery capacity will be considerably alleviated when projects begun under the First Five Year Plan are completed by 1961. The scientific instruments and chemical-engineering equipment industries, however, were

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relatively neglected up to 1958 and must be greatly expanded under the Second Five Year Plan.

According to the terms of the Sino-Soviet agreements on economic assistance in August 1958 and February 1959, the USSR agreed to build for Communist China 125 industrial enterprises in addition to the remainder of the projects prescribed by earlier agreements. Projects specified under the agreements, which include facilities for production of chemicals, coals, metals, machinery, radiotechnical equipment, building materials, electric power, and other commodities, are to be undertaken in 1959-67 at a reported cost of 5 billion rubles (equivalent to \$1,250,000,000 at the official rate of exchange, which overvalues the ruble). Essentially, the present agreement represents another in a series of long-term Soviet commitments to supply, on a compensated basis, machinery and equipment for specific industrial projects in China, the deliveries of such equipment being scheduled under trade agreements annually negotiated. The average annual level of Soviet "assistance" under the new agreement is generally considered to be somewhat lower than that provided under previous agreements. One reason for this decline is that the Chinese Communists will increase their participation by providing "the major part of the accessory equipment" for the enterprises stipulated in the agreement. It should be noted, however, that Chinese economic dependence on the USSR is not determined merely by the level of "assistance" in a given period but also by the more or less cumulative effects of steady Soviet technical influence, which will predominate through 1967. The heavy reliance of China on Soviet technology during the formative stages of the machine-building industry will have long-run effects because of the need for replacement of equipment and for compatibility of design and because of the general technical orientation toward the USSR. Although steps have been taken to reduce the role of advisers and technicians from the Soviet Bloc and to increase the capabilities of Chinese engineers for independent designing, the influence of the Bloc will probably remain strong for an indefinite period in electronics, synthetic fibers, metal-forming machinery, and heavy machinery.

Data on the participation of the European Satellites in Chinese Communist industrial development under the Second Five Year Plan are incomplete. The cost of complete sets of equipment for industrial plants of all types that Poland will deliver to China between 1956 and 1962 amounts to 221 million rubles (\$55.2 million). In connection with the protocol on scientific and technical cooperation, signed in 1957, Czechoslovakia agreed to turn over to Communist China technical documents on production of various machines and appliances and information on construction of hydroelectric stations; East Germany, data on production of optical apparatus, machinery and equipment for

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chemical and textile industries, machine tools, typographical machines, ships, and transformers; Hungary, data on production of radiotechnical apparatus, cable, motor vehicles, and tractors; Rumania, data on production of petroleum equipment and other items. 182/

The new Sino-Soviet assistance agreement is further evidence that Communist China is playing a more significant role in its own industrialization. At the same time, buoyant assertions of reduced Chinese dependence on the USSR underscore the fact that the Peking regime is now deeply committed to base future economic development on the foundation of its own machine-building industry. In view of the grave imbalances which developed in the Chinese economy and the enormously wasteful misallocation of resources under the First Five Year Plan, Chinese economic planning can be characterized as somewhat primitive and inept. Now that the Chinese Communists have assumed greater responsibility for equipping their own industrial projects, the effect of miscalculations on planning could be magnified. Dislocations would be the more difficult to overcome because the Chinese industrial base is small and additional capacity would often have to be created in order to produce items for which demand had not been foreseen. As a result, the progress of industrial construction projects could be delayed under the Second Five Year Plan.

B. Restoration of Balanced Growth

Notwithstanding continued Soviet economic assistance, although at a reduced rate, the Chinese Communists have formulated general outlines for the Second Five Year Plan (1958-62) which represent a considerable departure from Soviet experience. The appearance of grave imbalances and dislocations toward the end of the First Five Year Plan (1953-57) posed a serious challenge to economic policymakers in Peking. With considerable dissatisfaction the planners realized that the doctrinaire pattern of concentrating almost exclusively on the development of large-scale heavy industry put excessive demands on Chinese technology and capacity to import, at the same time neglecting agriculture and full use of Chinese manpower. Following this reappraisal the regime responded vigorously to the challenge with new ideas and programs.

1. New Attitude Toward Balanced Growth

Discussions of the Second Five Year Plan in 1956-57 reflected a more realistic attitude that recognized the need for intersectoral balance in economic development. The Peking regime had become concerned with the accelerated rate of population increase, which placed a population obviously too large on land that was too small and poorly cultivated. Food and clothing were, therefore, the two

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chronic worries of the government. In addition, the dependence of heavy industry on agriculture for investment funds and markets was recognized. Thus the lag in agricultural growth was seen as a drag on the entire economy, and drastic corrective measures were deemed necessary.

Although greater attention will be given to the needs of agriculture in the allocation of investment under the Second Five Year Plan, agriculture will not displace heavy industry as the primary aim in economic development. Rather, there will be some shifts in priorities within industry to support agricultural growth. The revised "general line for socialist construction," adopted at the Chinese Communist Party Congress in May 1958, called for the "simultaneous development of industry and agriculture, while giving priority to heavy industry." Accordingly, components of the machine-building industry associated with production of chemical fertilizer equipment and irrigation equipment are to be expanded at an accelerated rate.*

Moreover, the new plan sought to restore a balance between industries producing raw materials and those consuming raw materials. Within heavy industry the greatest stress will be given to the fuel, power, metallurgical, and chemical industries. Whereas the ratio of investment in industries producing raw materials to investment in the metal-processing industries during 1953-57 was 2.5 to 1, it was to be raised to 4.6 to 1 beginning in 1958. 183/ This change implies high priority within the machine-building industry for metallurgical equipment and power-generating equipment, which is actually in effect in the program for capital construction in 1959.

Chinese Communist planners assumed that machine building would require an increasing proportion of steel, whereas the proportion of steel used in construction and installation would decrease correspondingly. They estimated that under the Second Five Year Plan the quantity of steel used by the machine-building industry would account for about one-third of the total demand for steel. 184/ On the basis of this heavy demand a number of Chinese economists concluded that, compared with the First Five Year Plan, the steel industry should be allocated relatively more investment than the machine-building industry under the Second Five Year Plan. 185/

This allocation of investment appears to be sound. It is expected that industries producing raw materials should experience more rapid growth than machine building for a considerable time. At present the industries producing raw materials must supply both the reconstructed machine-building facilities and the new plants that

* See IV, C, p. 76, below.

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have been constructed. In addition, they must meet the needs of the over-all program of capital construction. A number of large machine-building projects begun under the First Five Year Plan will initiate production during 1958-60. As new capacity comes into production and the demands for capital construction continue, the industries producing raw materials may be even more hard pressed to meet their commitments, especially if the Chinese also desire to reduce such imports.

2. Changed Approach to Self-Sufficiency

In the light of their tremendous economic problems the Chinese Communists have profoundly altered their approach to economic independence and self-sufficiency. Whereas previously they had cast Communist China in the same role as the USSR before 1936, they found in 1957 that

The international environment in which we now find ourselves is different from that in which the Soviet Union found itself when building socialism. Ours is not an isolated and sole socialist country. The Soviet Union and, in particular, the Peoples' Democracies of East Europe generally speaking have a great capacity of machine-building industry and hope to supply our country with more machines. From the standpoint of international cooperation between socialist countries, it would appear that our country may produce fewer machines for the time being and solve our problem through international cooperation and concentrate more construction capital on projects which are more essential. 186/

This new attitude may be, in part, a reflection of certain changes in the position of the Soviet Bloc on self-sufficiency since the death of Stalin. Communist economic thought has become somewhat less doctrinaire on the requirement that every member must develop heavy industry and now differentiates between the more and less advanced Communist economies, maintaining that the former should supply machinery and equipment to the latter, who in turn would generally supply agricultural and mineral products to other members of the Bloc. A greater measure of discrimination in pursuing self-sufficiency clearly implies a change in Chinese trade relations with other countries of the Bloc. Extensive relaxation of autarkic tendencies which prevailed through 1957 would be required. Perhaps with the purpose of reassuring the European Satellites of this intention,

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a Chinese contributor to a Soviet economic journal stated: "The creation in [Communist China] of an integrated industrial system will not lead to a weakening of its ties with other countries of the socialist camp Division of labor and specialization of products within these countries, in correspondence with their economic possibilities and natural resources, will receive further development." 187/ A logical consequence of a program for specialization would be greater Chinese participation in CEMA (Council for Mutual Economic Assistance -- Sovet Ekonomicheskoy Vzaimopomoshchi).

The Chinese Communists are not likely, however, to pursue the principle of international specialization to its logical ultimate conclusion. An article in a Soviet economic journal indicated that, if the socialist countries cooperated on the basis of an international socialist division of labor, it would be possible to determine the effectiveness of investments not only on a national scale but also in respect to all countries of the Sino-Soviet Bloc and thus to increase the rational use of all productive resources. It noted that this plan would involve a comparative analysis of the productivity of labor and costs of production for each commodity. 188/ From only a hasty glance at the cost structure in Communist China compared with those in the Soviet Bloc, it is expected that the Chinese would have a comparative advantage in labor-intensive lines of production. It seems certain, however, that the Chinese would not allow themselves to specialize permanently in labor-intensive products, neglecting to give priority to the development of heavy industry in general and of the machine-building industry in particular. In fact, the Chinese Communists look upon international technical and economic cooperation as a way to overcome their weaknesses in producing heavy machinery, precision machine tools, and instruments, in spite of the fact that they do not have a comparative advantage in these industries. 189/

3. Program for Small- and Medium-Size Plants

The new emphasis on the construction of smaller units is one of the key policies in the drive for quicker returns on investment and represents a very significant departure from the typical Soviet techniques heretofore employed in Communist China. More reliance is to be placed on local investment, manual labor, and traditional methods of production in contrast with the large-scale, highly mechanized, and specialized plants built with Soviet assistance and controlled by the central government. In his report on 5 May 1958, Liu Shao-chi described the advantages of smaller plants in the following general terms:

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It is necessary for the central, provincial, municipal, and autonomous region authorities to build a certain number of big enterprises. Big enterprises which have a big output and a high technical level can solve key problems having a decisive bearing on the national economy. They form the backbone of the force that pushes forward the industrial development of the country. But small- and medium-size enterprises have the advantage over big enterprises in that they require less investment and can more easily absorb funds from scattered sources; they require less time to build and produce quicker results; they can be designed and equipped locally; they can make do with various types of equipment which are readily available in the localities. They can be set up over a wide area so as to facilitate industrialization of the country as a whole and promote the training of technical personnel throughout the country and a balanced development of the economies of the various regions. They can reduce transport costs and make flexible use of available resources, making it easier to bring about a satisfactory relation between supply, production, and sales. It is easier for them to make flexible use of the labor power available in the countryside and of casual labor, depending on the amount of work to be done, and thus help reduce the differences between city and countryside, between workers and peasants. 190/

What part small- and medium-size plants are to play in the development of the machine-building industry has not been clearly defined. It would not seem possible to rely principally on smaller plants for production of heavy machinery, which is to be greatly expanded under the Second Five Year Plan. Rather, the new heavy machinery plants at T'ai-yuan, Wu-han, and Fu-la-erh-chi will bear the primary responsibility in this field. The smaller plants may serve to support the larger units and fill the remaining gaps. Production at the large, new enterprises has tended to be highly specialized, so that there might be opportunities for smaller plants to produce accessory equipment and thus to broaden the range of products.

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Moreover, smaller plants can serve to supply parts and subassemblies and other items to large plants.

It is feasible, nevertheless, to assign important tasks in production of lighter machinery to the small- and medium-size plants. The First Ministry of Machine Building reportedly has developed about 120 standardized designs for such machinery and electrical equipment plants. The designs are mainly for plants that are to serve special districts, hsiens, and hsiangs, with a few to be managed at the provincial level. The plants include general machinery plants, agricultural machinery plants, power-producing machinery plants, chemical fertilizer equipment plants, antifriction bearing plants, electrical equipment plants, electric wire plants, and light-bulb plants. Investments range from less than 50,000 yuan to more than 1.5 million yuan.

Provincial or special district plants are designed to support heavy industry, consumer industries, and agricultural production (especially with respect to chemical fertilizer equipment and irrigation equipment). The small plants below the hsien level are designed to meet the needs of rural villages and will emphasize repair of tractors and agricultural machinery. 191/ Small, local plants should prove much better suited than larger plants, both from an administrative and a technical point of view, in coping with a limited demand for a wide range of products.*

4. Decentralization

During 1958, there was considerable discussion of decentralization in the machine-building industry as a means of coordinating production between larger and smaller plants. According to Chao Erh-lu, Minister of the First Ministry of Machine Building, a number of "economic coordination areas," each embracing a population of up to 100 million, will be established. Plants under the direct control of the ministry will be transferred "step by step and trade by trade" to regional authorities. The devolution of authority would appear to cover control of production arrangements and raw materials. The ministry would retain responsibility for general planning, technical guidance, and supervision. Within the areas, plants would be combined and production integrated so as to insure self-sufficiency in ordinary machinery requirements, whereas interarea coordination would be achieved in production of commodities that are heavy and large and require complicated techniques. Thus a considerable measure of regional specialization would be preserved, especially where the additional purpose of reducing costs of transportation

* See II, H, 4, p. 52, above.

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could be served. For example, heavy machine-building enterprises would be established in the vicinity of large metallurgical combines, mining equipment bases near large coal mines, marine equipment bases along the coast, and precision tool and instrument plants in areas where the technical standard is traditionally high and skilled personnel are relatively concentrated. 192/

There is little solid evidence that decentralization is actually being implemented in the machine-building industry, except to a limited extent in electrical equipment. Central government plants have given some assistance to local machinery enterprises, but it appears that the ministries retain control over the large and technically advanced plants that account for the most significant production of machinery.

It is possible that the trend toward decentralization, at least insofar as many existing plants are concerned, will not be pressed, because of the overriding need for coordination in production of complete sets of equipment. 193/ For example, production of thermal turbogenerator sets with a capacity of more than 12,000 kw involves coordination among more than 80 large- and medium-size machinery plants in various parts of Communist China. 194/

5. Emphasis on Better Adaptation of Foreign Experience

Under the Second Five Year Plan, the criteria for industrial design are to be fundamentally changed. Native engineers will be expected to adjust their technical standards and specifications to Chinese productive capacity and to take account of the pressing need to utilize abundant manpower.

Chinese engineers are said to be capable of designing machine tool plants, steam turbine and boiler plants, diesel engine plants, plants producing tractor and automobile parts, plants producing metallurgical and mining equipment, plants for locomotives and rolling stock, and shipyards for building both inland and ocean-going vessels. 195/ According to the terms of a Sino-Soviet technical assistance agreement signed in November 1958, most of the 47 industrial projects to be constructed or expanded were to be surveyed and designed by the Chinese, the main equipment being supplied by the USSR. The USSR agreed to provide many up-to-date designs, blueprints of new products, and other technical data. 196/ This agreement probably is significant as an indication of the extent of Chinese participation in the designing of large projects. It is believed that, until their capabilities for really original designing have greatly improved, Chinese engineers will play their most important role in modifying Soviet design so as to eliminate nonessential housing, amenities,

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materials handling, and other operations where labor can be used intensively. Soviet concepts of city planning in connection with industrial projects probably will be discarded in most cases. Since early 1958, all blueprints for above-norm projects must be scrutinized and approved at the ministerial level. 197/

In response to the need for modification of Soviet designs, Chinese Communist designers of the Ministry of Light Industry prepared a number of prototype designs for small plants, such as paper-making plants, breweries, and sugar refineries. These designs are said to be based on the principle of "using more manual labor, fewer steam boilers, and less electricity and improving quality." Little investment is required, and construction can be completed in a short time. 198/

In addition to paring "nonproductive" facilities from investment schedules, the new technological policy of Communist China calls for less emphasis on automation and highly complex machinery where appropriate. In connection with new development projects, executives of the Communist Party have urged greater attention to the possibilities of absorbing more workers into the industrial sector of the economy. Sectors selected for labor-intensive development include mining, construction of buildings, water conservancy, communications and transportation, forestry, and handicrafts in addition to agriculture. 199/

This trend will affect the type of machinery that the machine-building industry will be required to produce to support development in such fields as mining machinery, construction equipment, transport equipment, and agricultural machinery. In such instances, simple and light machinery and equipment can be turned out by local industries and agricultural cooperatives to meet local needs. In many applications, full mechanization is not feasible under Chinese conditions. This fact is recognized by the Chinese Communists, who are pressing forward a technological revolution of a character which may be extremely effective in a labor-surplus economy, although it would seem unimpressive to most Westerners. This program is based on the principle of combining mechanization with semimechanization, improvement of tools, and manual methods, and its goal is not to replace labor, as in advanced industrial countries, but to magnify its effectiveness. Thus the efficiency and productivity of labor are to be increased through the use of better hand tools, the replacement of carrying poles by push carts drawn by men, and similar measures.

There do exist considerable opportunities for the application of this approach to production of machines. Machines

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are indispensable in building tools and other machines. Conceivably a policy of intensification of labor inputs would not only improve industrial employment but also might alleviate problems of production caused by shortages of some of the more complex and specialized machine tools. The crux of the matter seems to be in simplifying the production processes so as to be able to use the simpler machinery made in Communist China. For example, if a certain machine tool could handle five operations but was in short supply, the same job could be done by five operators using simple lathes. Unskilled labor can be used to replace some materials handling operations. The program for development of small- and medium-size plants would seem to offer some of the best opportunities for setting up such production processes.*

6. Slowdown in Regional Dispersion

Considerable development of the machine-building industry in the interior of Communist China will take place under the Second Five Year Plan. This development is made possible largely by the accelerated construction of the new iron and steel bases at Wu-han and Pao-t'ou. The new industrial center of Pao-t'ou in Inner Mongolia will receive five times as much capital construction investment under the Second Five Year Plan as under the First. 200/

From recently established criteria, it is possible to infer that the Chinese Communists have decided, however reluctantly, not to press too rapidly plans to locate new plants in remote and less vulnerable areas. In the past, too much investment had to be funneled into dormitory and municipal construction, and new railroad links had to be created to support undertakings in underdeveloped areas. The new policy is to utilize small- and medium-size towns to the fullest extent as bases for new plants. 201/ Such use will maximize the return on investment and reduce costs of production. Shanghai and Tientsin, two vulnerable coastal cities, are to be developed as centers for producing heavy machinery.

7. Policy on Consumption of Fuel

The machine-building industry is making strenuous efforts to develop engines and motors suited to supplies of fuel and power in Communist China. Plans outlined by the National Technological Commission call for the development of tractors consuming solid fuels. Because of the shortage of petroleum, no large requirements for liquid fuels are to be considered for agricultural machinery. Instead of diesel engines for the countryside, therefore, plans call for production of coal-gas and steam engines that can be adjusted to the

* See II, H, 3, c, p. 51, above, and III, B and C, pp. 55 and 57, respectively, above.

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various characteristics of coal in different regions and to the employment of such local fuels as millet, stalks, and hay. After the coal is steamed at low temperature and liquid fuel and chemical material are extracted, the semicoked charcoal is to be used in agricultural machinery. 202/ A number of the trial models of new tractors that have appeared are fitted with coal-gas engines. Moreover, some "Liberation" trucks in 1958 were scheduled to have coal-gas engines. 203/ Although a few diesel, steam, and electrically driven engines will continue to be used in mechanized irrigation, the greatest emphasis will be placed on equipment powered by coal-gas engines, which have proved more efficient and cheaper to produce and operate than steam engines for this purpose. 204/ The use of electrically driven water pumps would be highly desirable, but opportunities are limited because of the slow pace of rural electrification. Motor vehicles and tractors using coal gas operate at reduced efficiency and considerably lower power, but this sacrifice is deemed expedient in view of the paramount necessity of reducing the demand for petroleum. Although promising discoveries of oil were announced in 1958, plentiful supplies of petroleum products still appear a long way off. Moreover, it seems likely that the Chinese Communists will not hasten to expand oil imports from the USSR but instead will continue to restrict requirements to the most essential uses.

8. Substitutes for Scarce Materials

As a means of alleviating shortages of certain raw materials, machine-building enterprises have undertaken the extensive substitution of more plentiful materials. In production of motor vehicles, substantial savings in the consumption of nickel have resulted from the use of chromium-manganese-titanium steel instead of nickel-chromium steel and chromium casting iron instead of nickel-chromium casting iron. Manganese steel or quality carbon steel has been substituted for structural chromium steel, straight carbon steel for quality steel, hot-rolled sheet for cold-rolled sheet, and aluminum for copper. 205/ Plants producing electrical equipment have experimented successfully with aluminum alloys as substitutes for copper in electric motors. 206/ Designs have been modified to eliminate unnecessary metal, and plants producing equipment of inferior design are to emulate the most economical producers. 207/ Proposals made by workers on the "leap forward" campaign within the First Ministry of Machine Building requested, perhaps somewhat overoptimistically, that the ministry "within 3 years, raise its metallurgical materials utilization rate 8 percent and substitute other steel materials for nickel-chromium steel in 90 to 95 percent of the cases. The copper consumption rate should also be lowered 30 to 40 percent within 3 years. Use of powder metallurgy and

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plastics to substitute for metal parts such as ordinary bearings and cutting tools, etc., should be expanded." 208/ An effort is being made to increase production and to popularize the use of oil-impregnated bearings as substitutes for ball and roller bearings in order to solve the shortage of bearings during the "leap forward" campaign. The oil-impregnated bearings can be applied in machinery having high speed, low load, and low thrust. Such bearings thus are suitable for light electrical equipment and textile machinery, but not for heavy machinery, transport equipment, and the like. In the development of agricultural machinery the use of wood is being emphasized. 209/

There is evidence to suggest that many substitute materials are of inferior quality. Although industrial personnel are exhorted to conserve materials in a number of ways, the reiterated warnings to preserve quality indicate that there is little leeway in substitution before reaching the point at which quality suffers. 210/ Deterioration of quality is believed to be a factor that will assume increasing importance as Communist China strives to increase the proportion of machinery produced for export.*

9. Fuller Use of Production Capacity

According to the draft plan announced by Po I-po, "production in the machine-building industry in 1958 is planned in a way that will make fuller use of the capacity of the various machine-building departments" 211/ As previously pointed out, there is considerable latent capacity in machinery plants, particularly in the coastal cities.** Now, however, both Shanghai and Tientsin are taking advantage of their industrial experience and comparatively advanced technical force to shift over to production of relatively high-grade, precision and specialized heavy machinery. 212/ In addition, a major improvement in utilization is to be accomplished by the diversion of some capacity for military production to meet urgent civilian requirements. Plants producing military items are reported to be capable of making wristwatches, bicycles, sewing machines, cameras, oil compressors, motor vehicles, measuring and cutting instruments, automobile parts, tractors, water pumps, diesel engines, agricultural machinery, well-drilling equipment, and other commodities. 213/

This shift came about in connection with the amalgamation in February 1958 of the First Ministry of Machine Building, the Ministry of the Power Equipment Industry, and the Second Ministry

* See II, H, 6, p. 54, above.

** See I, E, 3, p. 15, above.

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of Machine Building. The First Ministry is reported to control directly 110 large state plants producing machinery for civilian use. The Ministry of the Power Equipment Industry is believed to have controlled directly some 20 state plants producing equipment for power stations and transmission grids, as well as powerplants for ships and some other purposes. The Second Ministry of Machine Building is believed to have controlled about 100 state plants engaged in production of munitions and other military items.* The aim of the amalgamation of these three Ministries appears to be closer integration of civilian and military production. 214/ It is probable that the Chinese Communists expect to realize great gains from fuller use of the capacity of existing plants, at least during the early years of the Second Five Year Plan (1958-62). The greatest underutilized capacity, however, exists in coastal cities, where many plants have obsolete equipment and cannot produce high-grade, precision machinery until their facilities have been modernized.

10. Diversification of Production

During 1958, there was much criticism of the excessive specialization prevalent in many new plants established with aid from the Soviet Bloc. In conjunction with the emphasis on local industry and decentralization, more stress was placed on converting highly specialized plants into multipurpose plants to serve local needs for machinery, especially for metallurgical equipment. In October 1958, when Vice Chairman Chu Te was inspecting petroleum, chemical engineering, and machinery plants in Lan-chou, he declared that "there should be an integral industrial system at various places and that, from now on, factories along a special line should develop into multiple-purpose plant." 215/ He pointed out that smaller units should not attempt to satisfy national requirements for one type of product but that the largest units, such as the T'ai-yuan Heavy Machinery Plant, should undertake production of a wider variety of items. 216/

C. Impact of Policy Shifts on the Machine-Building Industry

Because of the drastic changes in over-all policies concerning its development, the machine-building industry of Communist China must undergo major adjustments in production, especially with regard to support for agricultural development. The industry appears to have been assigned two primary economic missions: (1) production of equipment for the projects undertaken with Soviet aid and other major undertakings and (2) direct and indirect support for agricultural development. The assumption of greater responsibility

* For a discussion of ministerial organization, see Appendix C.

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for equipping the large construction units will require great efforts on the part of the machine-building industry, for production of heavy machinery is weak, most of the existing plants are designed to make single machines, and the capability for supplying complete sets of equipment is at present very low. 217/ As has been pointed out already, great stress is being placed on completion of construction of heavy machinery plants under the Second Five Year Plan.

Since the reappraisal of the agricultural situation in Communist China in 1957, there has been a marked shift in the requirements imposed on the machine-building industry for agricultural machinery. It was found that large-scale mechanization of farming operations was not feasible for most farmland in China and actually was detrimental to full employment. In addition, reclamation of wasteland was economically sound only to a limited extent. Primary reliance is not to be placed on tractors, but tractors will perform subsidiary functions in reclaiming wasteland and in relieving temporary manpower shortages during peak periods. The greatest improvements in agricultural production that were at the same time consistent with the maximization of farm income lay in increasing the average yields per acre of land already under cultivation. The extension of irrigation and the use of chemical fertilizers held the greatest promise of increasing the productivity of the available manpower. Rapid increase in industrial support to agriculture along these lines would require the machine-building industry to accelerate production of equipment for the chemical industries and to expand production of irrigation equipment -- for example, motors of various types, pumps, and valves. Local machine works and communes could handle production of light tools and implements, fertilizer appliances, insecticide machines, and simple transportation equipment. 218/

Notwithstanding earlier doubts about mechanization, the Peking regime announced, in October 1959, a grandiose plan for modernizing agriculture in Communist China. Eventual mechanization of agriculture has been a leading long-term goal since July 1955, when Mao Tse-tung called for the complete technical transformation of agriculture in four or five 5-year plans. The new program, however, declared to be "the new content under new circumstances" of the old Party policy and outlined by economic planner Vice Premier Po I-po, is more specific and has shortened the timetable. The stated intent of the program is that by 1969 land suitable for machine cultivation will "in the main" be worked by mechanical instead of animal traction, that motorized pumps will replace manual waterwheels in irrigation, that motor vehicles will lift most of the age-old burden of rural transportation from the backs of men and animals, that the use of chemical fertilizers will become predominant, and that electric power will be in common use. The program is to be

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carried out gradually, with the first 4 years devoted to laying an initial foundation. The immediate goal of mechanization is at least a doubling of production of grain, whereas the ultimate objective is to release millions of farm laborers for work in industry. 219/

If this program were to be vigorously implemented, it would require a major shift in investment resources from building up heavy industry for maximum production of military equipment and self-reproductive machinery to a more selective buildup of those heavy industries that directly support the technological transformation of agriculture.* At present, however, the machinery possessed by agricultural activities is still insignificant in comparison with the goal of complete mechanization. For example, existing machines can only accomplish about 10 percent of the required amount of mechanical irrigation. In addition, agriculture is expected to have about 250,000 kw of electrical capacity in rural areas by the end of 1959. The consumption of chemical fertilizers increased from 592,000 tons in 1953 to 2,708,000 tons in 1958. 220/

Obviously it is too early to attempt to evaluate how seriously the Peking regime is determined to allocate to agriculture a greater share of the developmental resources. Earlier plans for mechanization were given prominence in public discussion for a time but later were allowed to slide quietly into oblivion. Some doubt can be raised as to whether or not the Communists will follow through with the present program, for they have vacillated in the past over the timing, speed, and even the practical value of mechanizing farm tasks. Furthermore, heavy industry still is accorded overriding priority in plans for economic growth. Moreover, although the Communists have hailed the communes as having unique potentialities for modernizing agriculture and have designated them as the principal agencies for implementing the present program, the Communists said the same things about earlier forms of collectivization. To emphasize that mechanization will be approached gradually, these communes have been instructed to exploit fully their potential for improving simple tools and to develop locally managed small- and medium-size plants for producing simple implements and low-grade chemical fertilizers. The communes are cautioned not to slacken their practical efforts at mechanization by merely waiting for tractors and other modern machinery, for some years will be required to fulfill the machinery needs of the communes. 221/ Nevertheless, renewed stress on mechanization is indicated in the establishment in August 1959 of a

* For Chinese Communist statistics on the increase in the holdings of agricultural machinery in China, see Table 20, Appendix B, p. 104, below.

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specialized ministry, the Ministry of the Agricultural Machine-Building Industry, to accelerate industrial support for agricultural modernization.*

To support the vitally important chemical fertilizer program, it will be necessary to enlarge the capacity for making heavy-duty compressors, high-pressure reactors, turbocompressors, oxygen-making equipment, pumps, and other chemical engineering equipment. 222/ It is intended that nearly all machines and installations for the manufacture of chemical fertilizer will be made in Communist China, with only a very small number of automatically controlled tools and implements to be imported. Shanghai is to undertake the production of large amounts of machinery and equipment for local chemical fertilizer works with a production capacity of 2,000 to 25,000 tons each. 223/ In 1958 the Harbin Boiler Plant trial-produced a high-pressure ammonia converter used to make synthetic ammonia, an essential raw material for nitrogenous fertilizer. 224/

Production of chemical fertilizer equipment is a formidable engineering task for the relatively inexperienced machine-building industry of Communist China. The principal machines and equipment have never been produced before in China and require a relatively high level of technique, especially for the high-pressure reflex cylinders and high-pressure air compressors. For example, the large air compressors on order weigh 290 tons each, the largest single casting weighing more than 20 tons. Driven by huge 4,000-kw motors, the rotors of the compressors must be delicately balanced to attain high precision in revolution. Moreover, certain difficult problems in raw materials must be worked out in production of such complicated equipment. 225/ Because much of the chemical equipment requires large forgings and castings, substantial advances in production are dependent on the completion of heavy machinery plants now under construction. 226/ Inadequate capacity in heavy machinery may prove to be a crucial bottleneck.

Production of equipment for mechanized drainage and irrigation was reportedly increased sharply in 1958. Although official statistics tend to blur the distinction between agricultural power machinery (nearly all of which is for irrigation) and all power machinery, it appears that about 60 to 70 percent of total power machinery is allocated for agricultural purposes. 227/ The total production of agricultural power machinery in 1958 was 1.2 million hp, compared with production of probably less than 500,000 hp in 1957. Some of the larger plants making diesel engines are involved in this

* For a discussion of ministerial organization of the machine-building industry, see Appendix C.

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task, but most of the irrigation equipment is being produced by small- and medium-scale machine shops run by local governments. 228/ Although numerous press accounts in 1958 indicated that this item would get high priority in the allocation of resources and transportation, the evidence so far suggests great improvement, but not a "crash" program. 229/

V. Foreign Economic Relations

A. Foreign Trade

1. Value

About 60 percent of all Chinese Communist imports during 1953-56 reportedly consisted of machinery and equipment. 230/ This proportion declined in 1957 to about 40 percent.* In 1957, Communist China imported about \$578 million worth of machinery and equipment, almost one-half of which came from the USSR.** The total value of such imports from the USSR reached a peak in 1956 but declined somewhat in 1957,*** whereas imports of machinery from East Germany and Czechoslovakia, the two most important Satellite sources, continued to increase. Imports of machinery from the Free World were relatively insignificant through 1955, but the volume of trade has increased markedly since then. Since 1955 the Free World has outranked Poland, Hungary, Rumania, and Bulgaria and by the end of 1957 was nearly as important as Czechoslovakia, the second most important Satellite.

There has been a striking increase in the proportion of machinery and equipment in Chinese imports from the USSR and the Free World.**** This increase reflects the efforts of the Peking regime to accelerate industrialization under the First Five Year Plan (1953-57), following the period of economic recovery (1950-52).

Quantitative data on Chinese Communist exports of machinery and equipment are somewhat scanty. Such exports to countries of the Soviet Bloc are probably negligible. Exports to the Free World consisted of sewing machines, radios, batteries, bulbs, textile machinery, transport equipment, general industrial machinery, and other items. Exports of machine tools were insignificant in 1957, amounting to only \$130,000, but were greatly expanded to about \$788,000 in 1958. Such exports, however, were limited primarily to

* On the basis of Chinese Communist data on value. 231/

** See Table 21, Appendix B, p. 105, below.

*** See Table 22, Appendix B, p. 106, below.

**** See Table 23, Appendix B, p. 111, below.

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Hong Kong and Thailand, and considerable difficulty had been experienced in selling Chinese Communist machine tools to other markets. 232/ A sizable quantity of textile machinery has also been exported under grants and credits to Burma and Indonesia.

2. Composition

Complete sets of equipment for new plants have been by far the most important item in Chinese Communist imports of machinery and equipment from the Soviet Bloc. Trade in complete plants was not significant during 1950-52 but expanded rapidly under the First Five Year Plan. In 1957, complete plants accounted for more than three-quarters of Chinese imports of machinery and equipment from the USSR* and for 40 to 60 percent of such imports from East Germany and Czechoslovakia.

Of the machines imported that were not included in the category of complete plants, the most important were petroleum equipment, metal-cutting machine tools, mining machinery, transportation equipment, construction equipment, electrical and communications equipment, agricultural machinery, and precision instruments. During 1953-56, Communist China reportedly imported 21,723 metal-cutting machine tools, more than 1,400 mining drills, 1,562 freight cars, more than 40,000 trucks, and 15,973 tractors.**

In 1957, imports of Soviet tractors and agricultural machinery by Communist China decreased precipitously. The number of trucks imported in 1957 was only one-tenth that of 1956. This decrease reflected the opening of the Chinese truck plant at Ch'ang-ch'un. To some extent, increased Chinese self-sufficiency was responsible for the reduction in imports of machinery in 1957, but shifts in policy on agricultural mechanization and a reduced volume of capital construction were also contributing factors. 234/ Imports of chemical equipment, associated with the expanded program for chemical fertilizers, increased in 1957 but did not reach the level achieved in 1955.

3. Increase of Exports of Machinery

In spite of numerous offers to export machinery, the seriousness of Chinese Communist intentions to export a significant proportion of its production has not been established conclusively. Chinese activity at trade fairs appears to be directed more toward

* See Table 23, Appendix B, p. 111, below.

** On the basis of statistics on the growth of the Chinese Communist agricultural tractor park, it is believed that a large share of the tractors imported were for nonagricultural uses. 233/

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displaying machinery and equipment to show the native population the industrial development achieved under Communism in China than toward finding a market for these products. 235/ Nevertheless, exports of machinery, although still small, are increasing rapidly, and the Peking regime does appear to be genuinely desirous of increasing such exports. Achievement of this goal would have the advantage of relieving the strain on Chinese agriculture as a source of goods for export.

B. Self-Sufficiency

1. Achievements and Prospects

One of the long-term goals of Communist China is the attainment of a high degree of economic self-sufficiency. Although heavily dependent on the Soviet Bloc for technical assistance and capital goods under the First Five Year Plan, China achieved considerable success in this endeavor. By the end of 1957, domestic production satisfied 60 percent of Chinese requirements for machinery and equipment, including 42 percent of the complete sets of equipment required for the 166 projects receiving Soviet aid.* 236/

The draft plan for 1958 called on the machine-building industry to provide about 60 percent of all equipment needed for the projects receiving Soviet aid. 237/ Communist China seeks to supply 70 to 80 percent of its requirements for machinery under the Second Five Year Plan (1958-62). 238/ Goals for self-sufficiency in certain individual commodities to be attained during the period 1958-67 are indicated in Table 24.** Although by 1962 the Chinese Communists might well achieve production of 70 to 80 percent of their requirements for all types of machinery, it is doubtful that some of the specific goals will be reached, particularly for items not developed under the First Five Year Plan (1953-57).

2. Restrictions on Imports of Foreign Capital Equipment

There are strong indications that Communist China intends to pursue a vigorous program of restricting imports of capital equipment. The Chinese Communists know the advantages of importing certain specialized materials or intricate equipment instead of producing them under unfavorable conditions. China, however, will avoid imports that do not prove technically superior and economically advantageous. 239/ The Chinese Communists intend to curtail the variety of imports of machinery and equipment, 240/ and under this program

* For examples of Chinese self-sufficiency in some major producer goods, see Table 24, Appendix B, p. 112, below.

** See Appendix B, p. 111, below.

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imports of simple machine tools, transport equipment, light electrical equipment, some types of metallurgical equipment, and machinery for light industry probably will be reduced. Nevertheless, it is expected that machinery and equipment will continue to constitute a high proportion of total imports.

As to the relative costs of domestic machinery versus imported machinery, several Chinese Communist statements imply that the cost of imported machinery is sometimes two to three times greater than that of domestic equipment of the same specifications. 241/ Such statements are believed to be misleading because nearly all of the imported machinery was of higher quality and complexity than Chinese machinery, which, for the most part, consisted of single machines rather than complete sets. Po I-po probably had in mind the more meaningful objective of replacing imports of heavier and more complex machinery when he stated that "any machinery that can be made in China should not be imported or imports should be reduced, even if quality is lower and the price higher than the imported machinery." 242/ The cost of production of the Chinese "Liberation" truck in 1958 reportedly was 60 percent higher than that of a comparable imported vehicle. 243/ It would be normal for the Chinese to experience such increased costs during the early years of production, although real costs might not be reflected accurately in higher prices, because of the hidden subsidies and below-equilibrium prices to be found in an arbitrary price system. Nevertheless, expenditures on imported machinery have been high, and it is likely that the Peking regime could realize large savings in the long run from domestic production of some items. However, one of the most significant indications of Chinese ability to curtail imports of capital goods is the ability to produce complete sets of equipment, and in this the Chinese Communists are expected to experience considerable difficulty.

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APPENDIX A

DEFINITION OF THE MACHINE-BUILDING INDUSTRY OF COMMUNIST CHINA

In Chinese Communist statements the concept of machine building is somewhat ambiguous and confusing. Most commonly the term is used generically and refers to that group of industries engaged in metal processing, including production of machinery and equipment. At times, however, the phrase refers specifically to machinery and equipment, especially in doctrinal discussions describing the strategic role of the machine-building industry in the rapid development of the economy.

As used in this report, the term machine building is broadly defined to cover all types of metal processing. This definition includes production of military goods, which is believed to have been under the jurisdiction of the former Second Ministry of Machine Building. In Communist China, as in the USSR, there is very little acknowledgement of the responsibility of the machine-building industry for production of military goods.

As defined in outline form the machine-building industry may be said to include the following:

1. Metal-processing sector
 - a. Machinery and equipment manufacturing
 - b. Fabrication of other metal products
 - c. Repair

2. Military goods sector
 - a. Weapons and ammunition
 - b. Military and civil aircraft
 - c. Other military transportation equipment
 - d. Most military and civil electronics equipment

This classification follows Soviet usage very closely.*

For purposes of this report, consideration of shipbuilding, production of aircraft, and various types of military production is limited to investment.

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APPENDIX B

STATISTICAL TABLES

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Table 6

Principal Construction Projects to Be Undertaken by the Machine-Building Industry of Communist China to Support Growth of Various Industries and Sectors Under the First Five Year Plan a/*
1953-57

Industry to Be Supported	Project	Number of Plants			Annual Capacity When Completed
		New	Rebuilt	Total	
Metallurgical and mining <u>b</u> /	Heavy machinery and equipment plant	2	2	4	75,000 metric tons of smelting, refining, rolling, and coking equipment
	Mining machinery plant	1	5	6	81,000 metric tons of mining and ore-dressing equipment
	Petroleum machinery plant	1	0	1	15,000 metric tons of oil-drilling equipment
	Pneumatic tool plant	0	1	1	20,000 sets <u>c</u> /
Electric power <u>d</u> /	Boiler plant	2	0	2	800,000 kilowatts of power-generating equipment
	Steam turbine plant	2	0	2	
	Generator plant	2	0	2	
	Electrical machinery plant	1	1	2	
	Electric wire and cable plant	1	0	1	
	Electric meter and instrument plant	1	0	1	
	Carbon brush plant	1	0	1	
	Transformer plant	0	1	1	
Low-voltage switch plant	0	1	1		
Transportation <u>e</u> /	Motor vehicle plant	2	0	2	90,000 trucks
	Motor vehicle accessory plant	1	0	1	
	Locomotive plant	1	0	1	
	Locomotive and rolling stock plant	0	2	2	930 locomotives and 9,000 freight cars
	Locomotive repair plant	N.A.	N.A.	5	
	Rolling stock repair plant	1	1	2	
	Railroad passenger car plant	1	0	1	

* Footnotes for Table 6 follow on p. 89.

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Table 6

Principal Construction Projects to Be Undertaken by the Machine-Building Industry of Communist China
to Support Growth of Various Industries and Sectors Under the First Five Year Plan a/
1953-57
(Continued)

Industry to Be Supported	Project	Number of Plants			Annual Capacity When Completed
		New	Rebuilt	Total	
Agriculture	Tractor manufacturing plant	2	0	2	15,000 54-horsepower tractors <u>f/</u>
	Combine grain harvester plant	1	0	1	
Chemical industry	Oil refining machinery plant	1	0	1	
	Chemical industrial machinery and repair plant	1	0	1	
Machine-building industry <u>b/</u>	Machine tool plant	N.A.	N.A.	4	30,000 machine tools At least 10 million units <u>g/</u>
	Ball-bearing plant	3	0	3	
	Measuring tool plant	1	0	1	
	Tool plant	1	0	1	
	Emery wheel plant	1	0	1	
Other industries and sectors	Textile machinery - construction and reconstruction of an unspecified number of plants	N.A.	N.A.	N.A.	
	Building and construction machinery - construction and reconstruction of an unspecified number of plants	N.A.	N.A.	N.A.	
	Broadcasting equipment plant or plants	N.A.	N.A.	N.A.	
	Measuring and weighing equipment plant	N.A.	N.A.	N.A.	

b. Projects were to be carried out during 1954-60.

c. Information that was released in 1957 probably refers to this plant. 246/

d. Projects were to be carried out during 1955-61.

e. Excluding shipbuilding. Projects were to be carried out during 1955-60.

f. The capacity for the plant that was completed in 1959.

g. Po I-po, Chairman of the National Economic Commission, in setting forth the annual economic plan for 1959, stated that the ball-bearing plants at Lo-yang and Harbin would have an annual capacity of 10 million units when completed. 247/

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Table 7

Investment in Capital Construction in the Machine-Building Industry of Communist China a/
1950-58

Sector	Million Current Yuan									
	1950-51	1952	1950-52	1953	1954	1955	1956	1957	1953-57	1958
Total industry	N.A.	N.A.	2,605	3,222	4,279	4,643	7,509	7,955	27,608	N.A.
Machine building <u>b/</u>	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	7,180	3,800 <u>c/</u>
Of which:										
Metal processing	112	250	362	460	660	720	950	620	3,410	1,800 <u>c/</u>
Of which:										
Machinery and equipment manufacturing	N.A.	190	N.A.	320	460	570	730	500 <u>c/</u>	2,580	1,400 <u>c/</u>
Military goods	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3,770 <u>d/</u>	2,000 <u>c/ d/</u>

- a. Data include values for both plant and equipment
b. For methodology, see Appendix E.
c. Estimated.
d. Residual.

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Table 8

Investment in Production Enterprises in Communist China, in Percentages of Total Investment a/
1953-56

Type of Enterprise	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u> /	<u>Four-Year Total</u>
Above-norm <u>b/</u>	89.7	89.9	92.3	91.0	91.0
Newly constructed	56.0	81.1	87.1	75.1	77.0

a. Data cover investment for the First Ministry of Machine Building and the Ministry of the Power Equipment Industry only.

b. The term above-norm project as used in the machine-building industry of Communist China refers to a project requiring an investment ranging from more than 5 million yuan, such as machine tool plants, to more than 10 million yuan, such as shipbuilding, tractor, and locomotive plants.

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Table 9

Investment in Newly Constructed Machinery and Equipment Manufacturing Plants
in Communist China, by Type of Commodity a/
1953-56

<u>Commodity</u>	<u>Million Current Yuan</u>	<u>Percent</u>
Machine tools and measuring and cutting tools	221.9	14.6
Heavy machinery and mining machinery	123.1	8.1
Electric power equipment and electrical equipment	361.8	23.8
Communications and transportation equipment <u>b/</u>	670.3	44.1
Tractors	94.2	6.2
Other	48.7	3.2
Total	<u>1,520.0</u>	<u>100.0</u>

a. Data include values for both plant and equipment.

The total value is estimated for the First Ministry of Machine Building and the Ministry of the Power Equipment Industry.

b. Including construction of shipyard facilities.

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Table 10

Growth of Fixed Assets of the Machine-Building Industry of Communist China a/
1952-58

Sector	Million 1952 Yuan							Absolute Increase 1952-57
	1952	1953	1954	1955	1956	1957	1958	
Metal processing	<u>2,117</u>	<u>2,530</u>	<u>2,962</u>	<u>3,462</u>	<u>4,719</u>	<u>5,000</u> <u>b/</u>	<u>6,500</u> <u>b/</u>	<u>2,880</u>
Type								
Productive <u>c/</u>	1,685	1,939	2,300	2,757	3,749	4,000 <u>b/</u>	5,200 <u>b/</u>	2,315
Nonproductive <u>c/</u>	432	591	662	705	970	1,000	1,300	565
Ministry								
First Ministry of machine building (excluding electrical equipment enterprises) <u>d/</u>	620	820	990	1,190	1,880	2,080	2,800 <u>b/</u>	1,460
Other	1,497	1,710	1,972	2,272	2,839	2,920	3,700	1,420
Military goods production	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	<u>3,200</u> <u>b/</u>
Total								<u>6,080</u>

a. Data include values for both plant and equipment

b. Preliminary estimate.

c. The term productive fixed assets as defined by the Chinese Communists and as used in this table refers to plant buildings and machinery and equipment for the purpose of production; to railroads, highways, seaports and wharves, and other means of transport; and to warehouses for commercial and financial enterprises. The term nonproductive fixed assets (consumer types of fixed assets) refers to fixed assets for such material and cultural needs of the population as housing, schools, hospitals, cinemas and theaters, nurseries, clubs, dining halls, and public office buildings.d. 252/

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Table 11

Location of Production of Selected Types of Machinery
and Total Production by the Metal-Processing Sector of Communist China, in Percentages a/
1955

Location	Boilers		Machine Tools (In Terms of Units)	Generators <u>b/</u>		Electric Motors <u>b/</u>		Transformers		Total Production	
	In Terms of Units	In Terms of Steam Output		In Terms of Units	In Terms of Kilowatts	In Terms of Units	In Terms of Kilowatts	In Terms of Units	In Terms of Kilovolt-amperes	Machinery and Equipment Manufacturing Enterprises (In Terms of Value)	All Metal-Processing Enterprises (In Terms of Value)
Maritime											
Peking	7.8	6.0	4.4	Negligible	Negligible	Negligible	Negligible	6.3	1.2	3.2	4.0
Tientsin	12.8	6.9	3.7	Negligible	Negligible	5.6	2.5	5.5	1.8	7.2	8.5
Shanghai	30.2	62.4	30.5	96.5	68.1	40.0	30.3	51.4	24.5	25.4	27.0
Liaoning	35.6	18.3	23.7			19.8	7.7	19.2	67.5	27.5	21.8
Shantung	1.3	0.6	4.6			18.7	5.2	2.9	0.2	5.5	4.3
Subtotal	<u>91.0</u>	<u>95.1</u>	<u>88.5</u>	<u>97.9</u>	<u>68.4</u>	<u>84.4</u>	<u>45.8</u>	<u>90.0</u>	<u>96.2</u>	<u>75.8</u>	<u>75.3</u>
Interior	9.0	4.9	11.5	2.1	31.6	15.6	54.2	10.0	3.8	24.2	24.7
Total	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

a. 253/

b. Alternating current only.

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Table 12

Location of Major Machine-Building Plants in Communist China, by Economic Region a/
January 1950 - January 1958

Type of Plant	Number of Plants										Total
	Northeast China (Region I)	Inner Mongolian Autonomous Region (Region II)	North China (Region III)	East China (Region IV)	Central China (Region V)	South China (Region VI)	Southwest China (Region VII)	Northwest China (Region VIII)	Sinkiang Uighur Autonomous Region (Region IX)	Tibet (Region X)	
Machine tool	6		6	4	2		2				20
Measuring and cutting tool	1						1				2
Mining machinery	4		5	2	1		1				13
Textile machinery	1		4	4	1						10
Metallurgical equipment	1		1	1		1					4
Power-producing equipment other than electrical	1		3	3	1						8 b/
Oilfield machinery and exploratory equipment				1				2			3
Agricultural equipment	4	3	3	1		1		1	1		14
Automotive transport equipment	2	1	2	3	1	1	1				11
Locomotive and rolling stock	4		4		2						10
Construction equipment	2										2 c/
Electrotechnical equipment	11		4	11	2		4	3			35
Chemical equipment	2							1			3 d/
Tractors			2								2
Machinery to support light industry			1	1		1					3
Antifriction bearings	2		2				1				5
General industrial equipment	6		3	2	3	1	1				16
Total	47	4	40	33	13	2	11	7	1		161

a. The economic regions referred to in this table are those defined and named on Map 25561 (5-57), Communist China: Economic Regions, inside back cover. Data comprise major plants the construction of which was completed or underway during this period.

b. Power-producing equipment other than electrical equipment is also produced at the Shanghai Steam Turbine Plant, which is counted in the category of electrical equipment.

c. Although only two construction equipment plants are listed, various pieces of construction equipment are being produced at other plants listed under the heading of general industrial equipment.

d. Although only three chemical equipment plants are listed, various pieces of equipment used in the manufacture of chemicals are being produced at other plants listed under the heading of general industrial equipment.

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Table 13

Growth of the Gross Value of Production by the Machine-Building and Metal-Processing Industries
in Communist China a/
1949-57

Sector	Unit	1949	1950	1951	1952	1953	1954	1955	1956	1957
Total industry <u>b/</u>	Million yuan <u>c/</u>	10,781	14,058 <u>d/</u>	20,214 <u>d/</u>	27,014	35,577	41,513	44,748	58,661	62,810 <u>e/</u>
Of which:										
Metal processing <u>d/</u>	Million yuan <u>c/</u> Percent of total industry	733	1,178	2,093	2,852	4,412	5,355	5,749	9,327	10,000 <u>f/</u>
		6.8	8.4	10.4	10.6	12.4	12.9	12.8	15.9	15.9
Of which:										
Machinery and equipment manufacturing	Million yuan <u>c/</u> Percent of total industry	291 <u>d/</u>	524 <u>d/</u>	976 <u>d/</u>	1,401	2,157	2,645	3,030	5,764	5,967 <u>e/</u>
		2.7	3.7	4.8	5.2	6.1	6.4	6.8	9.8	9.5
Index of growth of machinery and equipment manufacturing	1952 = 100	21	37	70	100	154	189	216	411	426

b. Excluding cooperative handicrafts and individual handicraft industry but including handicraft industry in workshops.

c. In 1952 constant prices.

e. 256/

f. Preliminary estimate.

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Table 14

Estimated Production of Selected Commodities
by the Machine-Building Industry of Communist China a/^{*}
1947 and 1949-58

Commodity	Unit	1947	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
Steam turbines	Number	0	0	0	0	0	0	0	N.A.	23	N.A.	N.A.
	Thousand kilowatts	0	0	0	0	0	0	0	36	121	144	b/
Hydraulic turbines	Number	0	0	N.A.	N.A.	11	N.A.	N.A.	N.A.	37	N.A.	N.A.
	Thousand kilowatts	0	0	N.A.	N.A.	6.7	17	10	33	103	72	b/
Electric generators <u>c</u> /	Number	N.A.	N.A.	N.A.	N.A.	746	N.A.	N.A.	2,517	6,883	N.A.	N.A.
	Thousand kilowatts	23	10	23	32	30	59	61	108	288	340	420
Electric motors <u>c</u> /	Number	N.A.	N.A.	N.A.	N.A.	91,147	N.A.	N.A.	107,387	184,571	N.A.	N.A.
	Thousand kilowatts	51	N.A.	200	335	639	N.A.	N.A.	607	1,069	1,370	1,430
Transformers	Number	N.A.	N.A.	N.A.	N.A.	16,185	N.A.	N.A.	55,660	110,514	N.A.	N.A.
	Thousand kilovolt-amperes	147	N.A.	570	815	1,167	N.A.	N.A.	1,926	2,891	3,590	3,900
Boilers	Number	690	209	479	782	1,000	N.A.	N.A.	1,274	1,033	N.A.	N.A.
	Evaporation capacity in tons per hour <u>d</u> /	N.A.	N.A.	N.A.	N.A.	1,222	N.A.	N.A.	2,059	3,022	4,020	N.A.
Internal combustion engines <u>e</u> /	Number	N.A.	N.A.	N.A.	N.A.	1,528	N.A.	N.A.	N.A.	29,234	N.A.	N.A.
	Thousand horsepower	13.8 <u>f</u> /	N.A.	N.A.	N.A.	27.6 <u>g</u> /	N.A.	N.A.	N.A.	541	690	2,000
Metal-cutting machine tools <u>h</u> /	Number	5,390 <u>i</u> /	1,582	3,312	5,853	13,734	20,502	15,901	13,708	25,908	28,297	50,000 <u>i</u> /
	Tons	N.A.	N.A.	N.A.	N.A.	16,298	24,039	23,530	N.A.	N.A.	N.A.	N.A.
Mainline steam locomotives	Number	22	N.A.	N.A.	N.A.	20	10	52	98	184	167	350
Freight cars	Number	257	3,155	696	2,882	5,792	4,500	5,445	9,258	6,376	7,300	11,000
Railroad passenger cars	Number	N.A.	N.A.	N.A.	N.A.	6	50	100	200	311	350	N.A.
Medium trucks	Number	0	0	0	0	0	0	0	0	1,654	7,500	15,000
Three-wheel trucks	Number	0	0	0	0	0	0	0	0	0	Negligible	500
Passenger automobiles <u>k</u> /	Number	0	0	0	0	0	0	0	0	0	Negligible	500
Tractors	Number	0	0	0	0	0	0	0	0	0	0	957
Agricultural machinery <u>l</u> /	Thousands	N.A.	N.A.	N.A.	N.A.	300	343	429	1,300	2,100	550	1,400
Combine grain harvesters	Number	0	0	0	0	0	0	0	2	20	124	545
Power-operated threshing machines	Number	0	0	0	0	0	0	0	0	0	0	740
Irrigation pumps	Thousand horsepower	N.A.	N.A.	N.A.	N.A.	60	70	80	80	90	150	500
Antifriction bearings	Thousand sets	N.A.	138	414	371	1,179	N.A.	N.A.	N.A.	4,400	6,000	13,300
Metallurgical equipment	Thousand tons	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	13	30
Mining machinery	Tons	N.A.	N.A.	N.A.	N.A.	Negligible	N.A.	N.A.	N.A.	N.A.	400	1,500
Oil-drilling equipment	Tons	0	0	0	0	0	0	0	1,600	3,000	4,000	5,000

* Footnotes for Table 14 follow on p. 98.

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Table 14

Estimated Production of Selected Commodities
 by the Machine-Building Industry of Communist China a/
 1947 and 1949-58
 (Continued)

Commodity	Unit	1947	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
Cotton-spinning machinery	Thousand spindles	220	N.A.	N.A.	N.A.	383	287	489	304	784	484	1,000
Cotton looms	Sets	N.A.	N.A.	N.A.	N.A.	6,470	9,650	15,120	9,290	19,250	15,000	31,000
Paper-making equipment	Thousand tons	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	7	15
Sugar-refining equipment	Thousand tons	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	9	15

- a. Data [redacted] have been accepted in most cases as the basis of estimates. Estimates for 1958 are preliminary.
- b. Estimated combined production of steam and hydraulic turbines in 1958 was 600,000 kilowatts.
- c. Alternating current only.
- d. Tonnages are given in metric tons throughout this table.
- e. Including diesel, gasoline, gas generator, and steam engines.
- f. Diesel engines only.
- g. Of the 27,600 horsepower, 17,995 horsepower were diesel engines and 7,458 horsepower were steam engines.
- h. In terms of weight, production in 1952, 1953, and 1954 was 16,298 tons, 24,039 tons, and 23,530 tons, respectively. The disparity between unit production and production in terms of weight was caused by shifts to heavier models.
- i. In 1941, the year of highest production before 1949.
- j. Excluding so-called native-style machine tools not produced in regular plants. In spite of this qualification, production in 1958 may not be quite comparable to that of other years, because of the inclusion of categories not previously reported.
- k. Including jeeps.
- l. New types only.

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Table 15

Production of Selected Commodities in Communist China
Compared with That in Other Countries a/
1957

Commodity	Unit	Communist China	USSR	US	UK	West Germany	Japan	India
Metal-cutting machine tools	Thousands	28.3	130.9	62	70 <u>b/ c/</u>	N.A.	34.8	N.A.
Mainline locomotives	Number	350 <u>d/</u>	670	1,320 <u>e/</u>	1,142	227 <u>b/ f/</u>	72 <u>b/ f/</u>	N.A.
Mainline freight cars	Thousands	7.3	38.3	100.0 <u>g/</u>	67.8	5.04	6.9 <u>b/ f/</u>	N.A.
Mainline passenger cars	Number	350	1,856	841 <u>g/</u>	2,420	2,458 <u>b/ f/</u>	569 <u>b/ f/</u>	N.A.
Commercial vehicles <u>h/</u>	Thousands	15.5 <u>d/</u>	381.8	1,100 <u>i/</u>	288	253	135	11.9
Tractors	Thousands	0.96 <u>d/</u>	204.0	265.9	147	118	N.A.	2.13
Transformers	Thousand kilovolt-amperes	3,590	N.A.	N.A.	N.A.	N.A.	3,535.9	1,219.2
Electric motors	Thousand kilowatts	1,370	2,898 <u>j/</u>	N.A.	N.A.	N.A.	1,344	349.8

a. Data for Communist China were obtained from Table 14, p. 97, above

c. Shipment or sales for 1948.

d. In 1958.

e. Units put into service on first-class railroads in 1957.

f. In 1956.

g. Factory shipments.

h. Including light and heavy trucks, wheeled tractors for road haulage, special vehicles, and buses except for India and Communist China, data for which include production of trucks only.

i. Factory sales, including parts shipped for assembly abroad.

j. Excluding motors of less than 100 kilowatts.

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Table 16

Production of Selected Commodities
in Communist China in 1957 and in the USSR in 1932 ^{a/}

Commodity	Unit	Communist China 1957	USSR 1932
Turbines	Thousand kilowatts	216	239
Electric generators	Thousand kilowatts	340	1,085
Electric motors	Thousand kilowatts	1,370	1,658
Metal-cutting machine tools	Thousands	28.3	19.7
Mainline steam locomotives	Number	350 ^{b/}	827
Freight cars	Number	7,300	15,200
Tractors	Number	0	48,900
Trucks	Number	7,500	23,700
Internal combustion engines	Thousand horsepower	690	96
Combine grain harvesters	Number	124	10,000

a. Data for Communist China were obtained from Table 14, p. 97, above

b. In 1958.

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Table 17

Comparison of Technical Capabilities of Selected Machinery Produced
in Communist China, the USSR, and the US a/

Commodity	Characteristic	Unit	Produced by End of 1956			Under Development, 1957-58		
			Communist China	USSR	US	Communist China	USSR	US
Steam boilers	Evaporation capacity	Tons per hour <u>b/</u>	150	660	750	N.A.	900	N.A.
Steam turbogenerators	Capacity	Thousand kilowatts	12	200	300	25	300	450
Hydraulic turbogenerators	Capacity	Thousand kilowatts	15	150	150	72.5	200	N.A.
Transformers (3-phase)	Tension	Kilovolts	154	400	330	N.A.	N.A.	N.A.
	Capacity	Kilovolt-amperes	40,500 <u>c/</u>	123,000	150,000	N.A.	200,000	360,000
Horizontal lathes	Distance between centers	Meters	5	20	30 <u>d/</u>	N.A.	N.A.	N.A.
Vertical lathes	Diameter of working platform	Meters	3.2 to 3.4 <u>e/</u>	18	14	8	22	N.A.
Cranes	Lifting capacity	Tons	140 <u>f/</u>	500	450	150	N.A.	N.A.
Excavating machinery	Bucket capacity	Cubic meters	3	25	46	N.A.	50	N.A.
Hydraulic presses	Pressure	Thousand tons	2	50	68	N.A.	N.A.	N.A.
Blast furnaces	Capacity	Cubic meters	1,000	1,513	1,800	N.A.	2,000	N.A.
Open-hearth furnaces	Capacity per heat	Tons	185	500	550	N.A.	N.A.	N.A.
Cargo trucks	Payload	Tons	4	25	75	N.A.	40	N.A.

b. Tonnages are given in metric tons throughout this table.

c. In 1957.

d. Approximate maximum length of standard types of lathes.

e. In 1958.

f. An overhead traveling crane designed for the An-shan Steel Works.

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Table 18

Industrial Labor Force of Communist China
1949, 1952, and 1955-58 a/

Sector	Unit	1949	1952	1955	1956	1957	1958
Total industry b/	Thousand workers	3,060	5,260	6,121	7,170	7,907	N.A.
Metal processing	Thousand workers	377	846	960	1,338	1,760 c/	3,000 d/
	Percent of total industry	12.3	16.1	15.7	18.7	22.3	N.A.

a. Data are for the end of the year

b. 263/

c. 264/

d. 265/

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Table 19

Productivity per Worker in the Metal-Processing Sector
of Communist China a/
1949, 1952, and 1955-56

<u>Year</u>	<u>1952 Yuan</u>
1949	2,962
1952	6,767
1955	10,814
1956	12,569

a. 266/. Data are for state-operated, local-state operated, and state-private jointly operated cooperative enterprises only. Productivity probably was computed on the basis of the total number of workers on the production line rather than on the basis of employees. The latter method was used in computing productivity for Figure 1, following p. 6, above.

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Table 20

Park of Agricultural Equipment in Communist China a/
1953-59

Type of Equipment	Unit	1953	1954	1955	1956	1957	1958	1959 (Planned)
Tractors <u>b/</u>	Standard (15-horsepower) units <u>c/</u>	113	778	2,377	9,864	12,176	25,197	55,000
Animal-drawn implements	Thousands	629	991	1,973	4,606	5,114	N.A.	N.A.
Combine grain harvesters <u>b/</u>	Number	N.A.	N.A.	N.A.	N.A.	N.A.	3,452	4,500
Threshers <u>b/</u>	Number	N.A.	N.A.	N.A.	N.A.	N.A.	5,516	7,500
Tractor-drawn implements	Thousands	N.A.	N.A.	N.A.	N.A.	N.A.	80	100
Mechanized drainage and irrigation equipment	Thousands	N.A.	N.A.	N.A.	N.A.	N.A.	1,600	2,800
Trucks	Number	N.A.	N.A.	N.A.	N.A.	N.A.	12,700	13,000
Insecticide spraying machines	Number	N.A.	N.A.	N.A.	N.A.	N.A.	1,100	N.A.
Total power machinery	Thousand horsepower	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	5,200

b. Nearly all items in these categories were imported. Compare production of these items given in Table 14, p. 97, above.

c. The 15-horsepower unit is a statistical measure used in the Sino-Soviet Bloc to convert tractors of various types and horsepower into comparable units for purposes of planning and accounting. It is calculated by dividing the "rated" drawbar horsepower of the tractor by 15. Thus the Soviet DT-54 tractor with a drawbar horsepower of 36 equals two and two-fifths 15-horsepower units. Drawbar horsepower may be defined as the horsepower equivalent of the pull exerted on the drawbar which is affixed to the rear of the tractor. This rating differs from ratings in terms of engine horsepower (more specifically brake horsepower) which measure the power delivered by the engine -- generally, the more powerful the engine, the greater the drawbar pull, regardless of the type of tractor. However, two engines of the same brake horsepower, one installed in a wheeled tractor and the other in a crawler type, would usually exert different drawbar pulls because of the different efficiencies of the two modes of traction. The wheeled tractor makes less efficient use of the power of the engine but is indispensable in cultivating row crops. Thus the ability of diverse types of tractors to pull drawn implements may be most significantly compared by means of ratings in drawbar horsepower.

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Table 21

Sources of Imports of Machinery and Equipment
by Communist China ^{a/}
1957

<u>Source</u>	<u>Million Current US \$</u>	<u>Percent</u>
Soviet Bloc		
USSR	271.6	47.0
East Germany	95.2	16.5
Czechoslovakia	73.9	12.8
Poland	27.0	4.7
Hungary	26.8	4.6
Rumania	14.0	2.4
Bulgaria	3.2	0.6
Subtotal	<u>511.7</u>	<u>88.6</u>
Free World	65.8	11.4
Total	<u>577.5</u>	<u>100.0</u>

a. Derived from Table 22, p. 106, below.

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Table 22

Imports of Machinery and Equipment by Communist China a/*
1950 and 1952-57

	Million Current US \$						
Source and Type of Import	1950	1952	1953	1954	1955	1956	1957
Free World							
Total	N.A.	269.3	284.3	292.6	314.5	432.2	523.2
Of which:							
Machinery and equipment <u>b</u> /	N.A.	12.0	20.9	13.3	15.0	41.6	65.8
USSR							
Total	388.2	554.2	697.6	N.A.	748.4	733.0	544.1
Of which:							
Machinery and equipment	41.4	156.6	163.6	N.A.	229.6	304.7	271.6
Of which:							
Complete plants	1.0	40.7	49.3	N.A.	141.5	217.0	209.0

* Footnotes for Table 22 follow on p. 110.

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Table 22

Imports of Machinery and Equipment by Communist China a/
1950 and 1952-57
(Continued)

	Million Current US \$						
Source and Type of Import	1950	1952	1953	1954	1955	1956	1957
East Germany							
Total	N.A.	N.A.	60.4	99.5	97.4	94.9	105.8
Of which:							
Machinery and equipment <u>c/</u>	N.A.	N.A.	54.4	89.6	87.7	85.4	95.2
Of which:							
Complete plants	N.A.	<u>d/</u>	N.A.	N.A.	N.A.	26.6 <u>e/</u>	44.4 <u>d/</u>
Czechoslovakia							
Total	N.A.	N.A.	60.7	64.4	57.6	64.7	81.2
Of which:							
Machinery and equipment <u>f/</u>	N.A.	N.A.	N.A.	N.A.	37.4	55.0	73.9
Of which:							
Complete plants <u>g/</u>	N.A.	N.A.	N.A.	N.A.	12.1	32.4	44.7

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Table 22

Imports of Machinery and Equipment by Communist China a/
1950 and 1952-57
(Continued)

	Million Current US \$						
Source and Type of Import	1950	1952	1953	1954	1955	1956	1957
Poland							
Total	6.3	23.8	31.0	37.0	34.8	50.3	44.8
Of which:							
Machinery and equipment <u>b/</u>	0.6	2.3	7.8	15.9	13.9	27.2	27.0 <u>h/</u>
Hungary							
Total	N.A.	20.5	29.6	30.9	36.5	31.0	29.8
Of which:							
Machinery and equipment <u>b/</u>	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	26.8 <u>i/</u>

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Table 22

Imports of Machinery and Equipment by Communist China a/
1950 and 1952-57
(Continued)

	Million Current US \$						
Source and Type of Import	1950	1952	1953	1954	1955	1956	1957
Rumania							
Total	Negligible	N.A.	N.A.	N.A.	7.0 <u>j/</u>	17.0	15.0 <u>j/</u>
Of which:							
Machinery and equipment	N.A.	N.A.	N.A.	N.A.	<u>k/</u>	N.A.	14.0 <u>l/</u>
Of which:							
Complete plants	N.A.	N.A.	N.A.	N.A.	<u>k/</u>	N.A.	3.8 <u>l/</u>
Bulgaria							
Total	N.A.	0.6	5.3	N.A.	4.6	5.2	5.0 <u>j/</u>
Of which: .							
Machinery and equipment <u>b/</u>	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.2 <u>j/</u>

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Table 22

Imports of Machinery and Equipment by Communist China a/
1950 and 1952-57
(Continued)

- a. Ruble values have been converted to current US dollar values at the official rate of 4 rubles to US \$1. Data do not include unrecorded trade. Instruments and a few other minor items are included in the Soviet and probably the Satellite definitions of machinery and equipment but are defined otherwise for the Free World. 50X1
- b. Data on exports of complete plants not available.
- c. Machinery and equipment accounted for "almost 90 percent" of Chinese Communist imports from East Germany, presumably as a general average during 1953-57. 269/
- d. Complete plants accounted for 2 percent of Chinese Communist imports from East Germany in 1952 and 42 percent in 1957. 270/
- 50X1
- f. Machinery and equipment accounted for 65 percent of Chinese Communist imports from Czechoslovakia in 1955, 85 percent in 1956, and 91 percent in 1957. 272/
- g. Complete plants accounted for about 21 percent of Chinese Communist imports from Czechoslovakia in 1955, more than 50 percent in 1956, and 55 percent in 1957. 273/
- h. Exports of complete industrial installations amounting to \$9.3 million were planned for 1957. 274/
- i. Machinery and equipment accounted for about 90 percent of Chinese Communist imports from Hungary in 1957. 275/
- j. Preliminary estimate.
- k. Petroleum equipment and complete sets of equipment for electric power plants accounted for more than 50 percent of all Chinese imports from Rumania in 1955. 276/
- l. Machinery and equipment accounted for 93 percent of Chinese imports from Rumania in 1957, and 25 percent of such imports represented complete installations for thermal electric power stations. 277/

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Table 23

Imports of Machinery and Equipment by Communist China
in Percentages a/
1950, 1952-53, and 1955-57.

<u>Source and Year</u>	<u>Machinery and Equipment as Percentage of Total Imports</u>	<u>Complete Plants as Percentage of Machinery and Equipment</u>
Free World		
1950	N.A.	0
1952	4.5	0
1953	7.4	0
1955	4.8	0
1956	9.6	0
1957	12.6	0
USSR		
1950	10.7	2.4
1952	28.2	26.0
1953	23.5	30.1
1955	30.7	61.6
1956	41.6	71.2
1957	49.9	77.0

a. Derived from Table 22, p. 106, above.

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Table 24

Estimated Self-Sufficiency in Selected Producer Goods in Communist China a/
1957-58, 1962, and 1967

Commodity	Percent of Total Requirements				
	1957	1958	1958-62	1962	1967
Medium trucks	14	30	N.A.	90 <u>b/</u>	100 <u>b/</u>
Machine tools	50 <u>c/</u>	75 <u>b/</u>	N.A.	90-95 <u>b/</u>	100 <u>b/</u>
Metallurgical equipment	Less than 20	35	N.A.	60	85
Iron-smelting equipment	40	50	N.A.	80	100
Steel-smelting equipment	40	50	N.A.	80	100
Rolling mills	3	Very low	N.A.	40	75
Heavy electrical equipment	N.A.	N.A.	N.A.	50 <u>b/</u>	100 <u>b/</u>
Steam turbines	13	N.A.	45 <u>b/</u>	N.A.	N.A.
Generators for steam turbines	13	N.A.	45 <u>b/</u>	N.A.	N.A.
Hydraulic turbines	10	N.A.	27 <u>b/</u>	N.A.	N.A.
Generators for hydraulic turbines	10	N.A.	27 <u>b/</u>	N.A.	N.A.
Machinery for light industry	90	90	N.A.	100 <u>b/</u>	100
Oil-drilling and exploratory equipment	20	25	N.A.	100	100
Chemical-engineering equipment	Less than 3	Negligible	N.A.	Low	N.A.
Cutting tools	0	Very low	N.A.	95 <u>b/</u>	N.A.
Measuring instruments	Very low	Very low	N.A.	95 <u>b/</u>	N.A.
Grinders	Unsatisfactory	N.A.	N.A.	95 <u>b/</u>	N.A.
Abrasives	Low	N.A.	N.A.	100 <u>b/</u>	N.A.
Casting equipment	N.A.	N.A.	N.A.	86 <u>b/</u>	N.A.
Forge-press equipment	N.A.	N.A.	N.A.	80 <u>b/</u>	N.A.
Presses	Low	Low	N.A.	N.A.	N.A.
Hammers	Satisfactory	Satisfactory	N.A.	100	100

b. Planned.

c. In 1956.

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APPENDIX C

MINISTERIAL ORGANIZATION OF THE MACHINE-BUILDING INDUSTRY
OF COMMUNIST CHINA

Originally, machine building in Communist China was controlled by the Ministry of Heavy Industry, which was established in 1950. In 1952 the First Ministry of Machine Building and the Second Ministry of Machine Building were created out of the Ministry of Heavy Industry, leaving the latter responsible for metallurgy, chemicals, and building materials until its abolition in 1956. (See Figure 6.*) The First Ministry of Machine Building was given responsibility for production of machine tools, locomotives and rolling stock, automobiles, electrical equipment, mining machinery, general industrial machinery and equipment, and agricultural tools and equipment, as well as shipbuilding. Production of arms and munitions was placed under the Second Ministry of Machine Building.

In April 1955 the Third Ministry of Machine Building was established as a step to centralize control over the smaller plants that did not come under the direct control of the First and Second Ministries of Machine Building. The Third Ministry of Machine Building was responsible for the direction of machine and electrical engineering industries of local-state, joint state-private, cooperative, and private enterprises.

In 1956, there occurred a general trend toward ministerial specialization. The Third Ministry of Machine Building was abolished in May 1956, a move which coincided with the virtual completion of socialization of private and joint state-private enterprises. In November 1956, however, a high-ranking Communist was appointed Minister of a new Third Ministry of Machine Building, apparently with a new responsibility. 279/ The Ministry of Power Equipment was established in 1956, apparently to supervise production of electrical and medical equipment. 280/ Thus this ministry probably absorbed part of the functions of the old First and Third Ministries.

A basic reorganization of the machine-building industry occurred in February 1958. The Chinese State Council announced on 11 February 1958 that the former Second Ministry of Machine Building and the Ministry of Power Equipment had been merged with the First Ministry of Machine Building and that the Third Ministry of Machine Building had been renamed the Second Ministry of Machine Building. The incorporation of the Ministry of Power

* Following p. 114.

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Equipment into the First Ministry was not unusual, because, as previously noted, the First Ministry of Machine Building controlled production of this equipment until 1956. More significant was the merger of the former Second Ministry of Machine Building, which was charged with production of military items, with the First Ministry of Machine Building. In November 1957, it was announced that industrial enterprises engaged in defense production would produce 50 types of products for civilian use in 1957. Moreover, the head of the new First Ministry of Machine Building is General Chao Erh-lu, a man with ordnance experience and Minister of the former Second Ministry of Machine Building since its establishment in 1952. His current appointment as head of the new First Ministry of Machine Building probably will insure the proper considerations of defense and civilian interests within the enlarged responsibility of the new ministry.

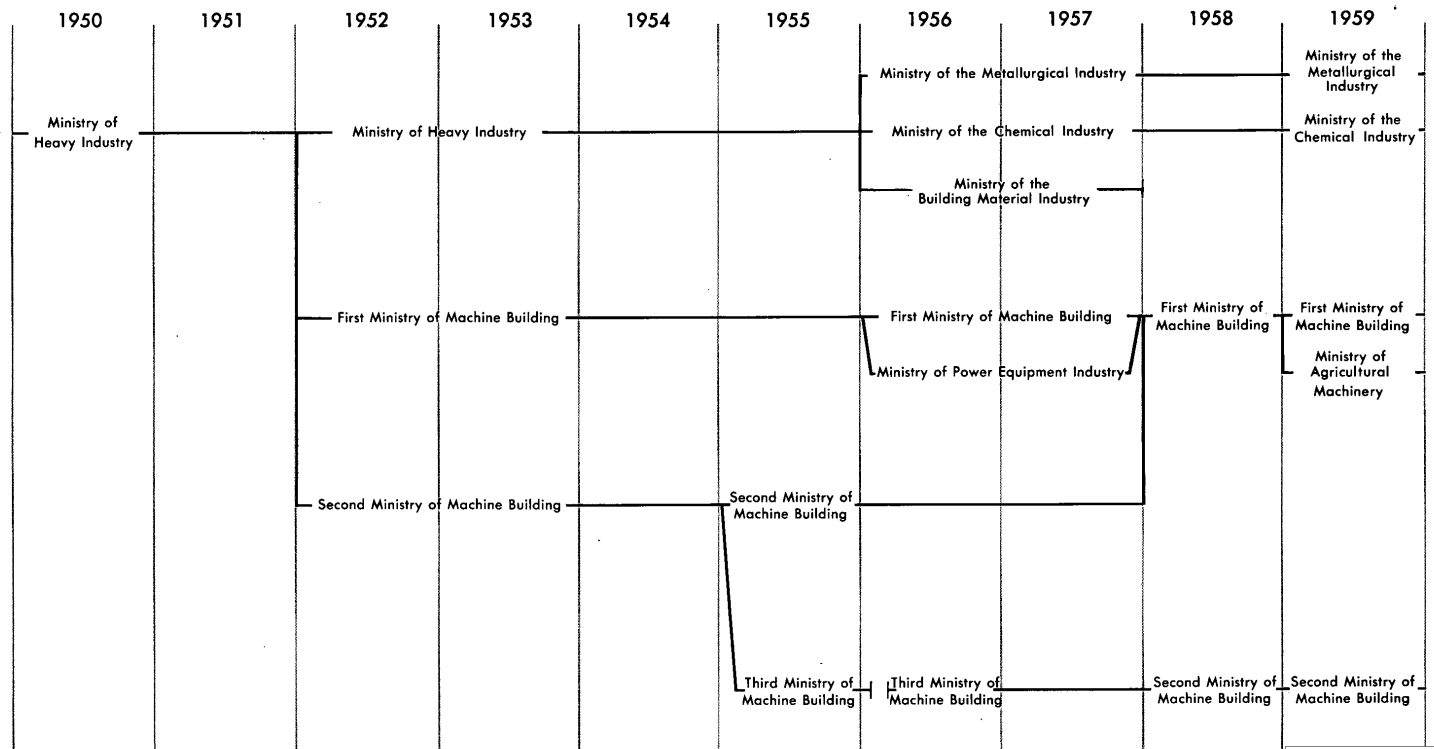
In August 1959 a Ministry of Agricultural Machinery was established with the purpose of accelerating the mechanization of Chinese agriculture. 281/ The newly completed Lo-yang Tractor Plant, which had been subordinated to the Sixth Industrial Control Bureau of the First Ministry, was immediately transferred to the new ministry. 282/ Actually, production of tractors, agricultural implements, and generating equipment used in agriculture, previously the responsibility of three bureaus, had been concentrated in the Sixth Bureau since February 1958. 283/

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Figure 6 50X1

Communist China: Ministerial Organization of Machine Building, 1950-59



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APPENDIX D

METHODOLOGY FOR ESTIMATING TOTAL INVESTMENT IN CAPITAL CONSTRUCTION
FOR MACHINE BUILDING UNDER THE FIRST FIVE YEAR PLAN (1953-57)
OF COMMUNIST CHINA

According to the announcement on fulfillment of the First Five Year Plan (1953-57) of Communist China, total state investment in capital construction amounted to 49.3 billion yuan, of which 56 percent, or 27 billion yuan, went to industry. 284/ During this period the machine-building industry reportedly received 26 percent of all industrial investment in capital construction. 285/ Therefore, investment in capital construction in the machine-building industry would have amounted to 7.18 billion yuan.*

Reported data for investment in actual machine building -- that is, for machinery and equipment manufacturing or for the metal-processing sector -- fall far short of the figure of 7.18 billion yuan. The metal-processing sector accounted for 3.41 billion yuan, or 47.5 percent of the total of 7.18 billion yuan. Moreover, it appears to be fairly clear that the plants comprising the metal-processing sector were subordinate to the First Ministry of Machine Building and the Ministry of Power Equipment Industry until the end of 1957. 287/ The remaining investment (3.77 billion yuan, or 52.5 percent of the total of 7.18 billion yuan) is assumed to have been allocated to industries engaged in military production under the former Second Ministry of Machine Building.

This conclusion is reinforced by an analysis of information on plants. It seems impossible that investment both for military production and for civilian machine building could be included in the figure of 3.41 billion yuan given for the metal-processing sector or the 2.58 billion yuan given for machinery and equipment manufacturing.** Construction costs for only five major plants amounted to 1.6 billion yuan.*** In that event, only 1.8 billion yuan would be left for all other construction, both civilian and military, a situation that seems quite unlikely in comparison with the scope of the construction program.

* It should be noted that the percentage figure for machine building coincides with the planned distribution of investment to machine building (6.93 billion yuan out of a total of 26.7 billion) under the First Five Year Plan. 286/

** See Table 7, Appendix B, p. 90, above.

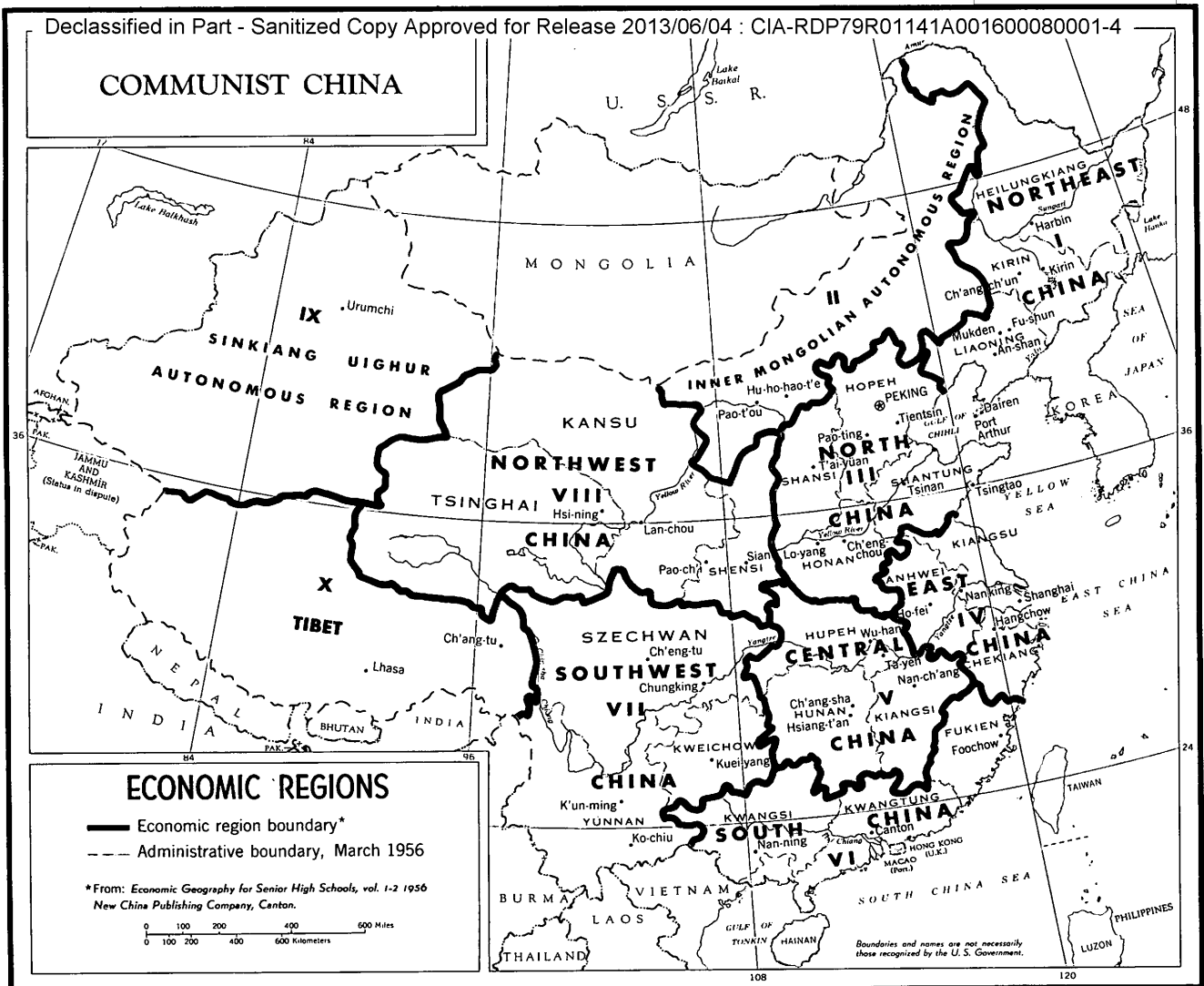
*** The five plants are the Lo-yang Tractor Plant [redacted], the Tientsin 50X1 Tractor Plant, the Ch'ang-ch'un Automobile Plant [redacted] the Fu-la-erh- 50X1 chi Heavy Machinery Plant, and the T'ai-yuan Heavy Machinery Plant. Part of this construction extended beyond 1957, the terminal year of the First Five Year Plan.

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