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RESEARCH AID

GROSS FIXED CAPITAL IN THE USSR 1940-55

CIA/RR RA-22
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(ORR Project 32.1104)

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FOREWORD

The major objectives of this research aid are to develop estimates of total Soviet gross fixed capital, to determine some of its major components, and to analyze its growth and structure during 1940-55. Estimates of total gross fixed capital are important in the study of Soviet capabilities for production of capital goods and of economic growth. The estimates developed in this research aid are by no means complete. For reasons stated in the text, these estimates cover in detail neither the nonindustrial sectors of the Soviet economy nor the years before 1940. They do cover, however, the total Soviet economy and some important branches of it. This research aid, therefore, is a partial foundation for analysis of Soviet growth and of total gross fixed capital in the nonindustrial sectors.

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GROSS FIXED CAPITAL IN THE USSR*
1940-55

Summary and Conclusions

Total gross fixed capital** in the USSR increased from 773 billion 1955 rubles*** in 1940 to 951 billion rubles in 1950 and 1,453 billion rubles in 1955, showing a steadily increasing average annual rate of growth since 1944.**** Productive fixed capital† increased by 34 percent during 1940-50, and its share of the total increased from 58 to 63 percent in the same period. By 1955, productive fixed capital amounted to approximately 67 percent of the total.

Since 1940 the fastest growing sector of the economy has been the industrial sector. In 1955, industrial productive fixed capital was 171 percent greater than in 1940, fixed capital in agriculture 94 percent greater, and fixed capital in transportation and communications 56 percent greater. Industrial productive fixed capital, which amounted to 29 percent of total fixed capital in 1940, increased to 37 percent

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* The estimates and conclusions contained in this research aid represent the best judgment of ORR as of 15 September 1957.

** Fixed capital, or basic funds (osnovnyye sredstva), is the stock of durable physical instruments of production used for more than one accounting period. The term fixed capital as used in this research aid refers to gross fixed capital unless otherwise indicated. For a more detailed discussion of fixed capital and for definitions of other terms used in this research aid, see the glossary, Appendix A.

*** Ruble values are given in terms of 1 July 1955 rubles throughout this research aid unless otherwise indicated. Ruble values may be converted to 1955 US dollars by a ruble-dollar ratio of 4 to 1.

**** The periods for which average annual rates of growth are given are from year end to year end, inclusive -- for example, 1942-45 for a period of average annual rate of growth means from the end of 1942 to the end of 1945. This measurement does not hold true, however, for any other dates given in this research aid -- for example, except in cases of average annual rates of growth, 1942-45 means from the beginning of 1942 to the end of 1945.

† For a discussion of types of fixed capital, see II, p. 5, below.

in 1950 and 42 percent in 1955. Productive fixed capital outside industry, which also amounted to about 29 percent of total fixed capital in 1940, has retained a relatively stable share -- about 25 to 26 percent -- since 1950. In 1954, machine building and metalworking was the largest branch of industry, with 25 percent of the industrial fixed capital. The next two branches in size were electric power (11 percent) and ferrous metallurgy (9 percent).

During 1950-54, all industrial productive fixed capital increased by 54 percent. Fixed capital in individual branches of industry increased as follows: building materials 92 percent; electric power 88 percent; petroleum 80 percent; coal 76 percent; ferrous metallurgy, chemicals, and light industry 54 percent; machine building 37 percent; and food processing 37 percent.

The Sixth Five Year Plan (1956-60) places considerable emphasis on the replacement of obsolete equipment in industry. The official recognition of obsolescence is something of a departure from the past. Much of the equipment which will be retired by 1965 was installed during World War II, when investments* were abnormally low. Therefore, it will be possible until about 1965 for the USSR to maintain the growth of its total fixed capital while replacing some of its existing obsolete assets. It is likely that after 1965 a continuous, widespread program of modernization will be a deterrent to the growth of total fixed capital.

I. Introduction.

Fixed capital is distinguished from working capital by the tendency of fixed capital to retain its form during numerous accounting periods and by the special accounting problems which result from its durability. The most crucial problem in fixed capital accounting is the determination of the original value of items of fixed capital and of the portion of an item of fixed capital that is used up during a given accounting period.

* The term investment as used in this research aid refers only to investments in fixed capital.

Fixed capital derives its value from its ability to generate income. Therefore, the theoretically correct valuation of fixed capital is the present (discounted) value of the future net incomes which it will produce. It is extremely difficult to value fixed capital practically on the basis of capitalization of income. A number of alternative measures have been used to approximate the value of fixed capital. Some of these measures are based on current market price, on cost of reproduction, and on original cost. For some purposes, one of these alternative measures may be preferable to the capitalization method of valuation. For example, in studies of long-run economic growth, estimates of undepreciated fixed capital measured in terms of costs of reproduction in constant prices may give the best approximation of an index of productive capacity. The reasons for this position will be elaborated below after the discussion of depreciation.

The portion of an item of fixed capital used up during a given accounting period may be approximated. The amount of decline in the value of fixed capital during a given period is termed depreciation. The theoretically correct determination of depreciation follows from the correct valuation of the fixed capital at a given point in time.

It was stated above that the theoretically correct valuation of fixed capital is the discounted value of the future net incomes which the fixed capital will produce. At the start of operation of an item of fixed capital, this valuation will be equal to all of the discounted net incomes which the item produces throughout its service life. At a subsequent point in time the valuation will refer to the sum of discounted net incomes which the item of fixed capital will produce in its remaining service life. The correct depreciation between two points of time then will equal the valuation of the fixed capital at the first point less its valuation at the second point.

It is impossible to compute precisely the depreciation in a given period, because it is impossible to determine precisely the correct valuation of fixed capital at a point of time. Some of the various approximate measures of depreciation used in actual accounting practice are the straight-line method, the declining-balance method, and the annuity method.

The straight-line method is probably the most widely used depreciation method. It is the simplest method to apply, although it may be somewhat less accurate than alternative methods. The basic assumption in the straight-line method is that depreciation is divided equally among the years of service life of fixed capital.

The other methods of depreciation imply changing annual depreciation charges against fixed capital. Some methods indicate a declining amount of depreciation in each subsequent year -- for example, the declining-balance method. Others indicate an increasing amount -- for example, the annuity method.

It was stated above that a fixed capital series in constant prices may give the best approximation of an index of productive capacity. The productive capacity of any factor of production may be defined as the maximum annual production which the factor will yield in combination with stated quantities of other factors. The productive capacity of fixed capital, therefore, is properly measured by the production which it will yield in each year. It is customary, however, to measure fixed capital by its total value.

Problems requiring measurement of net income or the valuation of productive services remaining in a stock of fixed capital may be solved by the use of estimates of depreciated fixed capital.

The use of estimates of fixed capital to measure growth of capacity is valid if the productive services rendered in each year by a given stock of fixed capital are approximately equal. In the absence of accurate knowledge, it is assumed for this research aid that capital repair offsets depreciation sufficiently for estimates of gross fixed capital to be used.

A major weakness of the estimates presented in this research aid is a failure to take account of the obsolescence of fixed capital. In a dynamic economy, obsolescence becomes a major problem. In the US, business and government authorities recognize obsolescence as a continuing process. The US Internal Revenue Service allows business firms to set their depreciation rates sufficiently high to cover "normal" obsolescence. In the USSR, however, until recently, the officials have refused to recognize the existence of obsolescence in a socialist economy.

It is impossible in this research aid to make adequate adjustment for obsolescence in estimates of the fixed capital for the USSR. Some of the implications of obsolescence, however, should be mentioned. Obsolescence may occur as a result of shifts either in supply conditions or in the demand structure in a given market or economy. Supply conditions may shift because of changes in natural (including human) resources or technical changes; the demand structure may shift because

of changing tastes. Undoubtedly, the most important cause of obsolescence of fixed capital has been technical innovations. Many of these innovations have resulted from shortages of labor and high costs of labor.

The usefulness of estimates of fixed capital as a direct measure of productive capacity depends on the constancy of the capital-capacity ratio.* In a dynamic economy the over-all capital-capacity ratio may remain constant, may increase, or may decline. Changes in this over-all ratio may result from technological changes in individual branches of the economy or from different rates of growth in branches of the economy which exhibit different capital-capacity ratios. The usefulness of estimates of fixed capital increases if estimates are available for significant sectors and branches of the economy.

In the special case of the USSR it is assumed that the output-capacity ratio is relatively stable.** Therefore, historical estimates of fixed capital add little or nothing to our knowledge of historical productive capacity if an adequate output series is available. Output and capital series, however, combined with data on other factors of production, may be employed in projections of output or capacity for future years.

II. Accounting Practice.

A. Fixed Capital.

An arbitrary division is made between fixed and working capital in Soviet accounting practice. In practice, Soviet accounts include in fixed capital (1) those objects which have a useful life of 1 year or more, regardless of their values, and (2) individual items of fixed

* This discussion is in terms of capital-capacity ratios rather than capital-output ratios because the latter fluctuate with changes in the degree of use of capital. The concept of capacity is itself somewhat elusive. Capacity must be defined rigidly if the use of capital-capacity ratios is to be significant.

** This statement refers to the absence of sharp cyclical or random shifts in the output-capacity ratio but is not meant to imply that there is no gradual increase in the ratio because of more efficient use of fixed capital. Changes of the former type reflect influences other than changes in productivity.

capital valued at 300 rubles per unit,* 1/** or more, regardless of their useful lives (until 1951, the limit was 200 rubles per unit). The classification of fixed capital according to function is not uniform among the various sectors and branches of the Soviet economy. The greatest intrasectoral uniformity is found within the industrial sector, where many branches use the following grouping 2/:

1. Productive Fixed Capital.

   a. Buildings (shops, offices, warehouses, and the like).
   b. Other structures.
   c. Power machinery.
   d. Production machinery.
   e. Transmission installations (power lines, pipelines, and the like).
   f. Mobile transportation facilities (locomotives, rolling stock, trucks, and the like).
   g. Tools and attachments.
   h. Housekeeping inventory.
   i. Reserve fixed capital (including only composite machines and the like). Items such as individual machine parts for repair are considered working capital.

2. Nonproductive Fixed Capital.

   a. Housing (including hotels, dormitories, and the like).
   b. Buildings for cultural and communal purposes (schools, hospitals, municipal and trading enterprises, and the like).
   c. Equipment and other items required for cultural and communal purposes.

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* There are two important exceptions to the minimum-value rule. The first is that agricultural machines and implements; adult working, beef, and dairy cattle; and adult poultry are part of fixed capital regardless of unit value. The second is that since January 1954 the Ministry of Trade (Ministerstvo Torgovli), the Central Union of Consumer Cooperatives (Tsentral'nyy Soyuz Potrebitel'skoy Kooperatsii -- Tsentrosoyuz), and other unspecified ministries and agencies have been allowed to carry on the working capital accounts equipment valued at not more than 500 rubles per unit.

** For serially numbered source references, see Appendix D.

Most of the categories of fixed capital listed above are used also in the various nonindustrial sectors of the economy. Additional categories which are peculiar to some of the nonindustrial sectors are as follows:

1. Agricultural machines, implements, and farming inventory.
2. Adult draft and dairy animals, and animals bred for meat, hides, wool, and the like (excluding those being fattened for slaughter).
3. Long-term planting (orchards, vineyards, certain medicinal and technical crops, parks, and the like).
4. Investments made to exploit the subsoil for land betterment, drainage, and irrigation projects.

Some items are counted in fixed capital upon formal acceptance by the purchasing enterprise. They are completed new buildings and other structures, installed new equipment, and completed alterations to fixed capital which increase its value. Equipment not requiring installation, tools, equipment assigned to the reserve, and adult animals are counted upon their receipt at the enterprise. Investments in long-term planting; improvements in plots of land, subsoil workings, forests, and water parcels; and geological exploration directly connected with a construction project are counted at the end of the year during which the investments were made. 3/

Fixed capital is carried in the USSR at full original cost. 4/ For assets acquired by an enterprise from a contracting supplier, the valuation is the actual expenditure including the cost of delivery and installation. Fixed capital made by an enterprise for its own use is valued at its actual cost of production. Fixed capital received free of charge from another enterprise is carried by the receiving enterprise at the same value at which the transferring enterprise carried it. 5/

B. Depreciation of Fixed Capital.

Because fixed capital, by definition, is used during several accounting periods, an estimate of the value of fixed capital which is used up during a given accounting period (depreciation charge) must be included by an enterprise in the cost of operations for the period. Depreciation charges for fixed capital in the USSR generally cover both capital repairs and complete replacement. No allowance is made for obsolescence. 6/

The following depreciation formula, used in most sectors of the Soviet economy, is based on the straight-line depreciation method:

$$N = 100 \frac{(P + R - O)}{PL}$$

where N = the annual rate of depreciation, in percent;

P = the full original cost of the average fixed capital during the year;

R = the projected cost of all capital repairs throughout the service life of the fixed capital;

O = the estimated salvage value of the fixed capital at the end of the service life; and

L = the estimated service life.

The depreciation charge is computed as a percentage of the average value of the fixed capital for the year. The value of both new and retired fixed capital is prorated according to the portion of the year during which the respective fixed capital operates. 7/

Depreciation charges are not made for all fixed capital in the Soviet economy. The categories for which no charges are made are the following:

1. Fixed capital held in reserve or storage 8/;
2. Fixed capital of organizations financed entirely from the state or local budgets 9/;
3. Fixed capital of kolkhozes 10/; and
4. Adult farm animals before the time they are worked. 11/

Historically, depreciation practice in the USSR has developed in three distinct stages. Before 1930 there were no national regulations setting rates for the various branches of the economy.

In June 1930 the Supreme Council of the National Economy (Vyshiy Sovet Narodnogo Khozyaystva -- VSNKh), USSR, established by decree depreciation rates for the various branches of the economy. Individual rates were set for several classes of fixed capital. Moreover, the intensity of use of fixed capital was considered. 12/

In January 1938, new depreciation rates were decreed by the Council of Peoples Commissars (Sovet Narodnykh Komissarov -- SNK), USSR. SNK was the successor to VSNKh in terms of the right to fix depreciation rates. These rates were established for various peoples commissariats but were not differentiated by branch of economy or by class of fixed capital. For the first time, SNK specified for each peoples commissariat percentages of the depreciation charges which were to be allocated for capital repair. 13/

Some changes have been made in depreciation rates since 1949. No comprehensive data about the new rates, however, are available. It is likely that for most sectors current rates do not differ greatly from those in use before World War II. 14/

The depreciation charges of an individual enterprise in the USSR may be passed on to other enterprises. That part of the charges which represents the depreciation of the original investment in an asset is allocated in full to the financing of the enterprise if the charge does not exceed the limit of investment set for the enterprise. If that part of the charge exceeds the limit of investment for the enterprise, the excess amount is transferred to the organization at the next higher level for distribution to other enterprises. 15/ A similar procedure governs the use of that part of depreciation charges allocated to capital repair.

C. Repair.

1. Current.

Repairs other than capital repair are sometimes grouped together as current repair. Such repair is on a smaller scale than capital repair and has as its objective the maintenance of fixed capital in operating condition. Under current repair would be included such activities as regulation of equipment and repairs to prevent breakdowns. 16/

2. Capital.

Before 1938, capital repair was treated in Soviet accounting as part of investment. Capital repair is now a distinct category not included in plans for investment. 17/

Capital repair is financed generally from depreciation charges. For those enterprises financed entirely from the state or local budgets, the budget itself is the source of funds for capital repair. Profits of the national economy were a supplementary source of financing capital repair in at least 1940 and 1949. 18/ Since 1938 a definite percentage of the depreciation charges for each peoples commissariat and subsequently for each ministry has been allocated to capital repair.

Fixed capital in the USSR is carried on the books at the full original cost. Expenditures for capital repair are treated as an offset to depreciation. These expenditures do not affect the fixed capital account but only the depreciation account. 19/

III. Size.

Soviet publications contain some information about the size and composition of fixed capital in the USSR during the plan years, 1928-40. Data showing the total fixed capital of the socialist sector in the USSR in several key prewar years are shown in Table 1.

Table 1

Total Gross Fixed Capital of the Socialist Sector in the USSR, According to Alternative Sources a/
Selected Years, 1928-40

Billion Rubles

Year of Ruble Value	1928	1932	1937	1940
1933 b/	51.0	91.7	192.1	N.A.
1945 c/	140.0	285.0	564.0	709.0

a. All values refer to fixed capital existing at the ends of the years.
b. 20/
c. 21/

Differences between the two series in Table 1 should be reconcilable on the basis of price changes and, perhaps, adjustments in the coverage of the data. An attempted reconciliation* indicates that the fixed capital series in 1933 prices is reasonably consistent with prewar investment data but not with the postwar investment data and the official indexes of growth of fixed capital since 1940. The fixed capital series in 1945 prices, however, agrees with the postwar data but not with the prewar data on investment.**

In the absence of postwar data on fixed capital in terms of value, the 709.0 billion rubles for 1940 shown in Table 1*** has been used as a base for estimating the total fixed capital in the USSR during 1940-55. The method* is to add the estimated gross additions of fixed capital in a given year to the fixed capital existing at the beginning of the year and to deduct the estimated retirements and losses of fixed capital during the wartime years 1941-42. The resulting estimate of fixed capital at the end of a given year then becomes the base for estimating the fixed capital existing at the end of the following year. The estimates are shown in Table 2.****

The estimates shown in Table 2 indicate that total fixed capital in the USSR declined during the German invasion of 1941-42 to about 75 percent of the 1940 total of 773 billion rubles. In the 13 years from 1943 to the end of the Fifth Five Year Plan (1951-55), total fixed capital increased by about 135 percent.

Since 1944 the annual rate of growth of fixed capital has been rising steadily. Estimated average annual rates for three significant periods are as follows:

Years	Average Annual Rate of Growth (Percent)
1942-45	5.5
1945-50	6.8
1950-55	8.9

* For detailed methodology, see Appendix B.

** Because inconsistencies in the prewar data prevent the development of a continuous series for 1928-55, the following analysis deals only with the estimates for 1940-55.

*** P. 10, above.

**** Table 2 follows on p. 12.

Table 2

Total Gross Fixed Capital and Major Components
in the USSR, in Rubles
1940-55

Billion 1 July 1955 Rubles

	Productive				
Year	Industrial a/	Non-industrial b/	Total c/	Non-productive c/	Total d/
1940	223	222	445	328	773
1941	N.A.	N.A.	N.A.	N.A.	582
1942	N.A.	N.A.	N.A.	N.A.	582
1943	N.A.	N.A.	N.A.	N.A.	619
1944	N.A.	N.A.	N.A.	N.A.	650
1945	N.A.	N.A.	N.A.	N.A.	683
1946	223	N.A.	N.A.	N.A.	724
1947	247	N.A.	N.A.	N.A.	773
1948	275	N.A.	N.A.	N.A.	827
1949	310	N.A.	N.A.	N.A.	885
1950	352	245	597	354	951
1951	394	262	656	367	1,023
1952	437	285	722	387	1,109
1953	489	304	793	412	1,205
1954	541	336	877	445	1,322
1955	604	371	975	478	1,453

a. Taken from Table 14, p. 42, below, and rounded.
b. Obtained as residual.
c. For methodology, see Appendix B.
d. Taken from Table 11, p. 31, below, and rounded.

Total Soviet fixed capital regained its prewar (1940) level in 1947. By the end of the Fourth Five Year Plan (1946-50) it was 23 percent greater than in 1940 and by the end of the Fifth Five Year Plan 88 percent greater than in 1940.

IV. Structure.

Changes in the structure as well as in the size of fixed capital of the USSR during 1940-55 are useful in the assessment of Soviet economic strength. Data published in the 1956 statistical handbook of the USSR 22/ permit a partial examination of the structure of postwar fixed capital. Estimates of some important components of total fixed capital are shown in Table 2.* Total fixed capital is divided into productive and nonproductive components. Productive fixed capital is subdivided into industrial and nonindustrial components.** Table 3,*** which is based on Table 2,* shows the percentage distribution of fixed capital, by major component. Table 3 indicates that productive fixed capital, which was about 58 percent of total fixed capital in 1940, increased to 63 percent in 1950 and to about 67 percent in 1955. Industrial productive fixed capital, which amounted to about 29 percent of total fixed capital in 1940, increased to 31 percent of the total in 1946 and to 42 percent in 1955. Productive nonindustrial fixed capital, which also amounted to about 29 percent of the total fixed capital in 1940, has amounted to about 25 to 26 percent of the total since 1950.

The relative share of industrial productive fixed capital in total productive fixed capital increased from 50 percent in 1940 and 59 percent in 1950 to about 62 percent in 1955. The indexes of fixed capital published in the 1956 handbook 23/ are shown in Table 4.****

Table 3 indicates that, despite severe war losses, the USSR finished the Fourth Five Year Plan (1946-50) with 23 percent more total fixed capital than in 1940. As would be expected, productive fixed capital has grown more rapidly in the postwar years than has nonproductive fixed capital. Of productive fixed capital, that in the industrial sector has grown more rapidly since 1940 than that in the nonindustrial sector.

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* P. 12, above.

** Although some of the basic data exist for estimating productive fixed capital in the agricultural and the transportation and communications sectors, these data are a first approximation and it is not considered feasible to attempt estimates for them. For a detailed methodology on estimating these components, see Appendix B.

*** Table 3 follows on p. 14.

**** Table 4 follows on p. 14.

Table 3

Distribution of Total Gross Fixed Capital in the USSR
in Percentages
1940 and 1946-55 a/

Percent

Year	Productive			Nonproductive	Total
	Industrial	Nonindustrial	Total		
1940	29	29	58	42	100
1946	31	N.A.	N.A.	N.A.	100
1947	32	N.A.	N.A.	N.A.	100
1948	33	N.A.	N.A.	N.A.	100
1949	35	N.A.	N.A.	N.A.	100
1950	37	26	63	37	100
1951	39	26	64	36	100
1952	39	26	65	35	100
1953	40	25	66	34	100
1954	41	25	66	34	100
1955	42	26	67	33	100

a. Derived from Table 2, p. 12, above. Because of rounding, percentages may not add to correct totals.

Table 4

Index of Gross Fixed Capital in the USSR
Selected Years, 1940-55

1940 = 100

Type of Fixed Capital	1940	1950	1954	1955
Productive	100	134	197	219
Industrial	100	158	243	271
Agricultural	100	105	169	194
Transportation and communications	100	117	146	156
Nonproductive	100	111	140	150
Total	100	123	171	188

During 1950-55, productive fixed capital increased by about 63 percent; and agricultural fixed capital increased by about 85 percent, which was a higher rate than the increase (72 percent) in industrial fixed capital.

The distribution of productive fixed capital, by branch of industry and by type of fixed capital, shown in Tables 5 and 6,* is only an approximation because the percentages given in the source are based on valuations at original cost. Nevertheless, the estimates seem to give a fair picture of the increase of fixed capital for individual industries.** Table 7*** shows an index of growth for industrial branches, based on the data underlying Tables 5 and 6. The branches of industry, with the exception of the category of residual, are listed in order according to rates of increase from 1940 to 1954.

During 1940-54, industrial productive fixed capital increased by 143 percent. Fixed capital in ferrous metallurgy increased at about the same rate as that for all industry. Fixed capital in four other branches of industry increased at a rate exceeding that for all industry. The branches were, in order of largest growth, coal, petroleum, construction materials, and electric power. In the heavy industrial group, fixed capital in only the machine building and chemical industries increased at a lower rate than that in all industry. Fixed capital in the combined residual industries (see footnote c to Table 7****) increased at about the same rate as that in all industry, whereas fixed capital in the light and food industries increased at a lower rate.

During 1950-54, productive fixed capital increased by about 54 percent. Fixed capital in the coal, petroleum, construction materials, and electric power industries increased at a higher rate than that in all industry. The construction materials and electric power industries, however, replaced the coal and petroleum industries, respectively, with the highest rates of growth. Fixed capital in ferrous metallurgy, in the chemical industry and in light industry increased at about the same

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* Tables 5 and 6 follow on pp. 16 and 17, respectively.

** The validity of the analysis of rates of growth in individual industrial branches depends partly on the constancy of the definitions of the branches. Although it is not certain, the data on the branches appear to have been adjusted for major organizational changes.

*** Table 7 follows on p. 18.

**** P. 18, below.

Table 5

Distribution of Gross Industrial Productive Fixed Capital in the USSR, by Branch of Industry a/
Selected Years, 1940-54

Branch of Industry	Billion July 1955 Rubles 1940	1950	1954
Heavy industry			
Ferrous metallurgy	20.0	31.7	48.7
Coal	8.9	24.6	43.3
Petroleum	8.9	21.1	37.9
Electric power stations and networks	20.0	31.7	59.5
Chemical b/	15.6	17.6	27.1
Machine building and metalworking c/	62.4	98.5	135.3
Construction materials	8.9	14.1	27.1
Other c/ d/	37.9	63.3	92.0
Subtotal	182.6	302.6	470.8
Light and food processing industries			
Light	15.6	17.6	27.1
Food processing	24.5	31.7	43.3
Subtotal	40.1	49.3	70.4
Total	222.7	351.9	541.2

a. Derived from Table 14, p. 42, below. Quantities reflect the rounding of original data and may not add to the totals shown.
b. Including the rubber-asbestos industry.
c. It is not known whether the defense (conventional weapons) industry is included in Machine building and metalworking or in Other.
d. Including the following industries: lumber, nonferrous metallurgy, paper, and construction.

Table 6

Distribution of Gross Industrial Productive Fixed Capital in the USSR, by Type of Fixed Capital a/ Selected Years, 1940-54

Billion July 1955 Rubles

Type of Fixed Capital	1940 b/	1950	1954
Buildings	111.4	98.5	146.1
Installations		80.9	135.3
Power equipment	20.0	28.2	48.7
Production equipment	69.0	95.0	135.3
Transmission facilities		14.1	27.1
Transportation facilities	13.4	24.6	32.5
Instruments, implements, and other industrial productive fixed capital	8.9	10.6	16.2
Total	222.7	351.9	541.2

a. Based on percentages given in source 24/.
b. Figures for 1940 are based on percentages for 1939.

rate as in all industry during 1950-54, whereas fixed capital in the machine building, in the food processing, and in residual industries increased at a lower rate.

V. Prospects for Future Growth.

An objective of the Soviet Sixth Five Year Plan (1956-60) is the following:

> To carry out on a wide scale measures for increased standards of production in all branches of industry on the basis of the further development of electrification, complex mechanization, and automation, introduction of modern and high-productive equipment and advanced technology, and the extensive replacement and modernization of obsolete equipment. 25/

Table 7

Index of Gross Industrial Productive Fixed Capital
in the USSR, by Branch of Industry a/
1950 and 1954

Branch of Industry	Index b/			Rank According to 1954 Index (1950 = 100)
	1950 (1940 = 100)	1954 (1940 = 100)	1954 (1950 = 100)	
Coal	277	486	176	4
Petroleum	237	426	180	3
Construction materials	158	304	192	1
Electric power stations and networks	158	293	188	2
Ferrous metallurgy	158	244	154	5
Machine building and metalworking	158	217	137	8
Food processing	129	177	137	8
Chemical	113	174	154	5
Light	113	174	154	5
Residual c/	167	243	145	
Total heavy industry d/	166	258	156	
Total light and food processing industries	123	176	143	
Total industry	158	243	154	

a. Derived from Tables 5 and 6, pp. 16 and 17, respectively, above.
b. The index in this table was derived from values expressed in 1955 rubles.
c. Including the following industries: lumber, nonferrous metallurgy, paper, and construction. It is not known whether the defense industry (conventional weapons) is included in the machine building and metalworking industry or in the residual industry.
d. Including the following industries: coal, petroleum, construction materials, electric power stations and networks, ferrous metallurgy, machine building and metalworking, and chemical.

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The problem of the obsolescence of fixed capital has now received official attention on a large scale. This change in the official view is related to the drive to increase the productivity of labor, a drive which has received emphasis throughout the postwar years.

During 1956-60, agriculture is envisioned as being the most favored sector in terms of the relative gain in investment just as it was in the Fifth Five Year Plan (1951-55). Industry, of course, still will get the major share of investment funds. If the plan for investment in industry is met, industrial productive fixed capital should increase by about 60 percent.

It is impossible to estimate accurately the effect of the new emphasis on technological change and replacement during 1956-60. On the basis of very rough estimates, it appears that total fixed capital (including nonproductive fixed capital) will increase by about 55 percent by 1960 if the plan for investment is met and if the emphasis on technological change does not result in retirements of existing fixed capital earlier than anticipated. The period from 1957 to about 1965 is a favorable time for the USSR to modernize because it will be replacing much of the equipment which went into service during World War II, when investment was abnormally low. It will be possible for the USSR thus to modernize to some extent without any increase in the ratio of retirements to investment.

It is almost certain that in the years after 1965 replacements of fixed capital will require a substantially larger share of Soviet investment for several reasons.

1. Average annual investment, which grew at a very rapid rate from 1943 through the early postwar years, has been increasing generally at a declining rate throughout the postwar period.

2. Investment in short-lived fixed capital has accounted for a substantially larger percentage of investment since World War II than previously. A continuation of this trend is implied in a statement of Bulganin that "large allocations are being made for new, more efficient equipment. Though capital investment generally is being increased 67 percent, appropriations for new machinery and equipment will increase 80 percent." 26/

3. The recognition of the obsolescence of fixed capital will result in shorter service lives for many items of fixed capital. The Council of Ministers (Sovet Ministrov), USSR, has directed a general

revision of amortization rates to be completed by 1959. The new rates will be set sufficiently high to cover the obsolescence of fixed capital. 27/ The above factors indicate a reduction in the rate of growth of fixed capital in the immediate future.

APPENDIX A

GLOSSARY

Any discussion of gross fixed capital in the USSR entails the use of numerous technical terms. The technical terms used in this research aid are defined in this glossary.

Accounting period. Any period of time for which economic flows (production, costs, income, and the like) are totaled.

Annuity method. A method of computing depreciation of an asset which provides a series of equal periodic amounts including depreciation allowances and interest on the depreciated value of the asset for each period throughout the service life of the asset.

Asset. The stock of economic goods and claims to economic goods of an economic unit. The terms fixed assets and fixed capital may be used interchangeably.

Capacity. The maximum production possible from a given combination of productive resources in specified quantities under stated conditions of operation during a given period (usually 1 year).

Capital-capacity ratio. The value of the fixed capital required in an industry or economy for each unit of annual capacity measured in terms of value.

Capitalization of income. The process of determining the present value of a given amount of income due at some future date. This process involves discounting the income from the maturity (collection) date back to the present time by some known or expected rate of interest.

Capital repair. In Soviet accounting terminology, relatively large-scale renovating projects involving the replacement of a large number of parts or of the most important parts of an item of fixed capital. 28/ The object of capital repair is to restore the item of fixed capital to full working power. If the object of renovation is to increase the capacity of the item of fixed capital, such renovation is termed capital reconstruction rather than capital repair. 29/

Current market price. In this research aid, the price at which an item of fixed capital would sell at a given time.

Declining-balance method. A method in which the annual depreciation of an asset is computed as a constant percentage of the net value of the asset.

Depreciation. The amount of decline in the value of a fixed asset during a given period.

Depreciation charge. The amount of depreciation which is charged as a cost of production during a given period.

Depreciation rate. The ratio of the annual depreciation charge to the gross or net value of the asset or assets against which the charge is made.

Factors of production. The productive services of economic resources.

Fixed assets. See Fixed capital.

Fixed Capital. The stock of durable, physical instruments of production that is used for more than one accounting period. In this sense the term instruments of production is defined broadly to include such social overhead capital as housing which is necessary to, but not used directly in, production. In Soviet terminology, this social overhead capital is termed nonproductive. The terms fixed capital, stock of fixed capital, and fixed assets may be used interchangeably.

Gross fixed capital. The total value of fixed capital without any deduction for depreciation.

Gross investment. As used in this research aid, the output of fixed capital during a given period of time -- usually 1 year.

Income. Goods and services produced in a given period.

Net fixed capital. The depreciated value of fixed capital.

Nonproductive fixed capital. In Soviet accounting terminology, fixed capital which is used for social and cultural purposes but not used directly in the productive process -- for example, houses and educational buildings.

Obsolescence of fixed capital. The functional supplantation of fixed capital by superior substitutes or supplantation because of a decrease in demand for its products.

Original cost. In this research aid, the cost of fixed capital when it first enters service.

Output-capacity ratio. The value of output in an industry during a given period of time divided by the capacity of the industry during the same period of time.

Present (discounted) value. The value of a sum due at the end of a given number of periods as determined by discounting the sum from the due date back to the present by a stated rate of discount per period.

Productive fixed capital. In Soviet accounting terminology, fixed capital which is used directly in the productive process.

Reproduction cost. In this research aid, the cost of reproducing a given stock of fixed capital in prices of the current year or some other specified period.

Retirements. The value of fixed capital removed from service in a given period.

Service life. The economic life of an item of fixed capital.

Stock of fixed capital. See Fixed capital.

Straight-line method. A method of computing depreciation of an item of fixed capital which provides equal periodic depreciation allowances that accumulate to the original cost of the item of fixed capital, less the salvage value, by the end of its service life.

Working capital. Resources used in a productive process which are consumed within a short time, usually in one accounting period.

APPENDIX B

METHODOLOGY

1. General.

The 1956 statistical handbook 30/ published in the USSR contains two categories of data which give a basis for estimating the value of fixed capital in the USSR. First, there is a set of indexes of fixed capital shown in Table 4,* covering the following categories: total fixed capital, productive fixed capital, industrial productive fixed capital, agricultural productive fixed capital, transport and communications productive fixed capital, and nonproductive fixed capital. Second, there is an investment series, giving total investments during 1918-55, as shown in Table 8.**

The general equation used in the estimation of fixed capital is derived as follows:

$$S_b + N = xS_b$$

$$xS_b - S_b = N$$

$$(1)\quad S_b = \frac{N}{x-1}$$

where S_b = fixed capital at the end of the base year, valued in prices of a given year;

N = the net additions to the fixed capital accumulating from the end of the base year of the period to the end of the terminal year of the period. N is valued in the prices of the same year used in the valuation of S_b; and

* P. 14, above.

** Table 8 follows on p. 27.

x = the numerical expression of the amount of fixed capital at the end of the terminal year of the period, relative to S_b.

When both S_b and x are known, fixed capital stock at the end of the terminal year (S_t) can be determined by equation (2), $S_t = xS_b$.

Both the indexes of total fixed capital and investment data cover all the years of the Five Year Plans.

2. Total Fixed Capital.

The first problem in estimation of total fixed capital is establishing a base. There is no figure for total fixed capital for any year since 1940. For the prewar plan years, there are two fixed capital series. The data from the two series are shown in Table 9.*

Little is known about the coverage and accounting procedures used in the development of the two fixed capital series shown in columns (1) and (3) of Table 9. According to the sources, both series include the socialist sector but do not include livestock. If the coverage of the two series were identical, adjustment to a common price base would make the series identical. A comparison of columns (1) and (3) of Table 9 shows, however, that the adjusted series in column (1) runs approximately three times that of column (3). This result indicates that coverage of the two series might not have been identical or that the price index, shown in Table 10,** used to adjust these series to prices of 1 July 1955 is erroneous.

A comparison of the net additions to fixed capital with a series of gross additions may also be made on the basis of Table 9. Net additions in columns (2) and (4) were derived from the data for fixed capital in columns (1) and (3), respectively. Gross additions were estimated from the official Soviet investment series, shown in Table 10, and a Soviet source 32/ which states that gross additions to fixed capital amounted***

* Table 9 follows on p. 28.

** Table 10 follows on p. 29. The price index in Table 10 is based on the ratios of investments in current prices of a given year to investments for the same year in prices of 1 July 1955. 31/

*** Continued on p. 30.

Table 8

Total Gross Fixed Capital Investment in the USSR a/
1918-55

Billion 1 July 1955 Rubles

Year and Period	Total Excluding Kolkhoz	Kolkhoz	Total Including Kolkhoz
1918-28	17.0		17.0
1929	7.6	0.4	8.0
1930	12.7	1.0	13.7
1931	18.4	0.7	19.1
1932	21.6	0.7	22.3
1933	18.0	1.1	19.1
1934	23.7	1.3	25.0
1935	27.8	1.7	29.5
1936	38.1	2.3	40.4
1937	33.8	2.7	36.5
1938	35.1	2.8	37.9
1939	40.8	3.3	44.1
1940	43.2	4.0	47.2
1941	37.4	3.1	40.5
1942	23.0	2.2	25.2
1943	23.1	2.8	25.9
1944	31.7	3.9	35.6
1945	39.2	3.7	42.9
1946	46.8	4.8	51.6
1947	50.8	5.9	56.7
1948	62.1	6.2	68.3
1949	76.0	5.2	81.2
1950	90.8	6.9	97.7
1951	102.1	8.5	110.6
1952	113.8	9.9	123.7
1953	119.2	10.9	130.1
1954	140.3	13.3	153.6
1955	149.9	18.8	168.7

a. 33/

Table 9

Data for Comparison of Magnitudes of Alternative Total Gross Fixed Capital Series with Total Gross Investment in Fixed Capital in the USSR 1928-40

Billion 1 July 1955 Rubles

	(1)	(2)	(3)	(4)	(5)
Year and Period a/	Unofficial Data b/ c/	Unofficial Net Additions d/	Official Data e/ c/	Official Net Additions f/	Gross Additions from Official Data on Investment g/
1928	152.6		50.6		
1932	310.7		91.1		
1937	614.8		190.8		
1940	772.8		N.A.		
1928-32		158.1		40.5	47.3
1932-37		304.1		99.7	135.1
1937-40		158.0		N.A.	N.A.

a. Refers to the end of the year.
b. 34/. It is not known whether these data were ever made official.
c. Converted to ruble values of 1 July 1955 by the price index in Table 10, p. 29, below.
d. Derived from column (1).
e. 35/
f. Derived from column (3).
g. 36/ and 2, p. 26, above.

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Table 10

Price Index for Total Gross Investment
in Fixed Capital in the USSR
1925-55 a/

1950 = 100

Period	Industrial	Total
1925	44	62
1926	48	68
1927	47	66
1928	45	64
1929	43	62
1930	43	61
1931	60	66
1932	74	73
1933	62	82
1934	85	81
1935	74	80
1936	85	76
1937	62	80
1938	N.A.	83
1939	N.A.	68
1940	71	72
1941	N.A.	66
1942	N.A.	66
1943	N.A.	69
1944	N.A.	75
1945	75	75
1946	82	82
1947	86	86
1948	91	91
1949	121	121
1950	100	100
1951	98	98
1952	92	92
1953	93	93
1954	91	91
July 1955	81.4	81.4

a. The price index for total state investment and post-war industrial investment is based on source 37/. The index for prewar industrial investment is based on source 38/. In computing this index, rubles of 1 July 1955 were used.

to 73.5 and 89.8 percent of investments,* respectively, in the periods of the First Five Year Plan (1928-32) and the Second Five Year Plan (1933-37). Columns (4) and (5) appear to check reasonably well. Although the difference between gross additions and net additions in 1932-37 appears somewhat high (35.4 billion rubles), this difference might conceivably approximate retirements plus investment items not counted in fixed capital.

Comparison of columns (2) and (5) of Table 9, however, indicates gross inconsistencies between the unofficial series of fixed capital in column (1) and the official series in column (3).

Because the data in column (3) of Table 9 appear to agree reasonably well with the investment information, the possibility of using the 1937 figure (190.8 billion 1 July 1955 rubles) for fixed capital as a base will be tested further. The recently published official index 39/ shows an increase of 23 percent in total fixed capital during 1940-50. This figure is used below in a test of the 1937 base.

The following assumptions are made for the purpose of this test:

a. The ratio of net additions of fixed capital to gross investments in 1938-40 was the same as the ratio in the Second Five Year Plan (see Tables 8 and 9**); and, in 1941 and 1943-50, gross additions were as shown in Table 11.***

b. According to unofficial figures 40/ war losses in 1941 amounted to about 30.3 percent of fixed capital in 1940. In 1942, war losses plus retirements were just equal to gross additions of fixed capital.

c. Retirements in 1943-50 were the same as shown in Table 11.

Trial computation of fixed capital in 1950 is in chronological order, as follows (in 1 July 1955 prices): fixed capital (190.8 billion

* Gross additions are less than investments in a given year because some of the investments are added to fixed capital in a later year -- for example, when a structure is completed and formally accepted by the enterprise for which it is built.

** Pp. 27 and 28, respectively, above.

*** Table 11 follows on p. 31.

Table 11

Data for Computation of Total Gross Fixed Capital
in the USSR
1940-55

Billion 1 July 1955 Rubles

Year	Gross Additions (with "Normal" Lag)	"Normal" Retirements	Estimated Actual Gross Additions	Estimated Actual Retirements	War Losses	Estimated Net Additions	Estimated Total (at End of the Year)
1940							772.8
1941	43.4		43.4	0	234.4	(-191.0)	581.8
1942	41.6		41.6	0	41.6	0	581.8
1943	31.2		37.2	0	0	37.2	619.0
1944	24.3		30.6	0	0	30.6	649.6
1945	29.2	5.6	33.8	0	0	33.8	683.4
1946	37.2		40.8	0	0	40.8	724.2
1947	44.9		49.0	0	0	49.0	773.2
1948	51.5		53.9	0.5	0	53.4	826.6
1949	59.4	2.6	58.4	0.5	0	57.9	884.5
1950	71.0	4.5	68.2	2.2	0	66.0	950.5
Subtotal	433.7	12.7	456.9	3.2	276.0	177.7	
1951	85.0	6.2	80.4	7.6	0	72.8	1,023.3
1952	101.7	7.2	94.2	9.0	0	85.2	1,108.5
1953	117.2	6.2	106.1	10.0	0	96.1	1,204.6
1954	126.9	8.2	126.9	10.0	0	116.9	1,321.5
1955	141.8	9.7	141.8	10.4	0	131.4	1,452.9
Subtotal	572.6	37.5	549.4	47.0	0	502.4	
Total	1,006.3	50.2	1,006.3	50.2	276.0	680.1	

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rubles) in 1937 plus net additions (85.6 billion rubles*) during 1938-40 minus war losses (83.7 billion rubles**) during 1941 plus gross additions (43.4 billion rubles*) during 1941 minus retirements (3.2 billion rubles***) during 1943-50 plus gross additions (371.9 billion rubles*) during 1943-50 yield fixed capital (604.8 billion rubles) in 1950.

This computation indicates that the total stock increased between 1940 and 1950 by about 119 percent, compared with the increase of 23 percent indicated in the official index.

It is concluded that the prewar base used for postwar estimates of fixed capital must be much higher than the above figure if consistency with other postwar data is to be maintained. The only prewar bases available at higher figures are the unofficial figures for fixed capital shown in Table 11.**** Although this fixed capital series fails to agree with the 1928-37 investment data, it is consistent with the deflated series for post-1940 investment and with other information about the wartime and postwar years.

The inconsistencies in the prewar data preclude a continuous fixed capital series from 1928 to 1955. The estimates of total fixed capital which are developed below use as a base the 1940 unofficial data from column (1) of Table 9† -- 772.8 billion 1 July 1955 rubles.

It is difficult to estimate the value of N†† because little is known about retirements of fixed capital in the Soviet economy. Consequently,

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* It was assumed (p. 30, above) that the ratio of net additions of fixed capital to gross investment in 1938-40 was the same as the ratio in 1933-37 and that, in 1941 and 1943-50, gross additions were as shown in Table 11 (p. 31, above).

** It was assumed (p. 30, above) that war losses in 1941 amounted to about 30.3 percent of the 1940 fixed capital and that, in 1942, war losses plus retirements were just equal to gross additions of fixed capital.

*** It was assumed (p. 30, above) that retirements in 1943-50 were the same as shown in Table 11 (p. 31, above).

**** P. 31, above.

† P. 28, above.

†† All symbols used in the discussion are identical with those defined in 1, p. 25, above. All the value data are presented in Table 11, p. 31, above.

equation (2)* will be employed in the estimation of total postwar fixed capital. The elements of the equation are established as follows:

a. The fixed capital (S_b) at the end of the base year (1940) is assumed to be 772.8 billion rubles, in prices of 1 July 1955. This is the unofficial figure, given in Table 9,** converted from 1945 prices by means of the index in Table 10.***

b. The indexes of total fixed capital for 1940, 1950, 1954, and 1955 were 100, 123, 171, and 188, respectively.

c. If S_b equals 772.8, the following values of S_t are established: 950.5 for 1950, 1,321.5 for 1954, and 1,452.9 for 1955.

Net additions to the fixed capital for several periods may be determined as follows, from equations (1) and (2)*:

$$N = xS_b - S_b$$

$$N = S_t - S_b$$

From this formula the following values are found for N:

Period	N
1941-50	177.7
1951-54	371.0
1955	131.4
Total	680.1

* See 1, p. 25, above.
** P. 28, above.
*** P. 29, above.

Estimates of fixed capital for the interim years are also derived as follows by application of equations (1) and (2):

$$xS_b = S_b + N$$

$$S_t = S_b + N$$

Because value of N is known only for the periods indicated above, its value for the shorter periods must be estimated from the following equation:

$$(3)\ N = G - (R + W)$$

where G = gross additions to fixed capital in the current year or period;

R = fixed capital retired from service during the current year or period; and

W = war losses of fixed capital during the current year or period.

Estimates of the elements in equation (3) will be made, first, for 1940-55. The following assumptions govern the computations:

a. "Normal" gross additions to fixed capital in a given year are equal to one-half the sum of investments in fixed capital during the 2 years preceding.* This lag assumption was determined purely on the basis of trial and error. A lag of 1 year was clearly too short for consistency with the other data, and a lag of 2 years was clearly too great.

* For 1950 and earlier years a deduction of 5 percent was made from the investment data to adjust for items which were counted in investments but not in fixed capital. The adjustment for lag was made in order to arrive at "normal" gross additions.

b. Estimated war losses of fixed capital are based on a statement 41/ that "as a result of occupation, fixed capital of socialist enterprises declined during the second half of 1941 by 215 billion rubles (in 1945 prices) and remained virtually at that level in 1942." From this statement, it was estimated that losses of fixed capital in 1941 amounted to 234.4 billion 1 July 1955 rubles and in 1942 to G - R. For reasons stated below, the actual value of R in 1942 is assumed to have been zero. Consequently, in 1942, W was equal to G.

c. From equation (3), the value of R may be determined as follows:

$$R = G - (N + W)$$

Because G, N, and W can be established for 1940-55, the value of R for that period may be obtained as a residual. For 1940-55, the computation for determining retirements is as follows: G (1,006.3 billion rubles) for 1941-55 minus the sum (956.1 billion rubles) of N and W yields the retirements (50.2 billion rubles) for 1941-55.

For the distribution of the retirements among individual years, fixed capital is conceived as consisting of two categories: long-lived capital, which will be referred to as "structures," and short-lived capital, referred to as "equipment."

Data on Soviet investment are reported for "construction and installation work" and for "equipment, tools, and the like." During the prewar plan years, construction and installation averaged about 80 percent of total costs of investment. To estimate retirements, the cost of installing equipment should be considered part of the investment in equipment. Precise data on the proportion of investment going to equipment, including installation, are not available for all prewar plan years. Scattered data for the early 1930's however, indicate that the percentage was about 30 to 40 percent. 42/ On this basis, it is assumed that the proportion of investment going to equipment, including installation, amounted to one-third of the total investment.

Estimation of retirements from data on investment requires an estimate of the service life of fixed capital. It is assumed in this research aid that the average life of equipment is approximately 20 years, which is, of course, an extremely rough estimate of life of equipment

in the USSR. This estimate is 3 years longer than the estimated average service life of US equipment* and is intended to reflect the Soviet tendency to keep equipment in operation for a longer time.

Although some data are available concerning Soviet depreciation rates (primarily those established in 1938), these data are difficult to analyze because they are composite rates which reflect individual rates for various classes of fixed capital with greatly different service lives. The determination of composite rates requires data on the rates for each class of fixed capital as well as on the percentage of each class in total fixed capital. The determination of service lives for each class of fixed capital from composite depreciation rates or composite service lives requires similar data for each class of fixed capital.

A rough estimate was made of the implied service life of structures, and equipment was estimated to have a service life of 20 years. For this purpose, a rough estimate of the weights of equipment and structures in terms of fixed capital in 1940 was made. An estimate then was made of the sector composition of the fixed capital. Composite depreciation rates, by sector, as shown in Table 12,** were then applied to the percentages of total fixed capital in the appropriate sectors. The average service life for structures thus obtained was approximately three times that estimated for equipment. This result is accepted as reasonable because the ratio of the service life of structures to that of equipment is also 3 to 1 in the US.

The war losses of fixed capital in 1941 and 1942 amounted to approximately one-third of total fixed capital existing in mid-1941. It is assumed that the relative losses of fixed capital of all ages were equal. Because much equipment was evacuated to safe areas before the German attack in 1941, however, it is further assumed that losses of equipment were relatively smaller than losses of structures. Consequently, estimated retirements of equipment in any year Y (on the assumption of a "normal" service life) would be equal to investment in equipment in the year Y minus 20 less losses of equipment which entered service in the year Y minus 20. It is assumed that retirements of equipment for 1941-55

* Studies of the fixed capital of all US business indicate an average life of 17 years for equipment and of 50 years for structures. 43/

** Table 12 follows on p. 37. It should be noted that rates used are those for replacement and not the total rates for depreciation which include an allowance for capital repair.

Table 12

Annual Depreciation Rates for Gross Fixed Capital in the USSR a/

Percent

Sector of the Economy	Replacement	Capital Repair	Total
Heavy industry b/	3.2	2.4	5.6
Machine building industry b/	3.3	2.2	5.5
Defense industry b/	2.9	2.6	5.5
Forest industries b/	3.0	3.0	6.0
Light industry b/	1.9	3.6	5.5
Food processing industry b/	3.2	2.8	6.0
Local industry			
Republic and oblast industry c/	2.3	3.3	5.6
Rayon industry c/	2.0	4.0	6.0
State procurement d/	3.2	2.8	6.0
Communal services e/	2.7	3.3	6.0
State farms f/	3.0	4.0	7.0
Trade			
Buildings and structures g/	2.0	3.0	5.0
Commercial equipment g/	0	12.0	12.0
Railroads h/	0.5	6.0	6.5
Construction industry i/	2.0	4.5	6.5

a. All rates are those established in 1938 unless otherwise indicated.
b. 44/
c. 45/
d. 46/
e. 47/
f. 48/
g. 49/
h. These rates were in effect in 1952. The date of establishment is uncertain. 50/
i. The rates were established in 1945. 51/

equal 80 percent of the investments in equipment in the years 1918-35, or 41 billion rubles. Because retirements for 1941-55 were 50.2 billion rubles,* retirements of structures for the period would equal 50.2 billion minus 41.0 billion, or 9.2 billion rubles. Retirements of structures were allocated to individual years in the same ratios as were retirements of equipment.

The above procedure assumes a constant service life for each class of fixed capital throughout 1941-55. It is likely, however, that war losses and wartime production requirements necessitated some deferment of retirements and a more rapid completion of investment projects. The data in Table 12** indicate that some adjustment actually occurred during the war and immediate postwar years. For example, estimates of fixed capital already derived indicate that the net additions to the stock during 1941-50 were 177.7 billion rubles. When net additions are computed from "normal" values of G, W, and R,**** the resulting figure is 145 billion rubles. For 1951-55, the net additions derived from the stock series are 502.4 billion rubles and 535.1 billion computed from the "normal" factors. Consequently, for estimating the fixed capital of the interim years, the following modifying assumptions were made:

a. No retirements were made during the war years.

b. After 1942 the period of completion of fixed capital was shortened so that G was equal to the investment of the previous year. From 1949 to 1954 the period of completion was lengthened. By 1954 this period was back to normal. Estimates of total fixed capital are shown in Table 11.****

3. Total Productive and Nonproductive Fixed Capital.

Official indexes of fixed capital which were published recently 52/ allow a breakdown between productive and nonproductive fixed capital. For the purpose of making the breakdown, the following symbols are employed:

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* See p. 35, above.
** P. 37, above.
*** P. 34, above.
**** P. 31, above.

S_y = total fixed capital at the end of year y.
P_y = productive fixed capital at the end of year y.
U_y = nonproductive fixed capital at the end of year y.

The official indexes, shifted to a 1950 base, follow:

	1940	1950	1951	1952	1953	1954	1955
S_y	81.3	100.0				139.0	152.8
P_y	74.6	100.0	110.0	121.0	133.0	147.0	163.4
U_y	90.1	100.0				126.1	135.1

By definition, $S_y = P_y + U_y$. The values of S_y, given in Table 11,* are 950.5 billion rubles for 1950 and 1,452.9 billion rubles for 1955.

The official indexes give relationships between 1950 and 1955. The following relationships have been established:

a. $P_{1950} + U_{1950} = 950.5$

b. $1.634\ P_{1950} + 1.351\ U_{1950} = 1{,}452.9$

These two equations are solved simultaneously as follows:

b. $1.634\ P_{1950} + 1.351\ U_{1950} = 1{,}452.9$

c.** $1.351\ P_{1950} + 1.351\ U_{1950} = 1{,}284.1$

Thus $0.283\ P_{1950} = 168.8$

$P_{1950} = 596.5$

Estimates of P_y for 1940 and 1951-55 are obtained by multiplication of P_{1950} by the index. For each year, U_y is obtained as a residual because U_y equals $S_y - P_y$. The resulting estimates are given in Table 2.***

* P. 31, above.
** Derived by multiplying a by 1.351.
*** P. 12, above.

4. Industrial Productive Fixed Capital.

Official Soviet data permit the construction of an index of industrial productive fixed capital with a postwar base. An index for selected years, 1940-55, is given in Table 13.

Table 13

Index of Gross Industrial Productive Fixed Capital
in the USSR
Selected Years, 1940-55

1940 = 100

Year	Index	Year	Index
1940	100 a/ b/	1952	196 b/
1946	100 c/	1954	243 a/
1950	158 a/	1955	271 a/
1951	177 c/ b/		

a. 53/
b. 54/
c. 55/

There is no base figure for industrial fixed capital. Such a figure may be derived, however, by equation (1).*

The value of the percentage increase in fixed capital (x) may be determined for several postwar periods from Table 13. Net additions (N) must be estimated. The period of the estimate is 1947-52, and the following assumptions apply:

a. Gross additions to industrial productive fixed capital (G) during 1947-52 are equal to investments in industrial productive fixed capital during 1946-51, inclusive.

b. Investments in industrial productive fixed capital in 1946-51 averaged 85 percent of total industrial investments during the same period.**

* See 1, p. 25, above.
** This assumption is based on data on Soviet industrial investments from source 56/.

c. Retirements (R) in 1947-55 equaled investments in industrial equipment in 1927-35 minus 20 percent for estimated war losses. It is assumed that retirements of industrial structures were negligible, because the structures being retired were erected when industry in Russia was a small part of the economy. The total retirements of industrial equipment for the period were distributed among the individual years in the same proportions that the total retirements of equipment in the economy were distributed.* Two additional figures are available from Soviet sources. Industrial investments were 46.4 billion current rubles in 1948 57/ and 320 billion 1950 rubles in 1946-51. 58/

With the known data and the foregoing assumptions, certain relationships, useful in the computation, must follow:

a. The sum of gross additions during 1947-52, in 1955 prices, is 221.4 billion rubles (see column (3) in Table 14**).

b. The total net additions for 1947-52, in 1955 prices, are equal to gross additions less retirements, or 213.8 billion rubles.

The data required to establish a base figure are included in Table 14. The following procedure was used:

a. From Table 14, net additions in 1947-52 were 213.8 billion rubles.

b. The industrial productive fixed capital in 1952 was 1.96 times that in 1946 (from Table 13***).

c. Substitution in equation (1)**** gives the following:

$$S_{1946} = \frac{213.8}{0.96}$$

$$= 222.7$$

d. Once the base was established the estimates of fixed capital in 1940 and 1950-55, excluding 1953, were derived by multiplication of the base by the index in Table 13. The estimates are shown in column (6) in Table 14.**

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* See 2, p. 26, above, and Table 11, p. 31, above.
** Table 14 follows on p. 42.
*** P. 40, above.
**** See 1, p. 25, above.

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Table 14

Data for Computation of Gross Industrial Productive Fixed Capital in the USSR 1940 and 1946-55

Billion 1 July 1955 Rubles

		Productive [a]				
	(1)	(2)	(3)	(4)	(5)	(6)
Year	Gross Investment [b]	Estimated Investment	Gross Additions	Retirements [c]	Net Additions	Total
1940						222.7
1946	27.2	24.7				222.7
1947	30.4	27.6	24.7		24.7	247.4
1948	39.6	35.9	27.6	0.2	27.4	274.8
1949	46.9	42.6	35.9	0.3	35.6	310.4
Total, 1946-49	144.1	130.8				
1950	55.6	44.8	42.6	1.1	41.5	351.9
Total 1947-50			130.8	1.6	129.2	
1951	62.5	45.8	44.8	2.5	42.3	394.2
Total 1946-51	260.5 [d]	221.4				
1952	71.0	56.4	45.8	3.5	42.3	436.5
Total 1947-52			221.4	7.6	213.8	
1953	71.4	56.8	56.4	4.0	52.4	488.9
1954	83.1	67.3	56.8	4.5	52.3	541.2
1955	86.5		67.3	5.0	62.3	603.5

a. Not including industrial nonproductive fixed capital.
b. Comprising industrial productive fixed capital and industrial nonproductive fixed capital. Estimates are derived from data in source 59/.
c. From data in sources 60/ and 61/.
d. Total industrial investment during 1946-51 was 320 billion 1950 rubles. The figure 260.5 billion 1 July 1955 rubles was obtained by multiplying the 320 billion rubles by the price index given in Table 10 (p. 29, above) to obtain the estimated investment in 1955 prices. The 1955 figure differs slightly from the total (262.2 billion 1 July 1955 rubles) obtained by summing the estimates for the individual years.

e. It was assumed (p. 40, above) that investment in industrial productive fixed capital averaged 85 percent of total investment in industrial fixed capital in 1946-51. Inasmuch as fixed capital at the end of the base year is now known for 1946 and 1950-52, net additions to industrial productive fixed capital are known for 1947-52. If retirements for 1947-50 are added to net additions, the result represents gross additions of 130.8 billion rubles for the period. Investment for 1946-49 is estimated at 144.1 billion rubles, 62/ as shown in column (1) in Table 14. The ratio of industrial productive investments to total gross industrial investments, then, is estimated to be 130.8 billion divided by 144.1 billion, or 0.908 billion rubles, for 1946-49. This ratio was applied to estimated investments in 1946-48 to obtain estimated gross additions in 1947-49.

f. Total gross additions in 1953 and 1954 were determined in the same way as those for 1947-50. These additions were allocated to the individual years 1953 and 1954 in the same ratio as the total investments for 1952 and 1953, respectively, were allocated to those years.

Soviet data are available 63/ giving percentage distributions for 1940, 1950, and 1954 of industrial productive fixed capital, by type (buildings, production equipment, and the like) and by branch of industry. Value estimates of these distributions were made by the multiplication of these percentages by the total estimated industrial productive fixed capital. The estimates are shown in Tables 5 and 6.*

5. Nonindustrial Productive Fixed Capital.

Soviet officials have published postwar indexes, shown in Table 4,** of productive fixed capital in the following two nonindustrial sectors of the economy: agriculture and transportation and communications. Estimates of fixed capital for these sectors are not made in this study, because it is believed that more research is required to improve the data which would be needed for such estimates.

Total productive fixed capital in the nonindustrial sectors has been obtained as a residual by the deduction of the industrial component from the estimate of total productive fixed capital in the economy for 1940 and 1950-55. The estimates are shown in Table 2.***

* Pp. 16 and 17, respectively, above.
** P. 14, above.
*** P. 12, above.

APPENDIX C

GAPS IN INTELLIGENCE

There are serious gaps in the information available for studying adequately fixed capital in the USSR. Both the basic statistical data and the information necessary to interpret these data are very weak. The innate conceptual difficulties in the study of fixed capital add to these weaknesses.

A major weakness in the data is the inconsistency between the two prewar fixed capital series. The differences prevent development of a complete fixed capital series from the beginning of the First Five Year Plan (1928-32) period to the present. Detailed information about the coverage of the prewar data on fixed capital would be required to reconcile the two series with each other and with the converted investment data.

The postwar estimates could be improved greatly if the following kinds of data were to become available:

1. A firm base figure for at least 1 postwar year.

2. Information about actual annual retirements, by type of fixed capital.

3. Data on the functional structure of fixed capital.

4. Price indexes for each type of fixed capital.

5. Details of methodologies underlying Soviet data.

No attempt has been made in this research aid to estimate fixed capital for each nonindustrial sector of the Soviet economy. The available information required for such estimates is considerably more tenuous than for the sectors covered here. Some valuable information on the makeup of agricultural fixed capital is presented in source 64/, which may be useful for future research in this sector.

The kinds of data listed above would be useful in studies of total fixed capital, of major sectors, or of important branches of industry.

APPENDIX D

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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