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ECONOMIC INTELLIGENCE REPORT

**THE ROLE OF THE TRACTOR INDUSTRY IN
THE USSR, 1940-54**



CIA/RR 37

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CENTRAL INTELLIGENCE AGENCY

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ECONOMIC INTELLIGENCE REPORT

THE ROLE OF THE TRACTOR INDUSTRY IN THE USSR
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(ORR Project 32.292)

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

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S-E-C-R-E-TFOREWORD

This report has five intelligence objectives: (1) to assess the Soviet tractor industry's past, present, and future capacity to produce tractors; (2) to assess the pattern of allocation of tractors between economic sectors in the USSR from 1946 through 1955; (3) to analyze the factors which have determined the demand for, and allocation of, tractors in the USSR during this period; (4) to relate changes in production and allocation to national economic policy; and (5) to determine what conclusions concerning the capabilities, vulnerabilities, and intentions of the USSR bearing upon the national interest of the US may be drawn from an analysis of the activity of the tractor industry and its consumers. Throughout the report the objective will be to explain the function of the industry and its product in the economy.

Soviet Marxists have a boundless faith that a change in the "productive forces" (for example, substitution of tractors for animal draft power) will bring about a change in the "productive relations" (for example, the structure and scale of the agricultural economy). In 1919, at the VIII Party Congress, Lenin stated:

"If we could give [to agriculture] 100,000 first class tractors tomorrow, supply them with fuel, supply them with drivers -- you well know that at this time this is a fantasy -- then the middle peasant would say: 'I am for Communism!' but in order to do this it would be necessary either to first defeat the international bourgeoisie, force them to give us the tractors, or to raise our own productive capacity to the point where we can supply ourselves with the tractors. Only in this manner can this question be truly decided."

The "bourgeois" world was neither overthrown, nor did it collapse. Therefore, in 1928 the USSR began to construct its own tractor industry. In 1930, on the occasion of the opening of the Stalingrad tractor plant, Stalin sent a greeting to the workers and managerial staff in which he wrote:

"The fifty thousand tractors which you must give to the country each year will be 50,000 [artillery] shells which will plow up the old bourgeois world and pave the way to the new, socialist order in the villages."

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Twenty-two years later in August 1952, when the XIX Congress of the Communist Party of the USSR convened, there were 585,000 tractors in the agricultural economy. The USSR had "socialism" in terms of the harsh Stalinist definition of "to each according to his work, from each according to his abilities." But it was a "socialism" of scarcity, not of abundance, and nowhere was the scarcity more intense than in the villages, all the tractors notwithstanding.

Within the context of the economy of the USSR, any judgment concerning the economic justification of the tractor industry ultimately depends upon the industry's success or failure in fulfilling its function in the economy -- that is, did it make the required contribution to the economy as a whole? For intelligence purposes, it is desirable to go one step beyond, describing the impact of the tractor upon the principal consuming sector, agriculture.

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(ORR Project 32.292)THE ROLE OF THE TRACTOR INDUSTRY IN THE USSR*
1940-54Summary

The low growth of Soviet agricultural output relative to the rate of growth of industrial output seriously limits increases in food consumption and exports and indirectly, through the resulting effects on labor productivity, hinders the growth of the entire economy of the USSR. As part of the solution of this problem, allocations of tractors to agriculture have been increased. The tractor industry of the USSR has thereby been committed to a relatively fixed production program extending through at least 1957. The scale of past resource allocations which resulted in a threefold expansion (compared with 1940) of the tractor industry during the Fourth and Fifth Five Year Plans reflected the belief of the leaders of the USSR that mechanization is not only the key to increased agricultural productivity but also the very foundation of the collectivization system. Failure to have supplied the demand for tractors in agriculture could have imperiled the stability of the agricultural sector of the economy.

The tractor industry of the USSR is capable of meeting the production goals which have been set for the period 1954-57. Although the industry failed to achieve the extraordinary goals of the Fourth Five Year Plan (1946-50) as a whole, the high rate of production reached by the end of the Plan (1950), and the further increases included in the Fifth Five Year Plan (1951-55), have enlarged the agricultural tractor park to the point where completion of the current program will virtually permit realization of the Soviet dream of full mechanization of agricultural field work. See Table 1.**

Output of agricultural field work per tractor unit in the MTS's*** and State Farms has consistently fallen short of the technological

* The estimates and conclusions contained in this report represent the best judgment of the responsible analyst as of 1 July 1954.

** Table 1 follows on p. 5.

*** The abbreviation for Mashino-Tractornaya Stantsii in Soviet usage is MTS. The abbreviation MTS's, as used in this report, refers to the English translation, Machine Tractor Stations.

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capabilities of the equipment because of disproportionately low investments in repair and maintenance facilities. Disproportionate investment in this sense means that in achieving full mechanization of field work in 1957-58 the tractor industry will be forced to supply the agricultural sector of the economy with more tractors than would otherwise be necessary if adequate ancillary investment had been made.

Although the Soviet tractor industry in 1955 will produce only 175,000 tractors, compared with current US production of nearly 750,000, the high proportion of heavy track-laying diesel tractors coupled with the MTS system of utilization, will enable the USSR to reach a saturation point in the application of mechanical draft power for field work in 1957-58 with an agricultural tractor park of less than 1 million tractors compared with a current US agricultural inventory of almost 5 million tractors. (The sown areas of the US and the USSR are roughly comparable.) The comparison illustrates the distortion which occurs when direct comparisons of annual production or size of tractor inventory are made between the USSR and US without taking into account the entirely different systems of utilization of equipment employed in the two countries.

Achievement of full mechanization will reduce the demand of the agricultural sector of the Soviet economy for heavy tractors to approximately the level required for replacement purposes. Consequently, beginning in 1956-57 the production of tractors in the USSR will be sufficient to enable the Russians to (1) resume the "great projects"; (2) export 25,000 to 30,000 heavy track-laying diesel tractors per year to carry out collectivization in the Eastern European Satellites; (3) export to any area deemed expedient, for example Communist China, or some non-Communist nation such as India; (4) initiate some other large-scale construction program such as building motor roads; or (5) carry out some combination of these alternatives.

Preoccupation with goals for producing tractors has resulted, within the tractor industry, in a chronic failure to produce sufficient spare parts. Shortages of high-quality material inputs and certain types of tempering and hardening equipment forced the industry to produce tractors until well into the Fifth Five Year Plan requiring relatively rapid and frequent replacement of many of the moving parts. In spite of the costs involved, and the relative loss in efficiency, the USSR still has several hundred thousand prewar tractors operating in agriculture. The continued manufacture of expensive, special-purpose machine tool equipment to make spare parts

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for the prewar tractor models indicates the Soviet intention to continue to use such tractors for a period far in excess of the length of time believed feasible in western nations, even though such retention will continue to aggravate the Soviet spare parts problem. Although the tractor industry devotes considerable resources to spare parts production, Communist Party decrees have repeatedly assigned major responsibilities for parts production to other industries such as the defense and aircraft industries.

Conversion to the production of military end items did not occur within the tractor industry in the postwar period. The Leningrad Kirov plant, which historically has not been a permanent part of the industry, ceased tractor production in 1951, but the reasons remain obscure. There is no direct evidence, however, indicating conversion of the tractor facilities to military end-item production. With the probable exception of the Chelyabinsk tractor plant, which was a major producer of heavy track-laying armored vehicles in World War II, the changing technology of modern tanks almost precludes the future possibility of conversion of the tractor industry to tank production, as such. The defense industries themselves mirror the synthesis which the USSR has achieved in reconciling internal needs with maintaining adequate forces in being, in that the defense industries have consistently acted as major suppliers of component and spare parts to the tractor industry.

Within the tractor industry, investment in highly specialized machine tools designed to produce single models over long periods of time (10 to 15 years) has reduced unit costs of production but at the same time has somewhat limited the industry's capabilities to convert to any other major end item. In an extreme emergency, however, the industry could be converted to the mass production of essential military hardware such as track-laying prime movers or component parts for tanks and other types of track-laying armored vehicles.

Historically, the tractor park has been the largest single consumer of intermediate distillates (kerosene and diesel fuel) in the USSR. During the period 1947-53 the tractor park as a whole (agriculture and other) consumed from 52 percent (1947) to 69 percent (1953) of the intermediate distillates produced by the USSR.* In 1955 the tractor park as a whole will consume approximately 75 percent of the estimated Soviet production of intermediate distillates. The agricultural part of the total tractor park has

* For data on Soviet tractor fuel consumption, see Table 2, following p. 6.

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consistently consumed from 50 to 55 percent of the Soviet production of intermediate distillates. The increasing substitution of mechanical for animal draft power in agriculture sharply reduces Soviet capabilities for diverting tractor fuel to other uses, including military. Any significant reduction of fuel supplies for agriculture would have serious effects upon the production of foodstuffs in the USSR.

The pattern of tractor allocation has consistently reflected shifting priorities in the economy. The reduced share of total tractor production allocated to agriculture from 1951-52 was occasioned by the demands created by massive investment in the construction projects and in the timber and petroleum industries. In 1953, with the re-emergence of agriculture as the dominant economic problem requiring immediate attention, the agricultural share of tractor production returned to its very high 1949-50 proportion. All available evidence indicates that the present leadership has every intention of increasing the production of tractors and the allocation of tractors to agriculture. The present Soviet policies stand out as a clear re-affirmation by Stalin's heirs of their unbounded faith that mechanization will increase agricultural productivity, the failures of the past notwithstanding.

In general, the growth and development of the tractor industry in the postwar period leads to the conclusion that the Soviet leadership has been primarily concerned with the solution of internal economic problems while maintaining and improving defensive capabilities. The growth and development of the tractor industry in the USSR does not reflect preoccupation with preparations for offensive warfare on a large scale.

I. Tractor Production and Soviet Agricultural Policy, 1928-45.

The economic policies initiated in the USSR at the start of the drive for the collectivization of agriculture in 1928 were designed: (a) to substitute large farms susceptible to centralized planning for the small, atomistic farms of the Russian peasantry; (b) to apply to those new farming units large inputs of capital equipment such as tractors, agricultural machinery, and combines, which would result

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Table 1

Estimated Production of Tractors in the USSR
1940, 1945-55

	Estimate										Plan	
	1940	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Physical Units (Thousands)	30	7	13	28	57	86	104	100	111	120	146	175
Index of Production (1950=100)	29	7	13	27	55	83	100	96	107	115	140	168
Increase over Previous Year (Percent)			86	115	103	51	21	-4	11	8	22	20
15-horsepower Units (Thousands)	73	13	28	66	137	199	245	236	256	267	298	333
Index of Production (1950=100)	30	5	11	27	56	81	100	96	104	109	122	136
Increase over Previous Year (Percent)			115	136	108	45	23	-4	8	4	12	12
Value (Million 1951 Rubles)	840	175	358	836	1,669	2,458	2,984	2,849	3,120	3,295	3,823	4,373
Index of Value (1950=100)	28	6	12	28	56	82	100	95	105	110	128	146
Increase over Previous Year (Percent)			105	134	100	47	21	-5	10	6	16	14

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Table 2

Estimated Consumption of Intermediate Distillates by Tractors in the USSR a/
1940, 1945-55

	Agricultural Tractor Park											
	<u>1940</u>	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954 Plan</u>	<u>1955 Plan</u>
Consumption (Million Metric Tons)	4.17	N.A.	N.A.	3.63	4.80	5.56	6.24	6.95	7.53	8.67	10.09	12.12
Consumption Index (1950=100)	67			58	77	89	100	111	121	139	162	194
Percentage Increase over Previous Year					32	16	12	11	8	15	16	20
Consumption as Percent of Estimated Total Soviet Intermediate Distillate Production	N.A.	N.A.	N.A.	46	54	55	54	53	52	52	54	58
	Total Tractor Park											
	<u>1940</u>	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954 Plan</u>	<u>1955 Plan</u>
Consumption (Million Metric Tons)	4.39	N.A.	N.A.	4.14	5.27	6.11	7.26	8.58	10.04	11.40	13.28	15.74
Consumption Index (1950=100)	60			57	73	84	100	118	138	157	183	217
Percentage Increase over Previous Year					27	16	19	18	17	14	16	18
Consumption as Percent of Estimated Total Soviet Intermediate Distillate Production	N.A.	N.A.	N.A.	52	59	60	62	66	69	69	71	75

a. Intermediate distillates include kerosene and diesel oil. The consumption figures above do not, therefore, represent total POL consumed. In the earlier years 1940-50, for example, ligroine consumption in the agricultural park amounted to from one-half to three-quarters of a million metric tons. By 1955 ligroine consumption will be negligible.

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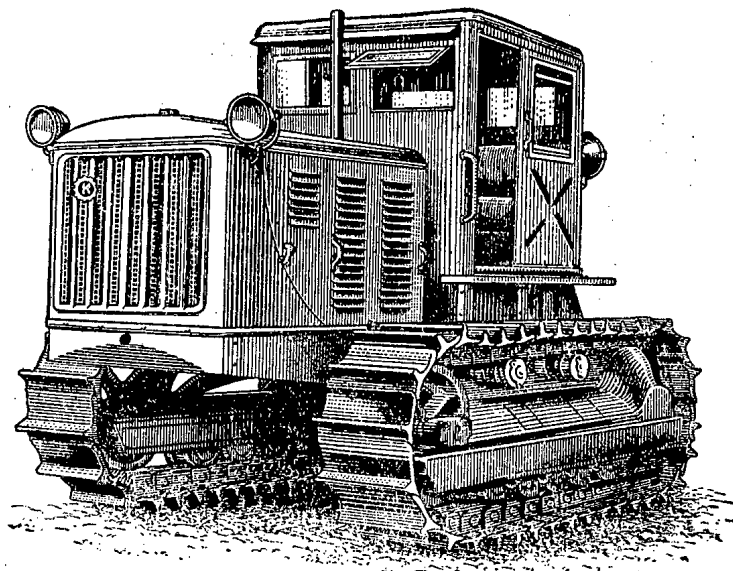


Figure 1. Heavy, General-Purpose Tractor, S-80

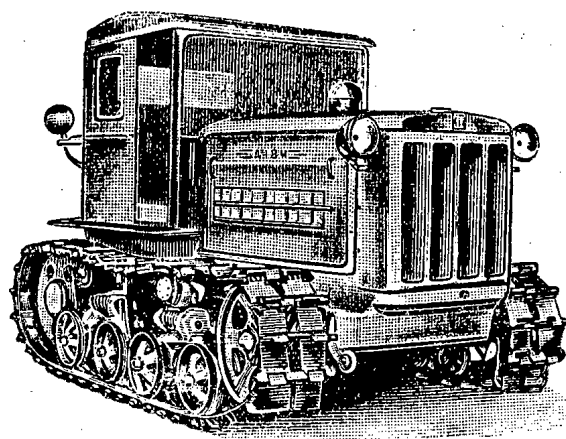


Figure 2. Medium, General-Purpose Tractor, DT-54

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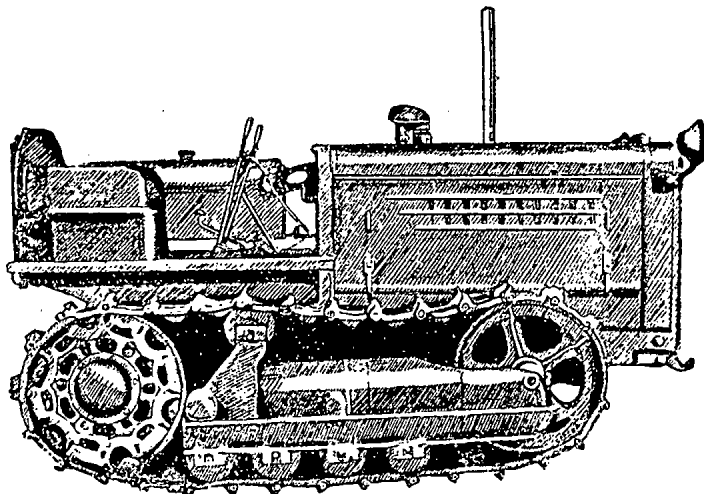


Figure 3. Small, General-Purpose Tractor, KD-35

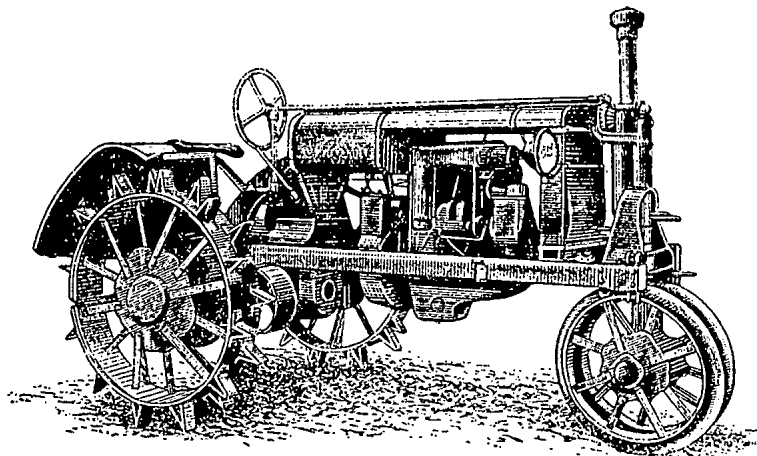


Figure 4. Row-Crop Tractor, Universal-1

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in higher yields, and which would release agricultural labor for industrialization; and (c) through the new centralized control, to assure the State a sufficiently large marketed share* of grain to feed the growing urban population. By placing the tractors and other agricultural machinery in MTS (Machine Tractor Stations) which were located apart from the farms themselves, the Government separated the capital equipment from the land. Thus, it increased its control over the peasantry, transforming the latter into part-time wage laborers, a kind of rudimentary rural proletariat, which was, however, still linked to the past by the retention of the private garden plot. The USSR could not carry out this sweeping economic and social revolution in the countryside, without large numbers of tractors.

A. Production.

The present Soviet tractor industry had its beginnings in the First Five Year Plan (1928-32) with the construction of tractor plants at Stalingrad and Khar'kov. The tractors produced at these plants were wheeled, kerosene-fueled, general-purpose tractors that delivered 15 drawbar horsepower.** They were Soviet copies of an International Harvester model of US design. A small wheeled row-crop tractor was also being produced in Leningrad at the "Krasny Putilovets" factory. To supplement domestic production, the USSR imported approximately 60,000 tractors in the period 1928-31. 1/** In 1932 when Soviet production reached 50,000 tractors per year, imports ceased. 2/

During the Second Five Year Plan (1933-37), the USSR built a large factory at Chelyabinsk to produce a Soviet copy of an imported Caterpillar model of US design. Production of this heavy track-laying tractor increased rapidly, reaching 29,000 in 1936. 3/ Construction of this tractor at Chelyabinsk marked the beginning of the significant Soviet trend toward the production of heavy track-laying tractors.

* The "marketed share" is that part of the grain crop which is available to feed the non-agricultural population. Most of it passes through state procurement and distribution channels.

** Drawbar horsepower may be defined as the horsepower equivalent of the pull exerted after the "drawbar" is affixed to the rear of the tractor. All statistical accounting measures of tractor power used in the USSR are in terms of drawbar horsepower. Unless otherwise specified, the term "horsepower" in this report will always mean drawbar.



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That trend was climaxed in 1937 (the end of the Second Five Year Plan) when the tractor plants at Stalingrad and Khar'kov converted from the production of wheel tractors to the production of a kerosene-fueled track-laying type tractor.*

There were several reasons for the conversion from wheeled to track-laying models: (1) track-laying traction delivers more horsepower at the drawbar than wheeled traction with equal engine horsepower; (2) the Russians held that, with the large fields which characterized the emerging collective farm system, heavy track-laying tractors would accomplish considerably more work, and in a considerably shorter time than was possible with wheeled tractors (chiefly by using large machinery aggregated, such as, combinations of plows, plows, and disk harrows); (3) the fuel inputs per hectare tilled would be reduced 30 percent or more; and (4) labor costs per unit of work would be reduced. On the other hand, these economies were not without their cost, for track-laying type tractors are considerably heavier and more complex than wheeled models of equivalent engine horsepower, and require larger labor, material, and capital inputs to manufacture. The Russians considered, however, that both the direct and indirect advantages (for example, less demand for fuel transportation and storage facilities) far outweighed the greater unit cost of the track-laying models.

Similar considerations prompted the Chelyabinsk tractor factory to change from a ligroine-fueled model** to a diesel-fueled model. A diesel tractor consumes approximately 25 percent less fuel (by weight) per unit of land tilled, and diesel oil is cheaper than other fuels.

By the beginning of the Third Five Year Plan (1938-42), the Russians were producing primarily track-laying tractors of both the kerosene and diesel categories. Only the "Krasny Putilovets" plant in Leningrad continued to produce wheeled tractors. Owing to the greater cost of producing track-laying tractors, problems resulting

* The new tractor was designated SKhTZ-NATI. The foregoing designation is derived as follows: Stalingrad Khar'kov Traktor Zavod (plant) - Nauchno Avto Traktorniy Institut (Scientific Automobile and Tractor Institute - the designer of the tractor).

** Ligroine is a light petroleum distillate used as a tractor fuel and as a solvent. In English-speaking countries this fraction is known as heavy naphtha or a heavy gasoline.

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from change-over to new models, and the impact of the armament program, tractor production dropped sharply to 50,000 in 1937 from a high of 116,000 in 1936.* Only 28,000 tractors were scheduled for production in 1941. 4/ Approximately half of the 1941 production was to be gas generator models** designed to operate on non-liquid fuels.

B. Allocation of Tractors to Agriculture.

Approximately 90 percent of the tractors produced in the USSR during the period 1932-40 were allocated to agriculture. 5/ During the period from 1929 to 1938, Soviet agriculture received 537,000 tractors totaling 10 million horsepower from domestic production whereas total production was approximately 601,000 tractors.*** The growth of the agricultural tractor park is shown in Table 3.**** In 1936 some 328,500 tractors (comprising 392,400 15-horsepower units) were in the MTS's servicing the approximately 240,000 collective farms, with the remainder on the 5,000 State Farms. 6/ By 1940 there were 435,000 tractors (totaling 557,300 15-horsepower units) in the 7,069 MTS's, and 88,000 tractors (totaling 126,000 15-horsepower units) on the State Farms.***** As a result of the conversion to production of track-laying type tractors, the composition of the agricultural tractor park***** also changed radically over the years. See Table 4.***** Together with its large number of tractors, Soviet agriculture in 1940 possessed 182,000 combines and 228,000 trucks. 7/ In 1940, however, horses and working cattle still accounted for almost half the total draft power available to the collective farms. See Table 5.*****

* See Appendix A, Table 22.

** A gas generator tractor is one which operates on producer gas derived from the combustion of solid fuels, for example, wood, peat, coke, and others. The fuel is burned in a large combustion chamber mounted on the tractor.

*** See Appendix A, Table 22.

**** Table 3 follows on p. 10.

***** See Appendix A, Table 23.

***** The term "park" is used in the USSR to designate any inventory of capital equipment. It will be used throughout this report in that sense.

***** Table 4 follows on p. 10.

***** Table 5 follows on p. 11.

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Table 3

Agricultural Tractor Park of the USSR a/
Selected Years

	Thousand Units			
	<u>1932</u>	<u>1936</u>	<u>1938</u>	<u>1940</u>
15-horsepower b/	148.3	513.4	600.3	683.0
Physical	148.5	422.7	483.5	523.0

a. See Appendix A, Table 23.

b. The 15-horsepower unit is a statistical measure used in the USSR to convert tractors of various types and horsepower into comparable units for planning and accounting purposes. It is calculated by dividing the "rated" drawbar horsepower of the tractor by 15. Thus, the DT-54 tractor with a drawbar horsepower of 36 equals 2.4 15-horsepower units and the Universal-1 with a drawbar horsepower of 10 equals 0.67 15-horsepower units.

All conversions from physical units to 15-horsepower units appearing in this report have been done in accordance with the methodology outlined in Shol'ts.

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Table 4

Composition of the Agricultural Tractor Park of the USSR 9/
Selected Years

	Percent of Total Horsepower		
	<u>1932</u>	<u>1938</u>	<u>1940</u>
Wheeled	91.5	62.2	56.0
Track-laying	8.5	37.8	44.0
Total	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

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Table 5

Structure of Draft Power on Soviet Collective Farms 10/
Selected Years

	Percent			
	<u>1928</u>	<u>1932</u>	<u>1937</u>	<u>1940</u>
Working Livestock <u>a/</u>	98.6	85.7	52.2	48.0
Tractors	1.4	14.3	47.8	52.0
Total	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

a. Translated into equivalents of mechanical power.

C. Utilization.

By 1940 the USSR had, in the space of a decade, built up a large agricultural tractor park. From the point of view of production, the USSR had achieved considerable success, but from the point of view of utilizing the equipment produced, the achievements were not nearly so successful.

In the USSR all field work is measured by an accounting unit, the so-called "soft plowing unit," into which all work (for example, plowing, harrowing, and harvesting) is translated using a standard conversion table promulgated by the central statistical authority. Similarly, tractor utilization is measured by the average number of "soft plowing" units performed per 15-horsepower tractor unit, and fuel consumption is accounted for and planned as an average consumption (in kilograms) per unit of tractor work for each type of tractor. Data on utilization are available for 1937 and 1940.

Although total field work increased with the growth of the park, the decline in tractor productivity from 1937 (which was the highest prewar year) to 1940 was pronounced. See Table 6.*

The investment program in tractors and related agricultural machinery had significant indirect investment effects, such as increased need for buildings and machine tools for repair facilities,

* Table 6 follows on p. 12.

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Table 6

Tractor Work on the MTS's of the USSR a/ 11/
1937, 1940

	Soft Plowing Units	
	<u>1937</u>	<u>1940</u>
Total Field Work	200,114,000	225,000,000
Work per 15-horsepower Tractor Unit	470	411

a. The figures in this and subsequent tables are from official Soviet sources. Because the average work per tractor unit includes a small amount of non-field work (approximately 2 percent in 1940) the MTS tractor park cannot be derived simply by dividing total field work by the official average of work per 15-horsepower tractor unit.

increased petroleum refining capacity, and increased transport and storage facilities. No detailed estimate of the agricultural demand for repair facilities, transport, and other needs, is available, but it is possible to estimate the demand of the agricultural tractor park for refined petroleum products for the year 1940 (and for later years). In 1940 the agricultural tractor park consumed approximately 5 million tons of kerosene, ligroine, diesel oil, gasoline, and lubricants. In the same year the agricultural sector of the economy as a whole consumed 66 percent of all kerosene, 82 percent of all ligroine, and 70 percent of all diesel oil produced in the USSR. 12/

The rapid increase in the agricultural tractor park enabled the USSR to greatly expand the sown area during the period 1928-40 in comparison with the pre-collectivization period. See Table 7.*

Most important of all, the application of modern capital equipment to the larger farm units did not have the expected, and desired, effect upon productivity per unit of land. In general, the supply of bread grains barely kept pace with the growth in the population so that the amount available per capita was very little above the pre-collectivization level. In 1940, after some 12 years of

* Table 7 follows on p. 13.

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Table 7

Sown Area of all Crops in the USSR 13/
Selected Years

	Millions of Hectares				
	<u>1913</u>	<u>1928</u>	<u>1934</u>	<u>1938</u>	<u>1940</u>
Grain	94.4	92.2	104.7	102.4	111.2
Technical Crops	4.5	8.6	10.7	11.0	11.8
Potatoes and Vegetables	3.8	N.A.	8.8	9.4	10.1
Fodder	2.1	N.A.	7.1	14.1	18.1
Total Sown Area	<u>105.0</u>	<u>113.0</u>	<u>131.5</u>	<u>136.9</u>	<u>151.1</u>

"socialist construction" in the villages, the livestock herds had not, on the whole, regained the 1928 level, and consequently the supply of meat per capita had declined somewhat. The marketed share of the grain harvest, however, had increased from 10.3 million tons in 1927-28 to 40.0 million tons in 1940. Consequently, for the peasantry the fruits of mechanization and collectivization consisted of a stagnated standard of living, coupled with greatly increased State control over economic activities in the countryside. In two respects, however, mechanization had been an outstanding success: (1) the State was able to extract sufficient quantities of grain from the villages to feed the urban population and to build up reserves for wartime use; and (2) labor had been released for industrialization.

D. Effect of World War II.

On the eve of World War II the USSR possessed a tractor industry which had produced approximately 640,000 tractors in the 12 years since ground was broken for the first major factory. Production in 1940 was approximately 30,000 track-laying tractors despite the fact that most of the industry's energies were devoted to the armament effort.*

* See Appendix A, Table 22.

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World War II wreaked havoc with the tractor industry and with the agricultural tractor park. Both the Stalingrad and Khar'kov tractor plants were destroyed, and the Chelyabinsk tractor plant was converted to the production of heavy armored track-laying vehicles. Some of the machinery from the Stalingrad and Khar'kov plants was evacuated to Rubtsovsk in the southern Kuznetsk Basin for what became known as the Altai Tractor Factory. This plant produced 3,000 of the SKhTZ-NATI 32-horsepower track-laying tractors by October 1944. 14/ The tractors in the countryside, meanwhile, were being decimated by requisitions for the Red Army, destruction and seizure by the Germans, lack of spare parts, and by the shortage of skilled drivers and mechanics. In the unoccupied regions, the draft power available for field work declined 32 percent while the truck park was reduced to 11 percent of 1940. 15/ The value of the production of spare parts declined roughly from 594 rubles per tractor in 1940 to a low of 142 rubles per tractor in 1942 and then rose during 1943 to 239 rubles per tractor. 16/

The output of soft plowing units per 15-horsepower unit declined from 411 in 1940 to 182 in 1943, and the aggregate for the unoccupied areas was only about 100 million soft plowing units 17/ compared to 225 million in 1940.* In 1943, each (15-horsepower unit) was supplied with only 4.2 tons of fuel compared to more than 8.1 tons in 1940. 18/ In the later years of the war some 25,000 tractors were transferred from the unoccupied areas to the newly recovered areas. 19/ Finally, according to Voznesenski 20/ the Germans destroyed or looted 137,000 tractors. Direct battle losses where the track-laying models were used extensively as prime movers were apparently not included. At the end of the war the bulk of the agricultural tractor park consisted of the 15-horsepower, wheeled, kerosene-fueled SKhTZ tractors, most of which had been produced prior to 1938. At the end of 1945 the entire Soviet agricultural tractor park was estimated at 469,000 15-horsepower units, as compared with a high of 683,000 in 1940.**

II. Tractor Production in the Fourth and Fifth Five Year Plans.

A. Postwar Situation.

The destruction and dislocation wrought by the war in the tractor industry and in its consumers, the MTS's, presented the USSR

* See Appendix A, Table 33.

** See Appendix A, Table 30.

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with very serious problems in the Fourth Five Year Plan (1946-50). In the industry, the Chelyabinsk tractor plant not only had to be reconverted to tractor production, but also had to participate in the postwar plans for production of track-laying armoured vehicles. The Stalingrad and Khar'kov tractor plants virtually had to be rebuilt from the ground up. Many of the MTS repair shops and fuel storage facilities had also been destroyed.

By 1946 the decline in the agricultural tractor park, together with the general dislocation occasioned by the war, had seriously affected not only agricultural production but also the entire collective farm structure. Official Soviet statistics indicate that in 1945 the grain harvest was about 55 percent of 1940, sugar beets approximately 40 percent, and cotton approximately 45 percent of 1940. 21/ Livestock had declined sharply 22/ and the areas sown to grain and technical crops were considerably smaller. 23/ The private plots of the peasantry had encroached upon the land of the collective farms, and in many cases land ostensibly cultivated by the collective was in fact being cultivated for the benefit of individual peasant households. Despite war losses, horses (in 1945) still accounted for more than 40 percent of total draft power available for field work, and a substantial part of the herd apparently was in the hands of individual households rather than the collective farms. 24/

In the eyes of the Soviet leadership the decline in agricultural productivity and peasant encroachment upon collective farm land constituted serious threats to the economic and political stability of the regime. Elimination of these threats required, among other things, the expeditious reconstruction of the agricultural tractor park. This determined the objectives and the function of the Soviet tractor industry in the Fourth Five Year Plan.

B. Plans and Objectives, 1946-50.

The plan for the production of tractors embodied in the Fourth Five Year Plan was very ambitiously aimed to provide the tractors necessary to rebuild the agricultural tractor park, to replace out-worn prewar tractors, to bring agricultural field work closer to the ultimate goal of complete mechanization, and, at the same time, to provide tractors for the other sectors of the economy. Despite almost complete destruction and dislocation in the industry, production for the entire Plan was to be at least 348,000 tractors, comprising

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814,000 15-horsepower units.* Total production in the 5 years immediately preceding the war had been approximately 278,000 tractors equaling 501,000 15-horsepower units. The 1950 planned output was to be 112,000 tractors, 25/ or almost four times the 1940 output. Approximately 80,000 tractors were to be the heavy track-laying, general-purpose models,** or more than two and one-half times the 1940 output of track-laying tractors. In addition to the reconversion and reconstruction of the large prewar plants at Chelyabinsk, Khar'kov, and Stalingrad, three new plants were to be constructed and the plant at Altai was to be expanded and completed.

Reconstruction had begun at the Stalingrad plant some time in 1944, and at the Khar'kov plant immediately after the German evacuation. These plants were to resume production of the prewar general-purpose SKhTZ-NATI. In order to take advantage of the greater efficiency and lower cost of diesel engines, the Stalingrad and Khar'kov plants were, by 1949, to convert to the DT-54, a diesel model based upon the SKhTZ-NATI design. Eighty percent of the parts on the new DT-54 were interchangeable with the SKhTZ-NATI. The Chelyabinsk plant experienced difficulties in re converting to tractor production and was not able to get into full production until the last few months of 1946. Instead of the model produced in 1940, it began production of a new larger track-laying diesel, copied from the American "Caterpillar" D-7.***

By 1950 both the Khar'kov and Stalingrad plants were to be producing the DT-54 model at the rate of 25,000 per year, and the Chelyabinsk plant was to be producing the S-80 model at the rate of 18,000 per year. 26/

Paralleling the Khar'kov and Stalingrad plants, the Sltai plant was to convert from the SKhTZ-NATI to the DT-54 at the end of the Five Year Plan period, producing at the rate of approximately 15,000 per year. 27/

* See Appendix A.

** Postwar Soviet tractor production can be divided conveniently into two categories: "general-purpose" and "row-crop." General-purpose are heavy, all-purpose, track-laying models, and row-crop are small (usually wheel) tractors designed for cultivation between rows.

*** In contrast to the American prototype which delivers 80 horsepower, however, the USSR copy is governed to deliver only 65 horsepower in order to conserve fuel.

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As necessary as the large tractors were to the fulfillment of the agricultural goals of the Fourth Five Year Plan, track-laying tractors of 36 horsepower and above were, however, too large to be used with maximum efficiency on the smaller fields that characterized the collective farms of the podsol' regions.* For podsol' regions the Russians designed a smaller, track-laying, diesel tractor of 24 horsepower, the KD-35 ("Kirovets" Diesel - 35). The Fourth Five Year Plan provided for the construction of 2 new plants to build this tractor, 1 at Lipetsk and 1 at Minsk. Both locations are in or near the podsol' regions. Planned production at these plants in 1950 was approximately 5,000 for Minsk and 5,000 for Lipetsk. 28/

All of the track-laying models were designed for grain cultivation and deep plowing (8 - 12 inches). Apparently only two types of row-crop tractors were scheduled for production during the Fourth Five Year Plan. The Vladimir tractor plant was to produce the 10-horsepower kerosene-fueled U-1, 2, and 4 models, and the Khar'kov Tractor Assembly Plant was to produce the 7-horsepower, gasoline-fueled KhTZ-7. Actual production of the KhTZ-7 did not begin until 1950. Most of the parts for this tractor were originally made in the main Khar'kov Tractor Factory but it was assembled at a separate assembly plant. In 1950 the Vladimir plant was scheduled to produce 18,000 tractors, 29/ and, while planned production of the KhTZ-7 for 1950 is not available, it is probable that not more than 2,500 were scheduled.**

The Fourth Five Year Plan also provided for a gas generator tractor for the timber industry. This was the KT-12, a track-laying 30-horsepower tractor operating on generator gas produced from wood chips, thus being admirably suited to the timber industry, which experiences considerable difficulty with supplies of petroleum products because logging enterprises are usually far from the centers of petroleum production and railheads. Approximately 4,500 KT-12 tractors were to be produced during the entire period, 30/ but the Plan was subsequently revised upward. 31/

In general, in the Fourth Five Year Plan the Russians continued to implement their theory that application to the land of larger capital

* In general the coniferous forested areas north of the chernozem, or "black earth," regions. The podsol' regions are characterized by white or gray ashlike soil.

** Based upon the scale of production actually achieved in 1950.

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units would lower operating costs and increase productivity per unit of land. To increase yields the Russians in the postwar period planned two basic innovations in cultivation practice: (1) the increase of average depth of plowing from approximately 6 or 7 inches to at least 8 to 10 inches, and in some cases to 12 inches; and, (2) the introduction of crop rotation with perennial grasses which would not only increase fertility but would also provide the fodder base necessary for the livestock plans. For deep plowing of heavy sod, track-laying diesel tractors are, of course, much more efficient than wheeled models. However, since the heavy tractors are not suitable for the harvesting part of fodder cultivation, the Russians apparently relied upon the collective farm herds of horses and working cattle for most aspects of fodder cultivation.

C. Plan Fulfillment, 1946-50.

The production goal of 348,000 tractors, amounting to approximately 814,000 15-horsepower units in the Fourth Five Year Plan, proved to be beyond Soviet capabilities. For several reasons the plan was only about 83 percent fulfilled. The reconstruction of the Stalingrad and Khar'kov plants lagged and the Chelyabinsk plant experienced great difficulties in reconversion. Construction at the new plants at Minsk and Lipetsk was slow and wasteful. It is quite apparent that the estimates of construction costs and indirect investment effects in the entire Fourth Five Year Plan were too low, and not precise enough. The tractor industry part of the plan was no exception. Requirements for material input, fuel, power, metal, and other requirements had also been underestimated; apparently machine tools were the only items available to the industry in sufficient quantity and close to the original time schedules. 32/ It is probable, however, that the tractor industry was given priority over the MIS's which did not receive the planned quantities of machine tools for the repair installations.

1. Tractor Allocations.

Lagging production in the tractor industry and in the agricultural sector of the economy were the principal items of business placed before the February 1947 Plenum of the Central Committee of the Communist Party of the USSR. In his report to the Plenum, Andreev, then a member of the Politbureau, noted that in 1946 the tractor industry (then part of the Ministry of Agricultural Machine Building) had failed to deliver nearly 3,500 tractors to agriculture. 33/ On the basis of Andreev's report, the Central

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Committee issued a decree specifying that in 1947 agriculture was to receive some 37,900 tractors, 34,000 of which were to be track-laying models. ^{34/} Apparently the allocations also represented the total planned production for the tractor industry. According to the same decree the industry was to produce 75,500 tractors in 1948, 67,000 of which were to be allocated to agriculture. The plans outlined in the February decree were not fulfilled. A summary of planned and actual production follows in Table 8. The actual production of tractors during 1946-50 expressed in physical units and in 15-horsepower units is presented in Appendix A.

Table 8

Tractor Production in the USSR
1946-50

	Thousand Units		
	<u>Plan a/ (1946-50)</u>	<u>Actual (1946-50)</u>	<u>Fulfillment (Percent)</u>
Physical	348	288	83.0
15-horsepower	814	676	82.0
	<u>Plan (1950)</u>	<u>Actual (1950)</u>	
Physical	112	104	92.8
15-horsepower	265	245	92.5

a. The total plan for 1946-50 has been interpolated from the known yearly plans for 1946, 1947, 1948 (February 1947 Plenum), and 1950 plan as given in the Fourth Five Year Plan. For further details see Appendix A.

By the end of 1948 the Soviet leadership realized that because of lagging construction, bad planning, shortage of material inputs, and other reasons, the tractor production goals of the Fourth Five Year Plan could not be attained. Consequently, the plants at Chelyabinsk, Stalingrad, and Khar'kov which produced the heavy track-laying tractors were given priority over the new plants being constructed for the smaller tractors. There was good reason for this

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decision because the heavy tractors were primarily designed for grain cultivation. An adequate supply of bread grains is necessary for survival. A very inadequate supply of vegetables, meat, and dairy products is inconvenient, and undesirable, but can be sacrificed for a time.

As a consequence of the continued priorities for the production of the heavy tractors, the new Minsk and Lipetsk plants, designed to produce the 24-horsepower diesel, track-laying KD-35 were not completed. The original plan had provided for the installation in these plants of modern automatic transfer lines for machining the engine blocks at a mass production rate of 35,000 to 37,000 per year. ^{35/} These transfer lines were produced and installed very close to the original schedule, but were not fully used because of the failure to complete the plants. In 1950 the Minsk plant produced only about 500 KD-35 tractors, and the Lipetsk plant only 4,500, as compared to a plan of at least 5,000 for each. Development of a 22-horsepower, wheeled model, designated "Belarus," with the KD-35 diesel engine, was also delayed. The impact of the failure to produce the KD-35 according to plan was somewhat eased by the collective farm consolidation program which the regime introduced in 1950. This administrative consolidation involved the reduction in the number of collective farms (from 250,000 in 1950 to 97,000 in 1952) and the merger of their fields as well, which meant that the larger tractors could now be utilized more efficiently. Thereafter, the future of the KD-35 model lay primarily in wheeled versions and in modifications of the tracked model which make it (KDP-35) suitable for row-crop tractor cultivation. The only major producer of wheeled row-crop tractors in 1950, the Vladimir Tractor Plant, also lagged, producing only 13,500 tractors in 1950 as compared to a planned goal of about 18,000.

2. Spare Parts.

Substantial quantities of ferrous and non-ferrous metals are consumed in the production of tractors and the spare parts necessary to maintain the tractor inventory in operating condition in the USSR. The inputs listed in Table 9* are minimum inputs for the current range of production, about 60,000 per year for the standard general-purpose agricultural tractor, the DT-54.

* Table 9 follows on p. 21.

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Table 9

Material Inputs for the DT-54 Tractor

<u>Material</u>	<u>Finished Weight a/ (Kilograms)</u>	<u>Coefficient b/ of Utilization</u>	<u>Minimum Estimate of Input Requirement for One Year's Production of 60,000 Tractors c/ (Metric Tons)</u>
Cast Steel	1,329	.85	93,780
Rolled Steel	1,549	.65	142,980
Cast Iron	2,059	.85	145,380
Wire	12		720
Bearings	92		5,520
Copper	1.5	N.A.	90 <u>d/</u>
Bronze	8.5	N.A.	510 <u>d/</u>
Brass	13.7	N.A.	822 <u>d/</u>
Aluminum Alloy	9.9	N.A.	594 <u>d/</u>

a. The finished weight of the various materials is subject to a negligible margin of error because the weights have been calculated from a Russian parts handbook which lists the material of which each part in the tractor is made, and weight of the finished part.

b. In the USSR the "coefficient of utilization" is defined as the fraction of weight of the raw inputs which is represented by the weight of the finished article. For example, a machined shaft which weighs 6.5 kilograms when finished, and has a "coefficient of utilization" of 65 percent, has been machined from a piece of bar stock weighing 10 kilograms. The average coefficient of utilization for ferrous metals in the DT-54 tractor is given as 65 percent by Russian writers. Hence allowing a coefficient of 85 percent for cast steel and cast iron is most generous, and the result probably has a margin of error of about 15 percent. Since the general problem of resource allocations to the tractor industry, capital and labor as well as material inputs, is the subject of a current ORR project, this estimate of material inputs has been introduced primarily to illustrate the general order of magnitude.

c. Estimated margin of error for figures in this column, +0 percent, -15 percent.

d. Minimum estimates are calculated at a coefficient of utilization of 1.0.

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An important part of the industry's job is the production of spare parts. However, plant managers do not always see it this way, and apparently have a strong proclivity toward neglecting the production of spare parts and concentrating on the production of tractors. Complaints of this practice are almost ceaseless in the press. Indeed, the February 1947 Plenum found it necessary to decree that, upon leaving the factories, tractors and combines be accompanied by a complete set of parts and instruments necessary to put them in running condition. Furthermore, the decree specified that the plants must produce: (a) one "complekt" (homogeneous spare parts kit) of parts for "current repair" (rings, bearings, gaskets, and so forth) for each 10 tractors produced; and (b) one "complekt" of parts for "capital repair" (pistons, crankshafts, major bearings, and other major parts) for each 50 tractors produced. ^{36/} Nineteen different ministries were engaged in the production of spare parts for tractors in 1947. Whereas available information does not permit an estimate of the aggregate value of yearly Soviet spare parts production, some idea of the order of magnitude can be obtained. For example, 100,000 S-80 tractors (65-horsepower, track-laying diesels) produced at the Chelyabinsk plant in the postwar period would require in a 10-year period the following number of major spare parts ^{37/}: piston rings, 54,600,000; bearings, 15,041,000; lower rollers, 5,460,000; pistons, 5,250,000; transmission gears, 4,580,000; cylinder sleeves, 2,730,000; track links, 34,270,000.

It is necessary to replace approximately half of the track links on each S-80 tractor each year. Thus, when 100,000 S-80 tractors in the USSR have each reached an age of 10 years, they will have consumed in the aggregate more than 500,000 metric tons of cast steel for the replacement of track links alone. The total cast steel required for this single replacement item is equal to the total cast steel input needed for 6 years' production of new DT-54 tractors at the current production level of 60,000 tractors per year.*

The Soviet spare parts problem has been complicated by the shortage of quality metal inputs and of tempering and hardening equipment. Until 1951, when higher quality inputs became available, the factory-guaranteed period before capital repairs for the S-80 tractor was only 2,000 hours. By the end of 1951, the guarantee was 4,000 hours, 6,000 by the end of 1952, and 10,000 by the end of 1953. ^{38/}

* This has been calculated at a coefficient of utilization of 85 percent for finished part over raw material input. See DT-54 input table, p. 21, above.

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Rapid expansion of the agricultural tractor park and retention of pre-1938 tractors continued to aggravate the problem of producing sufficient spare parts. For example, in 1953 the Russians installed two automatic lines for the production of piston pins. Each line was 100 meters long and consisted of 15 automatic, special-purpose machine tools, capable of producing 450,000 piston pins per year for the SKhTZ and the SKhTZ-NATI tractors. ^{39/} This quantity of piston pins would provide new pins for 100,000 tractors. It must be remembered that the SKhTZ tractor went out of production in 1937. The SKhTZ-NATI tractor was replaced by the DT-54 tractor at the Khar'kov and Stalingrad plants in 1949 and finally ceased production entirely with the conversion to the DT-54 tractor at the Altai plant in the latter part of 1951.

The production of spare parts remained behind schedule although the expansion of the agricultural tractor park and the retention, rather than retirement, of prewar tractors rapidly increased demand. The persistence, the seriousness, and the institutional nature of spare parts shortages are summed up by Khrushchev's statement in his report to the February 1954 Plenum of the Party ^{40/}:

"It is quite reasonable to ask the Minister of Machine Building, Comrade Akopov, why the production of spare parts has become a kind of insoluble problem, why the workers of this Ministry show an irresponsible attitude toward this important task and aloofness from the needs of MTS and State Farms. It is essential to raise the responsibility of workers of industry and distribution organs for the implementation of the production plan and the delivery of spare parts, and to sternly demand an accounting from executives who are wrecking the plan and are not assuring the dispatch of spare parts."

In the last 2 years of the Fourth Five Year Plan production rose rapidly, reaching approximately 92 percent of the original production goal for 1950 of 112,000 tractors. Aggregate production for the period (1946-50) was 288,000 tractors, comprising 676,000 15-horsepower units. The principal weaknesses in the industry at the beginning of the Fifth Five Year Plan were the failure to complete the Minsk and Lipetsk plants, and the chronic shortages of spare parts which the industry apparently could not satisfy.

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S-E-C-R-E-TIII. Production Goals of the Fifth Five Year Plan (1951-55).

When the Fifth Five Year Plan was finally announced in August 1952, the goals (later to be revised upward by the September-October 1953 decrees) for the tractor industry were quite modest, in comparison with those of the Fourth Five Year Plan. The program for the production of tractors set forth in the Fifth Five Year Plan was a simple projection of the trend at the end of the Fourth Five Year Plan. In 1955 the planned production of 292,000 15-horsepower units was to be only 19 percent above the 1950 production of 245,000 units. In contrast to the Fourth Five Year Plan, the construction of additional tractor plants was not to be necessary. The planned increase in production could easily be accounted for by completion of existing plants still unfinished or not yet up to capacity in 1950. The new models to be introduced were designed for row-crop and fodder cultivation and were to be adaptations of already-existing models. Mass production* of the "Belarus," was to begin by the middle of the Plan, and the experimental KDP-35 was to be introduced. In 1950 the small assembly plant in Khar'kov producing the KhTZ-7 received components from 150 widespread subcontractors, but by mid-1952 these had been reduced to 5 plants in the Khar'kov area, the principal plant being the heavy tractor plant. ^{42/} The original Fifth Five Year Plan provided for production of 16,000 tractors in 1955.** In 1955 the Soviet tractor industry as a whole was to produce approximately 47,000 15-horsepower units more than in 1950 with the row-crop tractors accounting for more than 90 percent of the increase.***

Production dropped slightly in 1951. This drop, however, was not occasioned by any general cutback in production. Rather, it was the result of losses incurred in a shift of production of the special-purpose KT-12 timber-hauling tractor from Leningrad to the Minsk tractor plant, and a changeover at the Altai plant from the ASKhTZ-NATI kerosene tractor to the DT-54 diesel tractor. The fact that the chassis and running gear of the KT-12 timber-hauling tractor is a direct copy of a German World War II prime mover suggests the possibility that the Kirov plant in Leningrad may have converted to the production of a tractor modified to meet the specifications of a military prime mover. While there is no confirmation of this hypothesis, it is offered because of the estimated paucity of Soviet

* In the USSR, "mass production" of tractors is defined as a rate of output of at least 5,000 units per year. ^{41/}

** See Appendix A.

*** See Appendix A.

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military prime mover production in 1946-50. With the possible exception of the Kirov plant in Leningrad, therefore, there was no conversion to what might have been military production in the tractor industry at any time in the postwar period.*

In 1950 the Minsk tractor plant was not completed and was producing at only a fraction of the original Plan despite the fact that a number of highly specialized and expensive machine tools had been installed -- for example, the largest automatic transfer line in the USSR. The decision to make this plant responsible for KT-12 production, at the very time it had been prepared for KD-35 production, further limited Soviet capabilities to produce the KD-35 and the row-crop models based on it.

The main body of the industry, the Khar'kov, Stalingrad, and Chelyabinsk plants, continued in 1951 to operate at the same levels as in 1950. The Vladimir plant began to approach its planned capacity of 18,000 row-crop tractors, and production of the small KhtZ-7 tractor at Khar'kov increased.

Over-all production in 1952 increased to approximately 111,000 tractors comprising 256,000 15-horsepower units.** Whereas 1952 production represented a sizable increase over 1951, it represented only a 6.5 percent increase in physical units over 1950 and a still smaller increase of only 4.4 percent over 1950 in 15-horsepower units. One of the few noteworthy events was the designing and testing of a very heavy track-laying diesel, the S-140, a 6-cylinder version of the 65-horsepower S-80. This new tractor was developed at the Chelyabinsk plant but production was limited to experimental models. The uniqueness of this tractor lies in the fact that it is the only known Soviet tractor adapted primarily for a nonagricultural use, in this case, construction. A gas generator version of the DT-54 diesel (designed to operate on various solid fuels) was developed, and production initiated at the Stalingrad and Khar'kov plants.

When Stalin's heirs laid down the new policy in August-September 1953, the USSR possessed a tractor industry producing 111,000 tractors comprising 256,000 15-horsepower units per year. Of these,

* It should be noted again that the Kirov Plant in Leningrad historically has never been a permanent member of the tractor industry as have the other plants. Thus its phasing out of tractor production cannot be considered too unusual.

** See Appendix A.

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85,000 tractors comprising 233,000 15-horsepower units were track-laying diesels. Moreover, the industry required relatively little additional investment in order to meet its goals in the Fifth Five Year Plan. Production of wheeled tractors, so necessary to row-crop cultivation, still lagged, however, and was below the rate of increase necessary to meet the Plan.

IV. Tractor Allocations and Economic Policy, 1946-53.

The agricultural tractor park of the USSR consisted of 360,000 physical units equaling 469,000 15-horsepower units at the beginning of 1946 (the first year of the Fourth Five Year Plan) as contrasted with 523,000 tractors equaling 683,000 15-horsepower units in 1940. The bulk of the 1945 park consisted of the older wheeled models, and the park as a whole was in a bad state of repair. Consequently, the Russians scheduled the allocation of 325,000 tractors comprising 720,000 15-horsepower units for delivery to agriculture during the Fourth Five Year Plan.* The industry's failure to fulfill the production plan resulted in the allocation to agriculture of only 244,000 tractors equaling 536,000 15-horsepower units.*

It is probable that with planned allocations to agriculture exceeding the total park in 1940 the Russians hoped to retire many prewar tractors. The agricultural tractor park in 1950 is estimated to have contained more than 200,000 wheeled tractors of pre-1938 vintage.* At the end of the Fourth Five Year Plan the total agricultural tractor park reached 878,000 15-horsepower units.* See Table 10.**

Actual allocation to agriculture for 1946-50 in 15-horsepower units is summarized in Table 11.***

In the first three years of the Fourth Five Year Plan allocations to the agricultural sector of the economy apparently received top priority with few tractors remaining for other sectors. Beginning with 1949, however, there appeared to be a shift in allocational priorities. Although 1950 production (in physical units) reached 92 percent of the original production plan, the allocation to

* See Appendix A.

** Table 10 follows on p. 27.

*** Table 11 follows on p. 27.

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Table 10

Agricultural Tractor Park of the USSR
on MTS's and State Farms a/
Selected Years

	Thousand 15-horsepower Units				
	<u>1936</u>	<u>1940</u>	<u>1946</u>	<u>1948</u>	<u>1950</u>
MTS's	392.4	557.3	400.0	515.0	718.0
State Farms	121.0	125.7	88.0	113.0	160.0
Total	<u>513.4</u>	<u>683.0</u>	<u>488.0</u>	<u>628.0</u>	<u>878.0</u>

a. See Appendix A.

Table 11

Allocations of Tractors to Agriculture in the USSR
1946-50

	Thousand 15-horsepower Units						
	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>Total 1946-50</u>	<u>(Percent of Plan)</u>
Plan	34	87	152	203	244	720	100
Actual	28	59	119	150	180	536	74

agriculture in that year was only 74 percent of the original allocation plan.* Production for the entire period (1946-50) reached 87 percent of the goal, while allocations to agriculture were only 75 percent of the originally planned allocation. Most of the allocational underfulfillment for agriculture occurred in 1949 and 1950. It is probable that, despite their importance, agricultural allocations were reduced in order to satisfy demand for tractors elsewhere in the economy.

* In order to fulfill the original Fourth Five Year Plan goal of 720,000 15-horsepower units to agriculture, allocations in 1950 must have been planned at approximately 244,000 15-horsepower units, as compared with planned production of approximately 270,000 15-horsepower units.

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Known increases in tractor requirements occurred in several areas of economic activity. For example, the Fourth Five Year Plan planned the allocation (during the period of 1946-50) of 12,000 tractors comprising 40,000 to 50,000 15-horsepower units to the timber industry. These were to consist of the KT-12 timber-hauling tractor, and the S-80 track-laying diesel.

The planned allocations to the timber industry were probably revised upward because by January 1948 the goal for KT-12 production, alone, was for 16,500 tractors to be produced by the end of 1950. 43/

The petroleum industry is known to use large numbers of tractors, particularly the S-80 in exploratory drilling. Allocations to construction activities apparently were relatively small until 1949-50 when the initiation of the "Great Projects" (that is, the Volga-Don Canal, Stalingrad hydroelectric project, and others) began to require ever-increasing deliveries. Military construction projects, particularly airfields, may also have required above-plan allocations of tractors during 1949-50. It is possible, therefore, that the requirements of the timber industry (which was the only industry to consistently underfulfill every yearly production plan), the petroleum industry, the "Great Projects," and possibly military construction, created a greater demand on the available tractor output than had been anticipated. Underestimation by the planners of the demand of the non-agricultural sector for tractors did, indeed, cut into agriculture's allocations. Despite this demand, agriculture received about 75 percent of the tractors produced during the Fourth Five Year Plan. Inroads into the agricultural allocations were to be even greater during the first 2 years of the Fifth Five Year Plan, only to be reversed again in 1953 when agriculture re-emerged as the dominant economic problem facing the new leadership.

The allocations to agriculture of 536,000 out of a planned 720,000 15-horsepower units in addition to the retention of prewar tractors enabled the MTS tractor park in 1950 to possess more horsepower than the entire agricultural sector in 1940. The impact of the heavier tractors is quite apparent in the ratio of physical units to 15-horsepower units as shown in Table 12.*

Originally the Fifth Five Year Plan provided for increasing the MTS park by 50 percent and presumably provided for some increase in

* Table 12 follows on p. 29.

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Table 12

Comparative Structure of Agricultural Tractor Park
of the USSR ^{a/}
1940 and 1950

Year	Thousand Units					
	MIS Park		State Farm Park (Sovkhoz)		Total Agricultural Park	
	Physical Units	15-horsepower Units	Physical Units	15-horsepower Units	Physical Units	15-horsepower Units
1940	435	557	88	126	523	683
1950	415	718	91	160	506	878

a. See Appendix A.

the State Farm Park. Assuming a slight increase in the relatively low rate of retirement which existed in 1950, the program of increasing the MIS park to its 1955 goal would require an allocation to agriculture averaging 125,000 15-horsepower units per year which, in turn, would result in a net increase of 450,000 15-horsepower units for the entire 5-year period. In 1951, 137,000 15-horsepower units were allocated to the agricultural sector, and 131,000 in 1952. ^{44/} Although this scale of allocation was reduced from the 180,000 15-horsepower units allocated to agriculture in 1950, the resultant net increase (111,000 15-horsepower units per year) was sufficient to ensure that the 1955 planned goal for the agricultural tractor park would be attained.

Judging from Stalin's discussion of the problem before the XIX Party Congress,* the question of more rapid retirement of the pre-war tractors was still undecided at that time. ^{45/} During the first 9 months of 1953 allocations continued at approximately the 1952 rate. ^{46/} Consequently, the agricultural tractor park in the period from 1 January 1951 to 1 September 1953 increased as shown in Table 13.**

* Discussed in "On the Economic Problems of Socialism," which was presented at the Congress. Actually Stalin had written this article some time in the spring of 1952, but it was not generally released until the Party Congress in August, 1952.

** Table 13 follows on p. 30.

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Table 13

Agricultural Tractor Park of the USSR
on MTS's and State Farms a/
1951-53

	Thousand 15-horsepower Units		
	<u>1951</u>	<u>1952</u>	<u>1 September 1953</u>
MTS's	810	900	969
State Farms	180	199	213
Total	<u>990</u>	<u>1,099</u>	<u>1,182</u>

a. See Appendix A, Table 30.

Lower allocations to agriculture permitted increased allocations to the nonagricultural sectors. In 1951-52 the nonagricultural sectors of the economy received a total of 76,000 physical units comprising 224,000 15-horsepower units* as compared with an allocation of 45,000 physical units comprising 140,000 15-horsepower units for the entire period 1946-50. Almost all of the nonagricultural allocations were track-laying models. The timber and petroleum industries continued to receive substantial allocations, but construction of the "Great Projects" apparently accounted for most of the nonagricultural demand. ^{47/} Military construction requirements, particularly airfields, may have increased substantially in the early part of the Fifth Five Year Plan, and some additional tractors may have been allocated to the army for use as prime movers.

V. Socialism in the Countryside.

There are two basic parameters used in the USSR for measuring the economic efficiency of the tractor in agriculture: (1) quantitative -- the amount of field work performed by each tractor unit; and (2) qualitative -- the effect of the tractor on productivity in the agricultural sector of the economy, either by facilitating an extension of the sown area or by increasing productivity per unit of land, or by some combination of these factors.

* See Appendix A.

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S-E-C-R-E-TA. Decrease in Agricultural Productivity.

It is one thing to put the tractor on the field and the peasant on the tractor, but it is quite another to induce the peasant to use the tractor efficiently. In 1937 at the beginning of the Third Five Year Plan the agricultural tractor park consisted almost entirely of new tractors, and most of them were the wheeled models which were relatively simple to operate and repair. Consequently, in 1937 the Russians reached their highest degree of efficiency in the prewar period: the average output of soft plowing units per 15-horsepower tractor unit reached 470 units per year. In the subsequent years, output per 15-horsepower unit declined owing to spare parts shortages, the increasing age of the park, and the drafting of skilled tractor drivers and mechanics for the armed services. In 1940, each 15-horsepower unit produced only 411 soft plowing units and by the middle of the war production per unit had dropped to 182. In the postwar period (1946-50), despite large numbers of the new, more powerful, and efficient tractors allocated to agriculture, output per tractor unit did not exceed the 1937 level until 1949 and even then fell slightly below the 1937 level again in 1950. See Table 14.

Table 14

Output of Soviet Agricultural Tractor Park
in Soft Plowing Units a/
Selected Years

<u>Soft Plowing Units per 15-horsepower Tractor Unit</u>								
<u>1937</u>	<u>1940</u>	<u>1943</u>	<u>1945</u>	<u>1947</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>
470	411	183	299	423	481	469	484	467

a. See Appendix A, Table 33.

Despite the greater potential output of each tractor unit in the postwar period, actual output per unit had remained at the level of the 1930's. The reasons for the low productivity were varied. In the first place, the MTS's experienced considerable difficulty in keeping the tractors in operation. The shortage of spare parts was a particularly vexing problem. Obviously also, spare parts requirements per tractor were much larger in the postwar

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period than before, primarily because of wartime inability to maintain equipment at optimum levels. In his report to the February 1947 Plenum, Andreyev noted that at that time there were 10,000 tractors in the MTS's which could be "rehabilitated" if sufficient parts were available. Apparently these were tractors requiring major repairs to put them into running condition. Moreover, Andreyev also noted that during the 1946 season 20,000 to 30,000 tractors had remained idle for lack of spare parts. The decree based upon Andreyev's report provided for considerable production of spare parts and components by various plants in the enterprises subordinate to 16 Ministries, among them the Ministry of Armaments and the Ministry of the Aviation Industry.

In addition to spare parts, repair facilities were also lacking. The February 1947 Decree of the Central Committee specified that in the period 1947-49 there were to be constructed: 631 repair shops in MTS's which lacked such shops, 194 rayon shops for capital repair, and 30 oblast repair factories. In 1947-48 the Ministry of Agriculture was also to receive 10,000 mobile repair shops (truck mounted). To equip the repair installations, the February Plenum decreed that agriculture was to be allocated in 1947, 20,000 machine tools, primarily from defense industries, and 5,000 new machine tools from current production in 1947-48. Although the exact degree to which this plan was fulfilled is not known, the fact remains that 6 years later when the September 1953 Plenum met, the problem was still unsolved.

If machinery to maintain tractors and other agricultural machines was in short supply, skilled labor apparently was in even shorter supply. This problem received almost no public attention until Khrushchev reported to the September 1953 Plenum of the Central Committee of the Communist Party. From his report it is apparent that the population movement from the rural areas to the cities in the Fourth Five Year Plan transferred the more highly skilled members of the agricultural labor force to the factories. It must be remembered that the increment to the industrial labor force planned in the Fourth Five Year Plan was fulfilled by the end of 1948, undoubtedly reflecting this movement. The industrial sector of the economy obviously benefited from the acquisition of labor recruits already possessing some skills (in contrast to the lower level of training and education in the 1930's), as the Russians reported yearly increments to labor productivity of 12 percent or more during the Fourth Five Year Plan. Migration of skilled labor to the cities meant that agriculture paid the

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price for the high rate of increase in industrial labor productivity and the increases in industrial production of 20 percent and more per year. 48/

While a population movement from farm to city is a "natural" concomitant of industrialization, and was undoubtedly accentuated in the USSR by the exceptional priorities given heavy industry, the flight of skilled labor from collective farms and MTS's was influenced by other factors as well. Following the war, life in the villages became increasingly unpleasant because of measures imposed by the State and Party. The principal repressive measure was that tax rates on the income from the private plots were increased, with that income calculated on the basis of estimates made by the authorities, not on the basis of the peasants' actual income from these plots. The consumer goods program in the Fourth Five Year Plan was conservative from the beginning -- it was underfilled, and the villages fared badly in the allocations of the few consumer goods that were produced.

The general postwar policy of applying punitive politico-economic measures in the agricultural sector of the economy is clearly set forth in the February 1947 Decree of the Central Committee of the Communist Party which defined the most important tasks in agriculture as follows:

1. Revival of the Party and Soviet leadership and control in the villages and in the MTS's;
2. Elimination of the private encroachment on the collective farm lands, a development toward which the local Party organs and Soviets had manifested considerable carelessness, and even connivance;
3. Revision of the MTS plan to emphasize fulfillment of the basic work indexes such as plowing and harrowing, not just the total plan for soft plowing units; and
4. Revision of labor payments to encourage high producers, but to penalize those who underfulfilled the plan.

B. Lower Costs of Production.

Although the larger, more technologically advanced, capital units (such as tractors) applied to agriculture in the postwar period

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did not result in any significant increase in the output of agricultural commodities, the direct cost (that is, fuel, repair, wages, and administrative expenses) of field work was reduced. This was achieved primarily as a result of the lower fuel consumption of the newer tractors, and to a lesser degree as a result of increased output of field work per tractor unit per a given number of labor units. The lower fuel costs of the larger diesel tractors are evidenced in Tables 15 and 16. The changes in the structure of direct cost of field work over the years reflect the changes in the structure of the tractor park.

Table 15

Cost of Fuel in Rubles per Hectare by Tractor Model a/

Ruble Cost of Fuel for STZ = 100						
<u>Wheeled, Kerosene-Fueled Models</u>		<u>Tracked, Kerosene-Fueled Models</u>		<u>Tracked, Diesel-Fueled Models</u>		
<u>STZ</u>	<u>U-2</u>	<u>SKhTZ-NATI</u>	<u>S-60</u>	<u>S-80</u>	<u>DT-54</u>	<u>KD-35</u>
100	107	71	78	34	40	43

a. See Appendix A, Table 39.

Table 16

Direct Cost (Sebestoimost') of Tractor Work in the MIS's 49/
Selected Years

	Percent of Total Cost				
	<u>1940</u>	<u>1947</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>
Fuel	49.5	40.7	40.0	39.3	35.8
Repair	18.5	28.0	33.0	30.0	31.6
Wages of Collective Farm Workers	16.8	12.9	11.0	13.7	14.8
Wages of MIS Personnel	11.5	15.0	13.0	14.0	14.7
Administrative Expenses	3.7	3.4	3.0	3.0	3.1
Total Cost	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

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The increased share of repair expenditures (1951 over 1940) reflects the large number of old tractors retained in the agricultural park, while the trend toward lower fuel costs reflects the introduction of the diesel tractors beginning in 1950. Direct costs declined 30 percent from 1949 to 1951, but, as Soviet writers point out, this was due almost entirely to the improved technological 50/ efficiency of the new tractors and to a reduction in fuel prices, and was not a result of more intensive utilization of equipment.*

By the end of the Fourth Five Year Plan, output per unit of capital in agriculture had failed to rise as a consequence of insufficient ancillary investment (that is, maintenance equipment and so forth), and to the lack of any significant rise in labor productivity in agriculture. Operating costs, however, had declined owing to the technological improvement in the new tractors. Furthermore, large allocations of new tractors and retention of several hundred thousand prewar tractors increased the total field work mechanized in the MTS's in 1950 to 143 percent of 1940. See Table 17.

Table 17

Tractor Work Performed by the MTS's in the USSR a/
Selected Years

Million Soft Plowing Units			
<u>1940</u>	<u>1946</u>	<u>1948</u>	<u>1950</u>
225	140	221	321

a. See Appendix A, Table 34.

In 1940, approximately 52 percent of the **basic** field work, plowing, harrowing, sowing, cultivating, and harvesting, was performed by tractors, and in 1950 about 55 percent. 51/ In the latter year

* It should be noted that no capital charges, not even an amortization charge, are included in the direct cost (sebestoimost') category. Interest charges as the price of capital, of course, do not exist in the USSR.

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approximately 85 percent of all plowing and 65 percent of sowing was performed by tractors. 52/ In general, the cultivation of technical crops was the most highly mechanized.

The Fifth Five Year Plan (1951-55) planned a 50-percent increase in the average daily output of work per tractor by 1955. At first glance, an increase of 50 percent in daily output seems quite imposing. "Daily output" refers to the intensity of use, the actual number of hours of operation, in any given 25-hour period. Hence an increase in the daily output does not necessarily result in a corresponding increase in yearly output. In 1952 an editorial in the MTS journal summed up the current situation in the following fashion:

It is sufficient to say, that if in 1951 all tractors had worked 2 shifts (20 hours per day) and had fulfilled the output norms per shifts, then the period of agriculture work would be cut in half. 53/

The significance of this is simply that a very short delay in the preparation of the seed bed and sowing may mean the difference between a good crop and a failure, especially in the Russian steppes.

Since much of the cultivated land in the USSR is in areas where drought is a constant menace, it is important to complete preparation of the seed bed and sowing in the shortest possible time. It is important to note, in Table 18,* that larger tractors not only do more work in a given time period but also increase productivity per worker.

Whereas the average yearly output per 15-horsepower unit rose to 484 soft plowing units in 1951, it fell to 467 units in 1952, compared with 470 units in 1937.** The official plan fulfillment report for 1952 did not mention output per 15-horsepower tractor unit, indicating only that all was not well in the MTS's.

Although the volume of agricultural work performed on the collective farms by the Machine Tractor Stations

* Table 18 follows on p. 37.

** See Appendix A, Table 33.

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Table 18

Norms of Output per Tractor Shift (10 hours)
for Plowing by Tractor Models a/

Model	Hectares	
	Output Norms per Tractor	Output Norms per Worker
S-80	15.0	5.0
DT-54 and SKhTZ-NATI	7.7	3.85
KD-35	5.8	2.9
SKhTZ	4.0	2.0

a. See Appendix A, Table 41.

increased significantly in 1952, the Machine Tractor Stations did not fulfill the work plan for harvesting of potatoes, ensilaging of fodder, and plowing. 54/

The reasons for these failures were the same as in 1946-50. Spare parts were still short, and apparently the ancillary investment in repair facilities and equipment sheds was insufficient. For example, from 10 July to 30 October 1953 approximately 15 percent of the entire Ukrainian agricultural tractor park stood idle for lack of spare parts and proper management. 55/ Total mechanized field work, however, continued to increase in the Fifth Five Year Plan despite the continued low productivity per unit. The explanation was obvious: The MTS's were equipped with an ever-increasing number of tractors: 557,000 15-horsepower units in 1940; 718,000 in 1950; and 1,005,000 at the end of 1953. See Table 19.*

By the end of 1952, almost 75 percent of all basic field work was mechanized, including approximately 95 percent of the plowing and 80 percent of the sowing. 56/ By the end of 1953 the continued increment to the heavy tractor park enabled the Russians to report that 96 to 97 percent of the plowing, 87 percent of the sowing, and 70 percent of the harvesting was mechanized. 57/ For cotton and sugar beets, virtually all plowing and harrowing and

* Table 19 follows on p. 38.

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Table 19

Tractor Work Performed by the MTS's in the USSR
by Soft Plowing Units a/
Selected Years

Million Soft Plowing Units						
<u>1940</u>	<u>1946</u>	<u>1948</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>
225	140	221	321	382	430	505

a. See Appendix A, Table 34.

95 to 98 percent of the sowing was mechanized. On the other hand, the lack of row-crop tractors resulted in a very low mechanization of row-crop cultivation, so low that the Russians seldom mentioned it. In September 1953 it was reported that in 1952 only 14 percent of the potato planting and less than 7 percent of the harvesting was mechanized. 58/ Mechanization in vegetable cultivation was negligible.

Thus from 1946 to 1952 the increased volume of mechanized field work in the collective farms was a function of the increase in the number of tractor units. Output per tractor unit and labor productivity in agriculture apparently were still near the 1937 level. In contrast to agricultural productivity, the Russians reported increments in the productivity of the industrial labor force of at least 81 percent per year during the entire period, 1946-50. Even the decline in direct costs of field work brought about by the more technologically advanced tractors and lower fuel prices was reversed. Direct costs of field work in 1952 increased as compared with 1951. 59/ As long as these conditions prevailed, the increased mechanization of agriculture required a continuing high level of production in the tractor industry.

C. Mechanization and Stability.

From the Soviet point of view, the primary economic justification for the tractor industry of the USSR has been its function as a supplier of capital equipment to the agricultural sector of the economy. The industry thus contributes to the stability of the

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regime by supplying the MTS's with sufficient tractors to insure maintenance of State control in the countryside and, as a consequence of this system of control, assurance of a marketed share of the grain crop sufficient to feed the urban population and to provide for necessary exports and reserves. Most important of all, the USSR is ideologically committed to the dogma that mechanization will assure greater productivity per unit of land.

As has been pointed out, productivity per unit of capital has been very low, which means that capital investment in the agricultural sector has been greater than would be necessary were the tractors used with something approaching maximum efficiency. Consequently, direct investment in the industry has been larger than would otherwise have been necessary, and other sectors of the economy such as the transportation facilities have been affected accordingly. Having paid this price for their agricultural mechanization program, the Russians have received a mixed return.

In respect to assuring the stability of the regime through mechanization of the countryside, the Russians have achieved considerable success: collectivization was carried out, it survived the war (although badly shaken in the process), and in the postwar period it had been reestablished more firmly than ever. From the point of view of the Soviet leadership, this is an important achievement, and the tractor industry is an indispensable prerequisite thereto. With regard to assurance of a marketed share of the grain crop, the Russians have achieved at least their minimum objective: the marketed share of the grain crop has increased sufficiently to feed the urban population and, if World War II is an example, to build up considerable reserves for emergencies. See Table 20.*

Despite the large number of heavy tractors supplied to agriculture by the tractor industry, yields apparently have not increased. Increases in total output have come from increased area under cultivation for both grain and technical crops. By 1953 the supply of bread grains still was barely keeping abreast of the growth in the population, although technical crops may have grown somewhat faster. What was true for grains was also true for fodder. As a result, livestock herds in 1953 were still, in general, under the precollectivization levels, and even under the pre-World War I levels. Consequently, the per capita supply of animal proteins

* Table 20 follows on p. 40.

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Table 20

Marketed Share of the Grain Crop of the USSR 60/
Selected Years

Million Metric Tons						
<u>1913</u>	<u>1927-28</u>	<u>1932</u>	<u>1937</u>	<u>1940</u>	<u>1950</u>	<u>1952</u>
21.3	10.3	19.8	38.0	40.0	38-41	40.4

apparently had declined as a result of collectivization. Since the USSR has a rapidly growing population, the failure to raise the productivity per unit of land through large-scale mechanization presented the Soviet leadership with a very serious problem at the midpoint of the Fifth Five Year Plan. In order to understand the seriousness of these problems, it is necessary only to briefly examine the ambitious plan for agricultural commodities outlined in the Fifth Five Year Plan. The goals for increasing yields and the aggregate production of major commodities were extremely ambitious, ranging as high as 80 to 90 percent for meat production. The results of the Plan's first 2 years, however, were anything but encouraging. The Russians reported a smaller grain harvest in 1951 than in 1940, and the grain harvest reported for 1952 was only 5 percent above 1950. The cotton harvest in 1952 also showed a negligible increase over 1950. In 1952, large-horned cattle numbers declined by 2 million head. It was clear to Stalin's heirs that as the Fifth Five Year Plan passed its midpoint, the original goals for the agricultural sector would not be achieved.

VI. Post-Stalin Policy.

The foregoing sections of this report have been designed to define the function of the tractor industry of the USSR in the economy as a whole, the successes and failures in meeting the various planned goals, the problem arising in the utilization of tractors which influenced the demand for them, and the impact of the tractor on the agricultural sector of the economy.

On 5 March 1953, Joseph Stalin died. In September 1953, his heirs, in the middle of a Five Year Plan, promulgated a series of policies designed to deal with some of the serious problems facing the economy, primarily in agriculture. The problems themselves

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were not new. Indeed, in the article entitled "On the Economic Problems of Socialism" -- his last major work before his death -- which was delivered to the XIX Party Congress, Stalin was preoccupied with the socio-economic problem of the private peasant plot, a problem which in his eyes represented a major threat to the stability and progress of the regime.

In September 1953, 6 months after the death of Stalin and 2 months after the fall of Beriya, a Plenum of the Central Committee of the Communist Party met to consider the general problem of the disproportion between the production of producer goods and the production of consumer goods and to consider the problem of lagging production in the agricultural sector.

When the reporter to the Plenum, First Secretary of the Communist Party, Nikita Khrushchev, delivered his report on agriculture collectivization had been in effect 25 years. During that 25-year period, tractor power in agriculture had risen from a few thousand 15-horsepower units to almost 1 million. The number of 15-horsepower units had almost doubled since 1940, and about 80 percent of the total had been produced since 1945. Despite the massive capital investment in the mechanization of agriculture, Khrushchev, in September 1953, was able to report few successes in increasing the output of agricultural products and in some cases was forced to report complete failure.

Official Soviet statistics show that production in the agricultural sector has lagged far behind the growth of the industrial sector. See Table 21.

Table 21

Trends in the Value of Output of the Industrial and Agricultural Sectors of the Economy of the USSR 61/
Selected Years

	1940 = 100			
	<u>1940</u>	<u>1950</u>	<u>1952</u>	<u>1953</u>
Industry	100	173	230	250
Agriculture	100	108-109	110	107-108

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Khrushchev reported that at the end of 1952 there were fewer cattle, sheep, and goats than in 1928, and only about a million more swine. ^{62/} According to official Soviet statistics, the grain harvest in 1952, the best of postwar years, was only 10 percent above 1940, ^{63/} and the harvest in 1953 was below 1950 owing to drought. ^{64/} Even the marketed share of grain, 40.4 million tons in 1952-53 was very little above 1940-41. While Khrushchev was able to report a considerable increase in technical crops, cotton, and sugar, as compared with 1940, the cotton crop in 1952 showed only a negligible increase over 1950. ^{65/} The Fifth Five Year Plan called for increases in cotton production of 55 to 65 percent in 1955 as compared with 1950. ^{66/} Very large increases had been planned for other crops, such as grain, 40 to 50 percent; meat, 80 to 90 percent; and milk 45 to 50 percent. ^{67/} By September 1953 it was obvious such increases were out of the question.

The low output per unit of capital equipment and the failure of mechanization to effect any substantial increase in output per unit of land continued to show no signs of improvement. Even the one previously favorable trend, the downward trend in the direct cost of field work which had continued into 1951, was reversed in 1952. (The Fifth Five Year Plan had planned a 25-percent decrease in the direct cost of field work.) ^{68/} The 1952 increase, according to Zverev in a speech to the Supreme Soviet on 5 August 1953, resulted in losses in the MTS's amounting to 386,000 million rubles.

A. New Program.

Thus in the fall of 1953 the new Soviet leadership found it necessary to promulgate **policies** designed (1) to reduce the disproportion in the growth rates between the agricultural and industrial sectors of the economy, and (2) to provide the agricultural sector with sufficient capital **equipment** to increase output of agricultural products and, at the same time, to increase the productivity of capital in agriculture.

If the problems facing the Soviet leadership in the fall of 1953 were not new, the methods chosen to solve them were a mixture of old and new. Under the new program, allocation of tractors to agriculture was to be increased across the board, and the increase in row-crop tractors would be strikingly large. According to the Decree of the Party and the Soviet of Ministers, in the period 1954 to 1 May 1957, allocations to agriculture were to

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be "not less than 500,000 general-purpose (track-laying diesel) tractors expressed in 15-horsepower units, and 250,000 row-crop tractors expressed in physical units." ^{69/} The magnitude of these goals is highlighted by the fact that at the end of 1953 there were 460,000 15-horsepower units of track-laying diesel tractors in the MTS's and that as of 1 February 1953 ^{70/} the entire agricultural sector possessed only 108,000 row-crop tractors. ^{71/} For the track-laying diesel tractors, this allocation represents a yearly average of 150,000 15-horsepower units compared with 115,000 allocated to agriculture in 1952. For the row-crop tractors, this allocation represents a yearly average of approximately 75,000 physical units compared with 19,000 row-crop tractors actually received by agriculture in 1952.

For the tractor industry, the new production goals meant an increase over the original Fifth Five Year Plan goals for 1955 of about 23,000 15-horsepower units (approximately 19,000 physical units), almost all of them row-crop tractors. To complete construction of existing tractor plants not yet finished and to provide additional facilities at completed plants, the industry is to receive an allocation of 750 million rubles in 1954-55, 350 million rubles of which are to be for the year 1954. The 750 million rubles probably represent the total capital investment required to bring the industry's tractor plants to the capacity needed for the new goals. Fifteen thousand additional row-crop tractors (approximately 22,000 15-horsepower units) are to be produced in 1954-55 by the Ministry of the Defense Industry. The installed machine tools in existing tractor plants are capable of producing enough engines for the tractors produced in the tractor industry itself (the then Ministry of Machine Building, now the Ministry of Automobile, Tractor, and Agricultural Machine Building) as well as for the tractors to be produced by the Ministry of the Defense Industry.

In increasing the allocations of track-laying diesel tractors, the Russians are planning to extend the sown area, increase the average depth of plowing, and possibly replace more of the prewar tractors. The row-crop tractors, which were particularly behind plan in the postwar period, are to be used in the program to increase the supply of vegetables, technical crops, and fodder for the livestock program, all of which are essential elements in the increased consumer goods program first announced in the Supreme Soviet in August 1953. Planned expansion of the sown area, to be devoted

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to grain cultivation, in 1954 and 1955 is 13 million hectares. 72/ This expansion is to take place in Siberia, Kazakhstan, the Urals, the Altai, and the Volga basin and will require approximately 120,000 15-horsepower units of diesel tractors which will be supplied in 1954. 73/ The importance of increasing the area sown to grain crops is highlighted by the fact that tractor allocations to the new program will come from a readjustment of previously planned agricultural allocation. 74/

B. Additional Facilities.

In order to increase the field output per tractor unit, the Russians significantly increased resource allocations for the construction and improvement of repair facilities and at the same time promulgated certain policies intended to increase labor incentives. In 1954-55 they plan to increase the storage capacity of petroleum products in the MTS's and State farms by more than 2 million cubic meters (528 million US gallons, or approximately 1.7 million metric tons of POL). In addition, 500,000 iron barrels, as well as portable tanks with a capacity of 200,000 cubic meters, will be supplied. It is estimated that this capacity will more than double the permanent storage capacity of the MTS's and State farms by the end of 1955.* In 1954-56 the construction program for repair facilities provides for the addition of 2,000 machine repair shops, 4,000 garages, 4,000 sheds, 4,000 houses, and 2,000 dormitories. 75/ The cost of this total construction program is given as follows 76/: 1954, 3,256 million rubles; 1955, 3,504 million rubles; 1956, 3,752 million rubles; totaling 10,512 million rubles.

In addition, 9 new repair factories and 6 intra-rayon shops for capital repair of tractors and agricultural machinery are to be constructed in 1954-55, 36 repair factories and 15 intra-rayon shops for capital repair presently under construction are to be completed, and 41 repair factories and 125 intra-rayon shops for capital repair are to be reconstructed. 77/ This program will require an additional expenditure of 850 million rubles, which, when added to the MTS construction, gives a total of 11,362 million rubles. A remarkable similarity existed between the ancillary investment program set forth in the decrees of February 1947 and September 1953. Six years had passed with no solution to the problem. The rate of growth of the agricultural tractor park continued to outstrip the growth of

* See Appendix B.

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maintenance facilities. Moreover, during 1954-55 the Ministry of Agriculture was granted the right to use all amortization allowances for the construction and equipping of the repair facilities. 78/ It is estimated conservatively that such allowances amount to at least 2 to 2.5 billion rubles per year.

C. Labor Incentives.

In the speeches before the Supreme Soviet in August 1953 and in the September 1953 Decrees, the Russians announced a series of measures to improve labor incentives. An increase in the output of consumer goods was planned. The pressure on the peasants' private plots was reduced by cutting taxes on peasant income from that source. Procurement prices for meat and dairy products were raised. The peasant was henceforth to be encouraged to keep a cow -- a reversal of the 1949-51 policy, when the private herds were denuded to build up the collective farm herds. Credit for such purposes and for private construction was to be supplied. Sale of produce from the private plots was to be facilitated. 79/ All these measures were designed not only to increase the output of vegetables, meat, and dairy products, but also to provide the incentives for increased productivity throughout the agricultural sector.

One of the most significant aspects of the new program is the transfer of the tractor drivers from collective farm members to full-time employees of the MTS's. Thus the Russians will for the first time have a fairly substantial agricultural group, between 1.25 and 1.5 million men and their families, converted into wage laborers. Moreover, a general effort will be made to raise the educational level and technical competence of MTS personnel by directing engineers and skilled labor to them. The need for this may be appreciated from Khrushchev's statement that 30 percent of the MTS directors, 64 percent of the chief engineers, and 90 percent of the chief mechanics possessed less than an eighth grade education. Any improvement in labor productivity resulting from these measures will have a significant effect upon the demand of the agricultural sector for tractors.

D. Conclusions.

There is little question that the tractor industry will be able to fulfill its obligations to produce the necessary tractors and ship them to the MTS's and State farms. Production and delivery

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schedules on the row-crop tractors may fall somewhat behind, but the aggregate effect should not be great. Production of tractors by the industry at the planned rate, and allocations to agriculture according to schedule, will increase the total agricultural tractor park to approximately 1.5 million 15-horsepower units by the end of 1955. Assuming an output of soft-plowing units per 15-horsepower tractor unit of at least 500 per year (the 1953 level) and assuming an increase in total field work (which can be performed by tractors) of 20 percent, as a result of changes in the crop pattern and extension of the sown area, it is estimated that agricultural field work will be totally mechanized by the end of 1956. A few possible exceptions in certain aspects of vegetable and technical crops may occur, but the demand for heavy track-laying tractors will be limited to replacement needs. Production of track-laying tractors will be running at the rate of 100,000 per year. Replacement needs after 1956 are estimated at not more than 40,000 track-laying tractors per year, leaving at least 60,000 track-laying tractors available for allocations to other purposes. Consequently, it is estimated that beginning in 1957 the production of tractors will be sufficient to enable the Russians to either: (1) resume the "great projects"; (2) export 25,000 to 30,000 heavy track-laying diesels per year to carry out collectivization in the Eastern European Satellites; (3) export to any area deemed expedient (for example, China or some non-Communist nation such as India); and (4) initiate some other large-scale construction program such as building motor roads; or (5) carry out some combination of these alternatives.

The supply of capital equipment to the land will be the least troublesome problem facing the new leadership. The most important problem in the current program is whether or not the incentives are sufficient to increase labor productivity. If the tractors are kept in good repair, adequately supplied with fuel, and utilized with maximum intensity in the fields, then the overcapitalization which has been characteristic of the past and which has been continued by the present leadership will be reduced or may even cease. If the tractor is utilized intensively, the field work done properly and on time, and full advantage taken of the possibility of deep plowing with the heavy tractors, the Russians should at last achieve some increase in productivity per unit of land as a result of mechanization. In view of the past failures, however, the success of the current program may well depend upon the success or failure of the incentives part of the agricultural program.

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APPENDIX A

TABLES

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Table 22

Production of Tractors in the USSR 80/
1928-41

	Thousands													
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941 (Plan)
Physical Units	1.2	2.3	15.5	33.0	50.6	78.1	94.5	112.5	115.6	50.0	49.0	33.0	30.0	28.0
15-Horsepower Units <u>a/</u>	N.A.	N.A.	N.A.	32.6	50.3	81.3	116.0	154.7	174.6	90.0	89.0	74.3	73.3	69.5

a. The Soviet "15-horsepower unit" is a planning and accounting unit utilized to reduce different types of tractors to a common denominator. Each type of tractor is rated at its drawbar horsepower and then reduced to 15-horsepower units: that is, the DT-54 caterpillar diesel model has a drawbar horsepower rating of 36 horsepower, or 2.4 horsepower units.

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Table 23

Agricultural Tractor Park of the USSR 81/
1928-40

	Thousand Units												
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Total Agricultural Park	-												
Physical <u>82/</u>	27.6 a/ b/	34.9 a/ b/	72.1 b/	125.3 b/	148.5 b/	210.9 b/	276.4 b/	360.3	422.7	454.5 b/	483.5	507.7	523.0
15-Horsepower <u>83/</u>	N.A.	26.1 a/ b/	66.8	123.3	148.3	213.9	297.5	N.A.	513.4	555.0	612.6	650.0	683.0
Machine Tractor Station Park <u>84/</u>													
Physical		2.4 a/	31.2	63.3	77.8	123.2	177.3	254.7	328.5	365.8	394.0	422.0	435.3
15-Horsepower		1.6 a/	24.8	56.6	71.8	117.2	183.6	285.4	392.4	445.2	495.8	533.3	557.3
State Farm Park													
Physical <u>85/</u>	6.7 a/	9.7 a/	27.7	51.6	64.0	83.2	95.5	105.6	94.2	84.5	85.0	85.0	87.7
15-Horsepower	5.2 a/	8.2 a/	32.2	59.5	69.5	93.4	111.7	N.A.	121.0	109.8	116.8	116.8	125.7 c/

a. October figures.

b. In the earlier years the MIS's and State farm parks did not equal the total agricultural tractor park because some tractors were operated by the collective farms and other enterprises. By 1940 almost all tractors were either on MIS's or State farms.

c. Calculated as a residual.

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Table 24

Designations and Characteristics
of Postwar Tractor Models in the USSR

-
1. ASKhtZ-NATI Altai Stalingrad Khar'kov Tractor Zavod (Plant)
Nauchno Avto Traktorni Institut (Scientific Automobile
and Tractor Institute).
- Type: Track-laying, general purpose.
Fuel: Kerosene.
Horsepower: 46-52 engine; 32-36 drawbar.
Weight: 5,100 kilograms (11,200 pounds).
Produced at: Altai, 1942-52; Stalingrad, 1944-49; Khar'kov,
1945-49.
2. DT-54 Diesel Traktor - 54 (rated engine horsepower).
- Type: Track-laying, general purpose.
Fuel: Diesel.
Horsepower: 54 engine; 36 drawbar.
Weight: 5,400 kilograms (11,880 pounds).
Produced at: Stalingrad, November 1949 to present; Khar'kov,
December 1949 to present; Altai, 1952 to
present.
3. KD-35 "Kirovets" Diesel - 35 (rated engine horsepower).
- Type: Track-laying, general purpose.
Fuel: Diesel.
Horsepower: 35-37 engine; 24-26 drawbar.
Weight: 3,700 kilograms (8,140 pounds).
Produced at: Lipetsk, 1948 to present. A few models were
produced at Minsk in 1950.
4. KDP-35 "Kirovets" Diesel Propashnikh (cultivator, or rowcrop) - 35
(rated engine horsepower).

The KDP-35 is a KD-35 modified so that there is additional ground clearance, and fitted with very narrow tracks that can be used for row-crop cultivation. Its characteristics are essentially the same as the KD-35.

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Table 24

Designations and Characteristics
of Postwar Tractor Models in the USSR
(Continued)

-
5. ChTZ-S-80 Chelyabinsk Tractor Zavod (Plant) "Stalinets" - 80
(rated engine horsepower).
- Type: Track-laying, general purpose.
Fuel: Diesel.
Horsepower: 93 engine (maximum); 65-73 drawbar.
Weight: 11,400 kilograms (25,000 pounds).
Produced at: Chelyabinsk, 1946 to present.
6. U-1, 2, or 4 Universal - 1, 2, or 4 (model number).
- Type: Wheeled, rowcrop.
Fuel: Kerosene.
Horsepower: 22-24 engine; 10-12 drawbar.
Weight: 3,000 kilograms (4,400 pounds).
Produced at: Vladimir, 1944 to present.
7. KT-12 "Kirov" Trelevochnogo (skidding) - 12 (model number).
- Type: Track-laying, special purpose (timber hauling).
Fuel: Gas generator.
Horsepower: 35 engine; 25-30 drawbar.
Weight: 5,750 kilograms (12,600 pounds).
Produced at: Leningrad "Kirov," 1948 to 1951; Minsk, 1951
 to present.
8. KhTZ-7 Khar'kov Tractor Zavod (Plant) - 7 (model number).
- Type: Wheeled, rowcrop.
Fuel: Gasoline.
Horsepower: 12 engine; 7.5 drawbar.
Weight: 1,300 kilograms (2,800 pounds).
Produced at: Khar'kov Tractor Assembly Plant, 1950 to
 present. Plans call for production also at
 Khar'kov Tractor Plant beginning in 1954.

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Table 24

Designations and Characteristics
of Postwar Tractor Models in the USSR
(Continued)

-
9. VTZ-T24 Vladimir Tractor Zavod (Plant) Tractor 24 (rated engine horsepower).
- Type: Wheeled, rowcrop.
 Fuel: Diesel.
 Horsepower: 24 engine; 12 drawbar.
 Weight: N.A.
 Produced at: To be produced at Vladimir beginning in 1954.
10. GT-58 Gas-generator Tractor - 58.
- Type: Track-laying, general purpose.
 Fuel: Gas generator.
 Horsepower: 53 engine; 30-35 drawbar.
 Weight: 5,850 kilograms (12,880 pounds).
 Produced at: Stalingrad and Khar'kov, 1952 to present.
11. "Belarus'" Named for the Belorusskaya SSR, in which the Minsk Tractor Plant, producer of the tractor, is located.
- Type: Wheeled, rowcrop.
 Fuel: Diesel.
 Horsepower: 37 engine; 22 drawbar.
 Weight: 3,250 kilograms (7,100 pounds).
 Produced at: Minsk, 1953 to present. Will also be produced by the Ministry of the Defense Industry in 1954 and 1955.

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Table 15
Tractor Production in the USSR by Model (1947-79)

Tractor Model	1947		1948		1949		1950		1951		1952		1953		1954		1955																				
	Physical	15-Horsepower	Physical	15-Horsepower	Physical	15-Horsepower	Physical	15-Horsepower	Physical	15-Horsepower	Physical	15-Horsepower	Physical	15-Horsepower	Physical	15-Horsepower	Physical	15-Horsepower																			
MTZ-80 (15-Horsepower, Rear-engine, Track-Laying)	500	3,100	1,100	2,100	1,200	4,100	1,100	3,800	12,600	13,100	12,500	31,700	71,000	11,900	92,900	15,000	30,100	5,000	16,800																		
MTZ-55 (15-Horsepower, Front, Track-Laying)									2,400	2,800	10,600	27,400	15,300	113,500	60,200	145,800	60,000	120,000	60,000	120,000																	
MTZ-50 (15-Horsepower, Front, Track-Laying)					900	3,000	5,700	22,800	11,300	56,800	17,000	19,000	21,700	15,000	77,100	18,000	71,900	18,000	71,900	18,000	71,900																
MTZ-35 (15-Horsepower, Front, Track-Laying)									700	1,100	1,000	5,600	5,000	8,000	1,000	8,000	6,000	9,500	7,000	11,000	8,000	14,000															
MTZ-30 (15-Horsepower, Front, Track-Laying)																			1,500	2,400	19,700	16,000	17,000	27,000													
MTZ-25 (15-Horsepower, Front, Wheel)																			1,000	1,600	15,000	80,500	85,000	16,500													
MTZ-20 (15-Horsepower, Rear-engine, Wheel)					200	800	1,800	800	1,400	900	1,000	2,000	4,300	5,600	12,000	9,700	13,000	9,000	14,800	9,900	16,800	11,300	17,500	11,700													
MTZ-15 (15-Horsepower, Front, Wheel)															1,100	700	1,900	900	2,500	1,300	5,800	4,900	10,500	5,300	18,000												
MTZ-10 (15-Horsepower, Gas Generator, Track-Laying)																			1,000	2,000	4,000	1,000	6,500	13,000	1,000	6,000											
Other (Primarily MTZ-1, 15-Horsepower, Rear-engine, Wheel)																			3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000			
Total Total	200	1,000	1,000	2,000	2,000	5,200	1,000	11,000	11,000	22,000	27,000	66,000	170,000	106,000	199,000	105,000	241,000	200,000	218,000	110,000	252,000	180,300	207,000	116,000	268,000	175,000	171,000										
Total, 1947-55																																					
Physical																																					
15-Horsepower																																					

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Table 26
Tractor Production in the USSR by Producing Plants
1948-52

Tractor Plant	Model	1948-51		1946		1947		1948		1949		1950		1951		1952		1953		1954 Plan		1955 Plan		
		Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	Physical	12-horsepower	
Komintern ^{55/}	MTZ-MAT, DT-54	900	1,070	2,800	4,800	5,600	12,000	18,400	26,600	17,700	31,800	19,600	47,000	19,600	47,000	20,500	49,800	20,500	49,800	20,000	46,000	20,000	46,000	
Shtalinsk ^{52/}	MTZ-MAT, DT-54	8,800	6,500	9,400	11,100	7,300	15,000	13,740	29,400	18,000	31,900	21,000	50,400	29,700	54,900	29,000	69,000	29,000	69,000	29,000	65,000	29,000	65,000	
Almat ^{55/}	MTZ-MAT, DT-54	5,000	12,630	1,400	7,800	6,600	14,100	7,200	16,900	10,100	21,400	18,000	28,100	18,000	29,800	18,000	36,000	18,000	36,000	18,000	36,000	18,000	36,000	
Chelyabinsk ^{52/}	DT-52		900	900	1,900	7,300	22,900	18,800	50,800	11,200	73,400	19,000	81,700	19,000	77,400	19,000	77,400	19,000	77,400	19,000	77,400	19,000	77,400	
Minsk ^{52/}	DT-52					700	1,100	3,300	5,600	500	800	1,000	2,000	1,000	2,000	1,000	2,000	1,000	2,000	1,000	11,600	16,200	28,000	26,000
Lipetsk ^{52/}	DT-52, DT-35					9,300	5,600	12,400	9,300	14,200	8,200	14,800	9,900	14,800	9,900	16,800	11,300	17,900	11,300	18,800	12,100	19,000	19,700	
Vladimir ^{52/}	DT-52, DT-35	1,500	1,000	1,400	900	3,000	2,000	1,600	2,000	4,000	3,400	700	1,000	900	2,500	1,800	1,800	2,200	1,800	10,200	10,200	10,200	10,200	
Cheremkhovo ^{52/}	DT-52																							
Other (primarily Tars)	DT-18																							
Ministry of the Defense Industry	DT-18																							
Total Production		10,700	20,800	13,100	27,000	27,000	66,000	56,000	137,000	85,000	129,000	100,000	243,000	100,000	236,000	110,000	252,700	110,000	252,700	105,000	226,000	105,000	226,000	
Estimated Accuracy (Physical Units)		+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	+2 Percent	

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Table 27

Production Goals in the USSR by Row-Crop Tractors
1954 - 1 May 1957

Tractor Model	1954		1955		1956		1 May 1957		Total	
	Physical	15-horsepower	Physical	15-horsepower	Physical	15-horsepower	Physical	15-horsepower	Physical	15-horsepower
Universal	18,200	12,140	19,000	12,670	20,000	13,340	6,700	4,490	63,900	42,640
KDP-35	10,340	16,540	17,000	27,200	17,000	27,200	5,400	8,640	49,740	79,580
KMTZ-7	10,500	5,250	18,000	9,000	21,000	10,500	7,000	3,500	56,500	28,250
"Belarus" (Machine Building)	10,000	15,000	15,000	22,500	20,000	30,000	6,700	10,000	51,700	77,500
"Belarus" (Defense)	5,000	7,500	10,000	15,000	10,000	15,000	3,300	5,000	28,300	42,500
Yearly Total	<u>54,040</u>	<u>56,430</u>	<u>79,000</u>	<u>86,370</u>	<u>88,000</u>	<u>96,040</u>	<u>29,100</u>	<u>31,630</u>	<u>250,140</u>	<u>270,470</u>

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Table 28

Comparison Between the 1955 Tractor Production Goals of the Fifth Five Year Plan and the Goals as Revised by Agricultural Decrees of September, October 1953

Tractor Model	General Purpose								Row Crop						Special Purpose		Units			
	S-80		DT-54		DT-58 (Gas Generator)		KD-35		KDP-35		U-2 and 4		"Belarus"		KhTZ-7		KT-12 (Timber Hauling)		Total	
	Physical	15-hp.	Physical	15-hp.	Physical	15-hp.	Physical	15-hp.	Physical	15-hp.	Physical	15-hp.	Physical	15-hp.	Physical	15-hp.	Physical	15-hp.	Physical	15-hp.
Estimated Fifth Five Year Plan Goal (1955)	18,000	76,000	50,000	118,000	10,000	21,000	8,000	13,000	10,000	16,000	18,000	12,000	10,000	15,000	16,000	8,000	7,000	14,000	147,000	293,000 a/
Estimated Goal (1955) As Revised By Decrees	18,000	77,000 b/	50,000	118,000	10,000	21,000	11,000	18,000	17,000	27,000	19,000	13,000	25,000	36,000	18,000	9,000	7,000	14,000	175,000	333,000

a. It will be noted that the figure of 293,000 is higher than the figure of 292,000 appearing in the methodology. The discrepancy is caused by rounding.
 b. The figure 77,000 more nearly corresponds to known past production in 15-horsepower units than does the figure 76,000. The figure 76,000, has been retained in the line above because the method of derivation is explained in the section on methodology.

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Table 29

Allocation of Tractor Production in the USSR a/
1946-55

Year	Units					
	Allocated to Agriculture		Allocated to Remainder of Economy b/		Total Production	
	Physical	15-horsepower	Physical	15-horsepower	Physical	15-horsepower
1946	13,000	28,000	0	0	13,000	28,000
1947	26,000	59,000	2,000	7,000	28,000	66,000
1948	52,000	119,000	5,000	19,000	57,000	138,000
1949	71,000	150,000	16,000	49,000	86,000	199,000
1950	82,000	180,000	22,000	65,000	104,000	245,000
1951	68,000	137,000	32,000	99,000	100,000	236,000
1952	67,000	131,000	44,000	125,000	111,000	256,000
1953	80,000	152,000	40,000	115,000	120,000	267,000
1954	115,000	208,000	31,000	90,000	146,000	298,000
1955	141,000	239,000	34,000	94,000	175,000	333,000

a. See Table 45, p. 73, for planned and actual production.

b. Calculated as residuals. Includes tractors allocated for foreign trade.

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Table 30

Growth of the Agricultural Tractor Park in the USSR
1940-55

<u>End of Year</u>	Units					
	<u>Machine Tractor Stations</u>		<u>State Farms</u>		<u>Total Agricultural Park</u>	
	<u>Physical</u>	<u>15-horsepower</u>	<u>Physical</u>	<u>15-horsepower</u>	<u>Physical</u>	<u>15-horsepower</u>
1940	435,000	557,000	88,000	126,000	523,000	683,000
1945	297,000	385,000	63,000	84,000	360,000	469,000
1946	302,000	400,000	64,000	88,000	366,000	488,000
1947	313,000	435,000	67,000	96,000	380,000	531,000
1948	343,000	515,000	73,000	113,000	416,000	628,000
1949	383,000	615,000	81,000	134,000	464,000	749,000
1950	415,000	718,000	91,000	160,000	506,000	878,000
1951	456,000	810,000	99,000	180,000	555,000	990,000
1952	498,000	900,000	107,000	199,000	605,000	1,099,000
1953	549,000	1,005,000	116,000	220,000	665,000	1,225,000
1954	593,000	1,110,000	127,000	245,000	720,000	1,355,000
(Estimated)						
1955	647,000	1,225,000	142,000	275,000	789,000	1,500,000
(Estimated)						

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Table 31

Growth of the MTS Tractor Park in the USSR
1945-55

End of Year	Units							
	Allocation		Retirement		Net Increase		Total Park	
	Physical	15-horsepower	Physical	15-horsepower	Physical	15-horsepower	Physical	15-horsepower
1945							297,000	385,000
1946	11,000	23,000	6,000	8,000	5,000	15,000	302,000	400,000
1947	21,000	49,000	10,000	14,000	11,000	35,000	313,000	435,000
1948	43,000	97,000	13,000	17,000	30,000	80,000	343,000	515,000
1949	58,000	123,000	18,000	23,000	40,000	100,000	383,000	615,000
1950	67,000	148,000	35,000	45,000	32,000	103,000	415,000	718,000
1951	56,000	112,000	15,000	20,000	41,000	92,000	456,000	810,000
1952	55,000	107,000	13,000	17,000	42,000	90,000	498,000	900,000
1953	66,000	125,000	15,000	20,000	51,000	105,000	549,000	1,005,000
1954	94,000	170,000	50,000	65,000	44,000	105,000	593,000	1,110,000
(Estimated)								
1955	116,000	196,000	62,000	81,000	54,000	115,000	647,000	1,225,000
(Estimated)								
Total	<u>587,000</u>	<u>1,150,000</u>	<u>237,000</u>	<u>310,000</u>	<u>350,000</u>	<u>840,000</u>		

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Table 32

Growth of State Farm Tractor Park in the USSR
1945-55

End of Year	Allocation		Retirement		Net Increase		Total Tractor Park	
	Physical	15-horsepower	Physical	15-horsepower	Physical	15-horsepower	Physical	15-horsepower
	Units							
1945							63,000	84,000
1946	2,000	5,000	1,000	1,000	1,000	4,000	64,000	88,000
1947	5,000	10,000	2,000	2,000	3,000	8,000	67,000	96,000
1948	10,000	22,000	4,000	5,000	6,000	17,000	73,000	113,000
1949	13,000	27,000	5,000	6,000	8,000	21,000	81,000	134,000
1950	15,000	32,000	5,000	6,000	10,000	26,000	91,000	160,000
1951	12,000	25,000	4,000	5,000	8,000	20,000	99,000	180,000
1952	12,000	24,000	4,000	5,000	8,000	19,000	107,000	199,000
1953	14,000	27,000	5,000	6,000	9,000	21,000	116,000	220,000
1954	21,000	38,000	10,000	13,000	11,000	25,000	127,000	245,000
1955	25,000	43,000	10,000	13,000	15,000	30,000	142,000	275,000
Totals	<u>129,000</u>	<u>253,000</u>	<u>50,000</u>	<u>62,000</u>	<u>79,000</u>	<u>191,000</u>		

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Table 33

Output of Soft-Plowing Units per 15-horsepower Tractor Unit
in the USSR
1937, 1940, 1945-53

<u>Year</u>	<u>Percent</u>	<u>Soft-Plowing Units</u>
1937 <u>93/</u>	100	470
1940 <u>94/</u>	87	411
1945 <u>95/</u>	64	299
1946 <u>96/</u>	74	349
1947 <u>97/</u>	90	423
1948 <u>98/</u>	99	468
1949 <u>99/</u>	102	481
1950 <u>100/</u>	100	469
1951 <u>101/</u>	103	484
1952 <u>102/</u>	99	467
1953 <u>103/</u>	107	505

Table 34

Tractor Work Performed by MTS's in the USSR
1940, 1946-55

<u>Year</u>	<u>Index (1940=100)</u>	<u>Million Soft- Plowing Units</u>
1940	100 <u>104/</u>	225
1946	62 <u>105/</u>	140
1947	80 <u>106/</u>	180
1948	98 <u>107/</u>	221
1949	119 <u>108/</u>	268
1950	143 <u>109/</u>	321
1951	170 <u>110/</u>	382
1952	191 <u>111/</u>	430
1953	224 <u>112/</u>	505
1954	266 <u>a/</u>	598
1955	320 <u>a/</u>	719

a. Extrapolated.

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Table 35

Annual Increment to the Sown Area
of the USSR 113/
1946-53

Million Hectares <u>a/</u>							
<u>1946</u>	<u>1947</u> <u>114/</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>
8.2 (Plan)	10.0 (Plan)	13.8	6.0	6.6	6.7	2.76	1.4
	8 (Actual)						

a. A hectare is the equivalent of 2.471 acres.

Table 36

Sown Area of the USSR
Selected Years

Million Hectares <u>a/</u>					
<u>1940</u> <u>115/</u>	<u>1946</u> <u>b/</u>	<u>1950</u> <u>116/</u>	<u>1952</u> <u>117/</u>	<u>1955 (Plan)</u>	
151.1	105-110	156.5 (Plan)	146-147 (Actual)	156.4	167-170

a. A hectare is the equivalent of 2.471 acres.

b. Estimate derived by subtracting sum of yearly increases from the known 1950 figures.

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Table 37

Dynamics of the Direct Cost (Sebestoimosti') of Tractor Work in the MTS's of the USSR 118/
1949-52

<u>Elements of Direct Cost</u>	<u>1949</u>	<u>1950</u>		<u>1951</u>		<u>1952 (Plan)</u>	
	<u>Percent of Total</u>	<u>Percent of 1949</u>	<u>Percent of Total</u>	<u>Percent of 1949</u>	<u>Percent of Total</u>	<u>Percent of 1949</u>	<u>Percent of Total</u>
Fuel	40.0	80.9	39.3	65.7	35.8	51.1	29.0
Repairs	33.0	76.6	30.0	72.0	31.6	60.6	28.0
Wages of "Producing Workers"	11.0	99.3	13.7	98.7	14.8	141.4	23.0
Wages of MTS Personnel	13.0	91.7	14.0	85.5	14.7	91.7	17.0
Administrative Expenditures	3.0	86.4	3.0	77.9	3.1	71.1	3.0
Total	<u>100.0</u>		<u>100.0</u>		<u>100.0</u>		<u>100.0</u>

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Table 38

Changes in the Relative Weight of Work
 Performed by Kerosene, Ligroine, and Diesel Tractors
 in the USSR 119/
 Selected Years

<u>Type of Tractor</u>	<u>Percent</u>			
	<u>1940</u>	<u>1948</u>	<u>1951</u>	<u>1952 (Plan)</u>
Kerosene	73.9	81.6	62.8	52.2
Ligroine	19.6	10.9	5.7	5.5
Diesel	6.5	6.7	31.1	41.9
Others	0	0.8	0.4	0.4
Total	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

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Table 39

Comparison of Expenditures and Cost of Fuel per Unit of Work between Kerosene and Diesel Tractors
in the USSR a/ 120/

Type of Tractor	Per Hectare of Soft Plowing		In Percent of Expenditure on the SKhTZ		Per Hectare of Plowing		In Percent of Expenditure on the SKhTZ	
	Kilograms	(Rubles)	Kilograms	(Rubles)	Kilograms	(Rubles)	Kilograms	(Rubles)
STZ-KhTZ	16.4	7.31	100.0	100.0	23.9	10.70	100.0	100.0
Universal	14.0	6.27	85.7	85.7	24.2	10.84	101.2	101.2
STZ-NATI	15.2	6.80	93.0	93.0	21.4	9.58	89.5	89.5
Average for Kerosene Tractors	15.6	6.98	95.4	95.4	22.3	10.00	93.3	93.3
STZ-60	15.2	7.78	92.6	106.4	20.8	10.64	87.0	99.4
S-80	9.3	2.94	56.7	40.2	12.3	3.89	51.4	36.3
STZ-65	10.1	3.20	61.5	43.7	13.7	4.31	56.9	40.3
KD-35	11.6	3.67	70.5	50.0	14.7	4.65	61.5	43.4
DT-54	10.2	3.23	62.1	44.0	13.4	4.24	56.0	40.0
Average for Diesel Tractors	9.98	3.16	60.85	43.2	13.0	4.12	54.3	38.5

a. The STZ-KhTZ tractor used as the basis for comparison is the 15-horsepower, wheeled, kerosene model produced at the Stalingrad and Khar'kov plants before 1938. The first comparison, "soft plowing," is an average for all field work, the second for plowing only. It will be noted that the track-laying diesels (the S-80, DT-54, KD-35, and S-65) are much less expensive to operate than any of the other models.

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Table 40

Comparison of Fuel Expenditures, Output per Worker, and Net Costs of Operation
for Six Models of Soviet Tractors in Saratov Oblast a/ 121/
1950

<u>Economic Indexes</u>	<u>Variation of the Indexes for Tractors of Different Types (in Percent of STZ)</u>					
	<u>U-2</u>	<u>STZ-NATI</u>	<u>S-60</u>	<u>S-80</u>	<u>ST-54</u>	<u>KD-35</u>
<u>Expenditure of Fuel (in Rubles) per Hectare</u>						
Harrowing	89	86	94	34	40	41
Cultivation	82	72	87	29	38	46
Sowing of Grain	81	76	85	30	38	42
<u>Output in Hectares per Worker of Tractor Brigade</u>						
Harrowing	91	194	194	236	199	156
Cultivation	89	160	148	198	172	148
Sowing	84	153	141	176	158	136
<u>Expenditure of Workdays per Hectare</u>						
Harrowing	108	67	63	52	65	79
Cultivation	99	71	61	48	63	83
Sowing	109	69	57	46	64	80
<u>Net Cost in Rubles per Hectare of Soft Flowing</u>						
	107	71	78	34	40	43

a. While regional variations in the USSR are so great as to preclude use of one oblast in estimates of absolute quantities, relationships between models are sufficiently stable for the purposes of illustration. The STZ tractor against which the others are compared is a wheeled, kerosene, 15-horsepower, general-purpose prewar model. In 1953 there were more than 100,000 STZ's operating in Soviet agriculture.

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Table 41

Comparative Data on Heavy and Wheeled Tractors in the USSR 122/

Type of Tractor	Plowing			Sowing			Shallow Plowing of Stubble			
	Output per Tractor per Shift (in Hectares)	Workers Needed to Service the "Aggregate"	Output per Worker (in Hectares)	Output per Tractor per Shift (in Hectares)	Workers Needed to Service the "Aggregate"	Output per Worker (in Hectares)	Output per Tractor per Shift (in Hectares)	Workers Needed to Service the "Aggregate"	Output per Worker (in Hectares)	Number of Workdays per Shift by "Tractorists"
S-80 a/	15.0	3	5.00	80	6	13.3	55	2	27.5	6.0
DT-54 and STZ-NATI a/	7.7	2	3.85	44	4	11.0	35	2	17.5	5.0
KD-35 a/	5.8	2	2.90	33	2	16.5	26	2	13.0	5.0
STZ-KMTZ b/	4.0	2	2.00	18	2	7.0	14	2	7.0	4.5

a. One of the most important advantages of the heavy tractors (S-80, DT-54, STZ-NATI) is illustrated by this table: their field output in a given time period is much greater than that of the wheeled tractors. This characteristic is particularly important in the climatic conditions of the Russian steppes.

b. The STZ-KMTZ is the wheeled, 15-horsepower, kerosene model produced at Stalingrad and Khar'kov plants before 1938.

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Table 42

Value of Soviet Tractor Production
1940-55

	<u>1940</u>	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955 Plan</u>
Value in Millions of 1951 Rubles <u>a/</u>	840	175	358	836	1,669	2,458	2,984	2,849	3,120	3,295	3,823	4,373
Index: 1950=100	28	6	12	28	56	82	100	95	105	110	128	146
Percentage Increase over Previous Year			105	134	100	47	21	-5	10	6	16	14

a. 1951 ruble values were derived for each tractor model by adjusting prices (appearing in 1948 and 1949 Soviet price catalogues) according to industrial price indexes. Each year's total was then calculated according to the tractor production estimates appearing in Table 25.

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APPENDIX B

PRELIMINARY ESTIMATE OF MINIMUM POL STORAGE CAPACITY
IN MTS'S AND STATE FARMS AT THE END OF 1953

Recently information has become available which permits a first approximation of the POL storage capacity of the MTS's. Table 43 represents the capacity considered necessary for MTS's of various sizes:

Table 43

Average Capacity (Emkosti)
of "Typical" MTS POL Storage Facilities a/ 123/

	Metric Tons		
	<u>Type of Machine Tractor Station</u>		
	<u>50 Tractors</u>	<u>75 Tractors</u>	<u>100 Tractors</u>
Kerosene	140	180	245
Diesel Oil	13	34	40
Gasoline	25	36	50
Avtol	13	18	25

a. This level of storage capacity for MTS's was approved by the Soviet Ministry of Agriculture, 8 April 1947.

Table 43 gives an average of 3.6 tons per tractor. The mix, of course, will have been changed considerably since 1948, when there were very few diesel tractors in agriculture. According to present plans there will be approximately 750,000 tractors in the agricultural tractor park at the end of 1955, and in the meantime it is planned to construct permanent storage capacity in the MTS's for 1,700,000 metric tons of POL. This construction probably makes due allowance not only for tractors but also for the combines, stationary engines, and trucks in agriculture. If it is assumed that by the end of 1955 the Russians plan to have adequate storage capacity installed in all

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MTS's and State farms, the minimum requirement for tractors alone will be 2.7 million metric tons (750,000 multiplied by 3.6). Since trucks, combines, and stationary engines will increase the requirements for storage capacity, it is estimated that, if the present construction program is completed, the MTS's and State farms at the end of 1955 will have a minimum installed, permanent storage capacity for POL of 3 million metric tons.

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APPENDIX C

POL CONSUMPTION OF THE SOVIET TRACTOR PARK

The consumption of the major categories of POL products by the agricultural tractor park is summarized in the following table:

Table 44

Consumption of POL by the Agricultural Tractor Park
of the USSR a/ 124/
1940, 1947-55

	Million Metric Tons									
	<u>1940</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>
Kerosene, Diesel Oil, and Ligroine	5.12	4.38	5.36	6.04	6.67	7.39	8.00	9.08	10.33	12.12
Gasoline	0.06	0.08	0.09	0.10	0.14	0.15	0.17	0.20	0.23	0.28
Lubricants	0.48	0.42	0.54	0.63	0.72	0.81	0.93	1.10	1.29	1.58

a. The methodology for computing these figures is basically the same for all years, and may best be explained by using one year, 1948, as an example. (See Table 45.*)

The consumption of gasoline and lubricants by the MTS's has been individually expanded in Table 44 to include consumption by the State farms. In Table 45, the aggregate of intermediate distillates, lubricants, and gasoline has been adjusted. In each case the methodology is identical: for example, column 6 in Table 45 gives 0.42 as MTS's lubricant consumption. This figure is divided by 82 and the dividend multiplied by 105 (the loss factor). The answer 0.54 is the same as that given in Table 43. (See footnotes to Table 45.)

The consumption of intermediate distillates by the Soviet tractor park as a whole (agricultural and other) which is given in Table 2 is based upon the assumption that the nonagricultural park consumes at least as much per 15-horsepower unit as the agricultural park.

* Table 45 follows on p. 73.

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For purposes of calculating the percentage of intermediate distillates derived from domestic crude consumed by the agricultural tractor park, and by the tractor park as a whole, it was assumed that the Russians could not have refined more than 36 percent of domestic crude oil in the form of kerosene and diesel oil. The estimate of Soviet production of intermediate distillates, therefore, represents a maximum estimate. Domestic crude oil production is taken from a CIA estimate for the years 1947-52, and is defined as the net crude oil available after allowance for field and refinery losses. Crude oil production for the years 1953-55 is based upon the assumption that the Fifth Five Year Plan will be fulfilled. In summary, the estimates of intermediate distillates available are thought to be a maximum, the tractor consumption estimates a minimum.

The margin of error for the estimates of POL consumption by the agricultural tractor park are believed to be plus or minus 3 percent for the years 1947-52. Estimated margin of error for 1953-55 is plus or minus 7 percent. For the consumption of the Soviet tractor park as a whole the estimated margin of error is plus or minus 10 percent for all years.

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Table 45
POL Consumption of the Agricultural Tractor Park of the USSR
1948

	1	2	3	4	5	6	7	8	9	10	11	12	13
	Percent of Total ^a <u>1948</u>	Soft Plowing Units ^b (Millions)	Fuel Consump- tion per Hectare by ^c <u>1948</u> (G kilograms)	Primary Fuel Consumption ^d (Metric Tons)	Lubricant Norms ^e <u>1948</u> (Percent of Fuel Consumed)	Lubricant Consumption ^f (Metric Tons)	Gasoline Norms ^g <u>1948</u> (Percent of Fuel Consumed)	Gas Consumption ^h (Metric Tons)	Nonfield Work in Percent of Fuel Expended in Field Work ⁱ <u>1948</u>	Total Fuel Consumption in Field Work and Nonfield Work ^j	Storage Loss in Percent of Total Fuel and Lubricants Consumed ^k <u>1948</u>	Total POL Consumption Including State Farms ^l	Total POL Consumption Including State Farms ^m
Kerosene													
SOVET	46.4	102.54	19	1.95	10	0.20	1.5	0.03					
Universal	5.3	12.34	17	0.31	10	0.03	1.5	0					
NATI	26.9	59.4	17.2	1.02	11.5	0.12	3	0.03					
Total	81.6	180.3		3.28		0.35		0.06	7.8	3.56			
Ligroine	10.9	24.1	17.5	0.42	10	0.04	1.5	0.01					
Diesel	6.7	14.8	11.5	0.17	17	0.03	3	0	13.2	0.20			
Total	22.2	53.2		0.61		0.07		0.07	13.2	0.20	5	4.91	5.92

a. Computed as the percent of total soft-plowing units as given in Table 34.
 b. This is the average amount of fuel consumed per soft-plowing unit for each type of tractor in the MTS's for the USSR as a whole.
 c. The product of columns 2 and 3 is given in column 4. This represents the direct expenditure of distillates, excluding gasoline for the starter engines - columns 7 and 8 -- in field work on the MTS's.
 d. Lubricant norms are computed as a percentage of distillate consumed.
 e. Column 5 as a percent of column 4.
 f. Column 6 as a percent of column 4.
 g. This represents the percent of total distillate consumption in nonfield work.
 h. According to the data in column 9, the kerosene expended in field work -- 2.06 million tons in column 4 -- represents only 92.2 percent of total kerosene consumption on the MTS's. The figures for ligroine and diesel consumption appearing in column 10 are similarly derived.
 i. This is a minimum allowance for losses in storage.
 j. Represents 105 percent of the sum of columns 6, 8, and 10 and consequently represents the total consumption of distillates and lubricants by the MTS's.
 k. Since the State Farm Tractor Park has maintained an almost constant ratio to that of the MTS's, (see Table 30) it is assumed that column 10 represents 86 percent of total POL consumption of the agricultural tractor park. Consequently, column 13 has been calculated in this manner and represents total POL consumption of both the MTS's and the State farms.

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APPENDIX D

PLANNED AND ACTUAL ALLOCATION OF TRACTORS TO AGRICULTURE

From the data given by Voznesenskiy, 131/ the February 1947 Plenum, and the Fourth Five Year Plan, it is possible to construct an index of planned tractor production, and planned allocation to agriculture, with an estimated margin of error of not more than plus or minus 5 per cent. Table 46 shows planned and actual production and allocation of tractors to agriculture. There seems to be a slight discrepancy in

Table 46

Planned and Actual Production and Allocation
of Tractors to Agriculture
1946-50

	Thousand Units				
	<u>Planned Physical</u>				
	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>
Production	17.0	44.0	75.5	100.0	112.0
Allocation to Agriculture	17.0	41.5	67.5	91.0	108.0
	<u>Planned 15-Horsepower</u>				
Production	33.5	93.0	180.0	235.0	272.0
Allocation to Agriculture	33.0	87.0	152.0	204.0	244.0
	<u>Actual Physical</u>				
Production	13.1	27.8	56.9	86.2	104.0
Allocation to Agriculture	13.1	25.9	53.0	70.6	82.4
	<u>Actual 15-Horsepower</u>				
Production	27.9	66.5	137.6	198.8	244.9
Allocation to Agriculture	27.9	58.3	118.9	150.0	180.0

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the planning data for 1950, the difference between production and allocation in physical units being not sufficiently large to account for the difference in 15-horsepower units. Nevertheless, the general trend appears quite clear that the original plan provided for the allocation of a larger share of 1949-50 production for agriculture than was actually allocated. The only known explanation is that there was a change in priorities, and, as has been pointed out in the text, the timber industry definitely received more tractors than originally scheduled. It is also possible that the "Great Projects" were actually started prior to the original planned date.

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APPENDIX E

METHODOLOGY

The methodology for the major part of this report is embodied in the text. Methodology for individual tables follows in this appendix.

A. General Methodology and Appraisal of Tables 24, 25, and 26.

Table 26 is a composite of yearly production estimates drawn up for each Soviet tractor plant. Official Soviet indexes were applied to the yearly total production figures after the plant-by-plant estimates had been made. Although the yearly totals varied slightly (maximum variance, approximately plus or minus 3 percent) from the Soviet index, no effort was made to alter the totals, because of the composite nature of their make-up and the fact that the variance from the index was not significant. The data on which the plant-by-plant estimates are based were generally more accurate in showing total plant production up to a given date than in showing the level of production during a monthly or quarterly time period. Thus, in Table 26, a figure for total production at a plant over a 3- or 4-year time period will generally be more accurate than any single segment within that time period. The aggregate production figures in Tables 25 and 26 are believed accurate to within 2 percent. All conversions from physical units to 15-horsepower units were made in accordance with Soviet methodology.

Total Soviet tractor production for the period 1946 through 1949 has been announced at 430,000 15-horsepower units. 132/ The estimates in these tables total 430,700 units for that period.

Official Soviet indexes of tractor production are as follows 133/:

	1946=100								
	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>
Production	58 a/	100	209	426	661	813	780 a/	835 a/	944 a/
Percent as of Preceding Year		172	209	204	155	123	96 a/	107	113

a. Estimated. All other figures are official Soviet figures.

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A detailed production graph, utilizing all available information, was drawn up for each of the tractor plants appearing in Table 26. Types of data were as follows: (1) official Soviet announcements that a certain tractor (for example, the ten thousandth) has been completed at a particular plant on a certain day; (2) official Soviet announcements of 1 year's production at a plant as a percentage of a previous year's production; (3) 1 year's production at a plant as a percentage of an earlier year's production (for example, the year 1940); (4) the officially announced plan for production for a given period, with a subsequent announcement indicating the percent of fulfillment; and (5) serial number data appearing in various open-source publications such as Soviet parts catalogues and agricultural journals and newspapers. There was considerable information of the types for each of the plants involved. Combining the various kinds of information into a single chart for each plant, therefore, resulted in plant-production figures of considerable accuracy. Interpolation and extrapolation were utilized to fill gaps between known information, and, where necessary, to project production trends. The primary sources for the information used to compile production tables for each of the plants will be found in the footnotes to the tables.

B. Methodology for Tables 27 and 28.

The official Soviet automobile and tractor journal outlined the tractor goals of the Fifth Five Year Plan as follows:

"The growth of the production of tractors (1955 over 1950) is specified at 19 percent. By the Ministry of the Automobile and Tractor Industry, the production of tractors will increase by 47 percent, in which the production of diesel tractors will increase by 57.2 percent." 134/

The relative proportions expressed in the foregoing statement are such that the percentages involved apply reasonably only when 1950 production in terms of 15-horsepower units is used as the base. Using 1950 production in 15-horsepower units as the base, the following steps were carried out: (all calculations which follow are in terms of 15-horsepower units unless specified otherwise).

1. The figure of 292,000 units representing the 1955 goal for total production was derived by multiplying the 1950 figure of 245,000 by 119 percent. The Automobile and Tractor Ministry's portion of 1950 production (147,000) was multiplied by 147 percent, which

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results in a figure of 216,000 representing the 1955 goal for production by that Ministry. The difference between 292,000 and 216,000 is 76,000, which coincides almost exactly (76,000 against 77,000) with the current level of production at Chelyabinsk, which, in 1953, was the only tractor plant not located in the Ministry of the Automobile and Tractor Industry.

2. The Automobile and Tractor Ministry's production of diesel tractors in 1950 (105,000) was multiplied by 57.2 percent, which yields a total of 165,000, which represents the 1955 goal for diesel tractor production by the Automobile and Tractor Ministry. The Ministry's diesel tractor goal was subtracted from its total goal to derive a figure of 51,000, representing nondiesel production.

3. Production of nondiesel tractors at the Vladimir plant (U-2 and 4), the Khar'kov Assembly Plant (KhTZ-7), and the Minsk plant (KT-12) was estimated in physical units on the basis of known planned capacities, and the physical unit totals were converted to 15-horsepower units deriving a figure of 30,000. This figure was subtracted from the nondiesel goal of 51,000, leaving a residual of 21,000 representing production goals in 1955 for gas generator tractors (GT-58 model) manufactured at the Khar'kov, Stalingrad, and Altai plants. The gas generator total was converted to physical units and subtracted from the current level of DT-54 production at the 3 plants, leaving a residual of 49,000 physical units of the diesel DT-54, as the diesel goal of the 3 plants in 1955. The 49,000 physical unit figure was converted to 15-horsepower units (118,000) and subtracted from the Ministry's 1955 diesel tractor goal of 165,000. The residual of 47,000 was portioned among the Lipetsk (KD-35), Minsk ("Belarus"), and Vladimir (VTZ-T24) plants, using the production goals outlined in the September 1953 agricultural decrees to determine the ratio of production between the 3 plants.

4. The revised production goal for 1955 has been estimated on the basis of information released in the September 1953 agricultural decrees. The Ministry of Machine Building, Ministry of Transport and Heavy Machine Building, Ministry of the Defense Industry, and Ministry of the Aviation Industry are called upon to supply agriculture with not less than 500,000 general-purpose tractors (expressed in 15-horsepower units) and 250,000 row-crop tractors (expressed in physical units), during the period 1954 to 1 May 1957. ^{135/} The row-crop tractor goals were outlined in detail in another of the decrees and are given in Table 27 as they appeared in the decree. ^{136/}

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S-E-C-R-E-TC. Methodology and Sources for Tables 30, 31, and 32.

The methodology and sources for Tables 31 and 32 are outlined together because of their close interrelation and interdependence. Considerable data used in one or the other of the tables have been used for calculations in the other.

1. Size and Composition of the 1940 MTS's Park.

Table 47 outlines the structure of the 1940 MTS's park by tractor model in percentages of the total 15-horsepower units on the MTS's 137/:

Table 47

Size and Composition of the MTS's Tractor Park
1940

Year	Percent of Total MTS's Tractor Horsepower								
	Wheeled			Caterpillar					
	SKhTZ- NATI	U-1	Total	ChTZ- S-60	ChTZ- S-65	STZ- NATI	SG- T2G	SG- 65	Total Caterpillar
1940	47.0	9.0	56.0	22.0	7.0	11.0	3.0	1.0	44.0

The total 15-horsepower units on the MTS's at the end of 1940 were 557,000. 138/ The percentages in Table 47 were applied to the MTS's 15-horsepower unit total, and then the portions were each converted from 15-horsepower units to physical units according to Soviet conversion factors and methodology. 139/ There were 435.3 thousand physical units in the 1940 MTS's tractor park. 140/ Table 48* shows the composition of the 1940 MTS's park.

2. Size and Composition of the 1940 Non-MTS's Park.

A physical unit figure of 88,000 was derived for the 1940 non-MTS's park by subtracting the 1940 MTS's physical unit figure of 453,000 from a figure of 523,000, which represented the total number

* Table 48 follows on p. 81.

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Table 48

Structure of the MTS's Tractor Park
1940

Thousand Units										
Model	Wheeled			Caterpillar						Total Park
	SKhTZ- NATI	U-1	Total	ChTZ- S-60	ChTZ- S-65	STZ- NATI	T2G	SG- 65	Total	
15-horse- power	262	50	<u>312</u>	123	39	61	17	5	<u>245</u>	<u>557</u>
Physical	267	76	<u>343</u>	39	12	30	9	2	<u>92</u>	<u>435</u>

of tractors in all of Soviet agriculture in 1940. 141/ A non-MTS's 15-horsepower unit total was similarly calculated as a residual from a total agricultural park figure of 683,000 15-horsepower units. 142/

Within the 88,000 total, the breakdown of 72,000 wheel-type tractors (equaling 54,000 15-horsepower units) was derived by projection of ratios which existed in the 1938 non-MTS's park. 143/

3. Composition of the Total Soviet Agricultural Tractor Park, 1940.

From the data in paragraphs 1 and 2 above, Table 49 is derived:

Table 49

Agricultural Tractor Park of the USSR
1940

Thousand Units							
Unit	MTS's			Non-MTS's			Total Park
	Wheeled	Cater- pillar	Total	Wheeled	Cater- pillar	Total	
15-horse- power	312	245	<u>557</u>	72	54	<u>126</u>	<u>683</u>
Physical	343	92	<u>435</u>	72	16	<u>88</u>	<u>523</u>

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The purpose of calculating wartime losses is to estimate the composition and number of physical units contained in the 1945 tractor park. The total 1945 park in terms of 15-horsepower units (469,000) has been calculated with considerable accuracy by extrapolation from data covering the 1946-53 period, but those data do not indicate the composition or number of physical units in the park. The methodology for calculating wartime losses is centered upon determining losses in the wheel-type tractor category. The 1945 track-laying tractor park was then calculated as a residual resulting from subtracting the wheeled-tractor total from the estimated total 1945 tractor park.

The wheel-type tractors were used as the base because production of such tractors had ceased in the USSR by 1939. The 1940 figures, therefore, represent a stable base from which to calculate.

During World War II 137,000 tractors were destroyed or looted by the occupying forces in the occupied regions of the USSR. 144/ Seventy-five percent (102,000 tractors) of the 137,000 tractors thus lost are estimated to have been wheel-type tractors. A factor of 75 percent has been used because it is known that the Soviet Army requisitioned many caterpillar tractors from agriculture immediately after outbreak of hostilities for military uses (therefore, they would not be in the "... looted by occupying forces ..." category); and, further, the fact that the type of tractor least likely to have been included in evacuation planning and movement to Eastern areas, would have been the smaller wheel-type tractors. It is estimated that, in addition to direct losses to the Germans, approximately 10 percent of the remaining wheel-type tractors in Soviet agriculture were rendered non-usable due to other causes during the war. A factor of 10 percent represents the closest approximation that can be drawn from available data. Ten percent of the 313,000 wheel-type tractors remaining (415,000 prewar minus 102,000 lost to the Germans) in the non-occupied Soviet agriculture equals 31,300 tractors. Thus, total wartime losses in the wheel-type category are estimated at 133,000 tractors. If 133,000 tractors are subtracted from the prewar wheel-tractor park of 415,000, a figure of 282,000 is derived which represents the total number of wheeled tractors remaining in Soviet agriculture at the end of the war.

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The 282,000 figure, representing wheel-type tractors, was converted at the 1940 ratio of wheeled tractors to 15-horsepower units (.94 15-horsepower units per wheel tractor), to derive a post-war total of 265,000 15-horsepower units in the wheel-type category. The wheeled tractors were then divided at the prewar ratio of SKhTZ's to Universals to derive a 1945 figure of 236,000 SKhTZ wheeled, general-purpose tractors and 46,000 Universal row-crop tractors.

The figure of 265,000 15-horsepower units (wheel-type) was subtracted from the 469,000 15-horsepower units over-all agricultural total (see paragraph 6, below, for derivation of the 469,000 figure) to derive a figure of 204,000 15-horsepower units, which represents the total 15-horsepower units in the track-laying tractor category in Soviet agriculture as of 1 January 1946.

The 1942-45 production of 20,000 15-horsepower units was subtracted from the 204,000 15-horsepower unit figure, above, to derive a figure of 184,000 15-horsepower units which is the total 15-horsepower units represented by prewar track-laying tractors in Soviet agriculture on 1 January 1946.

The 184,000 15-horsepower unit figure was converted to physical units at the 1940 ratio of track-laying tractors to 15-horsepower units (2.66 15-horsepower units per track-laying tractor), to derive a 1 January 1946 total of 69,000 prewar track-laying tractors in Soviet agriculture.

Division of the 1945 tractor park between the MTS's and non-MTS's was done on the basis of 1940 ratios.

From the foregoing calculations, Table 50 is, thus, derived:

Table 50

Agricultural Tractor Park of the USSR
31 December 1945

Unit	Thousand Units							Total Park	
	MTS's			State Farm (Sovkhoz)					
	Wheeled	Caterpillar	Total	Wheeled	Caterpillar	Total	Total		
	SKhTZ- NATI	U-1		SKhTZ- NATI	U-1				
Physical 15-horse- power	192	41	64	297	44	5	14	63	360
	192	26	167	385	44	3	37	84	469

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Division of each year's total agricultural allocation between the MTS's and non-MTS's was made at a ratio of 82 percent of the 15-horsepower units to the MTS's and 18 percent to the Sovkhozes. This is based on the known ratio of the size of each tractor park to the other for the years 1940, 1952, and 1953. The Fourth Five Year Plan directives specified that the MTS's were to receive 290,000 tractors of the planned 325,000 total to be delivered to all of agriculture during the period 1946-50. ^{145/} Judging from the known composition of the park, the MTS's apparently received fewer small-wheeled tractors than had been originally planned, therefore, they received a smaller percentage of the total horsepower than is indicated in the planned allocation.

6. Retirement Calculations 1946-53.

Yearly retirement figures were calculated as residuals by subtracting the yearly net increases in each tractor park from the yearly allocations. Yearly allocations have been taken from official Soviet announcements. Retirement figures, therefore, have the same accuracy as do the individual park estimates.

7. Retirement Estimates for 1954 and 1955.

The estimated 1954 and 1955 MTS's retirements are based upon the probability that a majority of the prewar tractors are to be retired by the end of 1955. In view of the large increase in the agricultural tractor allocations, outlined for 1954, 1955, and 1956, in the September 1953 decrees, and the modest goals previously outlined in the Fifth Five Year Plan for the 1955 MTS's park (50 percent over 1950), it is believed highly probable that the prewar tractors will be retired. The 1954 and 1955 retirement figures in Tables 31 and 32 are based upon that assumption. The Sovkhoz retirement figures for 1954 and 1955 are based on the probability that most of the prewar tractors will be retired by the end of 1955.

8. General Appraisal of Tables 30, 31, and 32.

The yearly park totals are believed to be accurate within less than + 4 percent. The 1953 estimate is based upon an official March 1954 figure and, therefore, should be accurate within 1 percent.

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There will be a compensating factor in any error which might occur in the division of allocations between MTS's and Sovkhozes in that the total agricultural allocation figures for each year are accurate within 1 percent and any error in one direction (plus or minus) in division of the allocation will be compensated for by an error in the opposite direction for the other park. The MTS's park figures are believed accurate to within ± 3 percent in that the 1940, 1946, and 1953 totals are officially accepted Soviet figures. The total increment and retirement for 1946 - 1953 should be accurate within ± 3 percent. Table 30, which is a composite of Tables 31 and 32, is believed accurate in its yearly figures to within ± 3 percent.

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APPENDIX F

GAPS IN INTELLIGENCE

Within the framework of this report there are no significant gaps in intelligence. The focus of this report has been on production, distribution, and utilization of tractors in the USSR. Soviet open-source literature provides copious information on all three of the major categories mentioned above.

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