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ECONOMIC INTELLIGENCE REPORT

AGRICULTURAL LABOR IN THE USSR

CIA/RR 39
31 August 1954

CENTRAL INTELLIGENCE AGENCY

OFFICE OF RESEARCH AND REPORTS

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CIA/RR 39

(ORR Project 45.268)

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Office of Research and Reports

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AGRICULTURAL LABOR IN THE USSR*

Summary

Total man-day inputs in Soviet agriculture in 1951 are estimated to exceed 9.5 billion man-days. These inputs are over 200 million man-days, or 2.3 percent less than those in 1938.** Labor inputs by 1953, however, were above both the 1938 and the 1951 levels. Total 1953 inputs are estimated to exceed 9.8 billion man-days.

Field and animal husbandry combined consumed the great proportion of the required labor. Thus, in 1951, total husbandry required 7.9 billion man-days, about 3 percent below the 1938 level of 8.1 billion. Labor inputs in husbandry in 1953, however, had mounted to the 1938 level.

Labor efficiency in sown crops in 1951 was slightly below the level of 1938. A total of 24.98 man-days per sown hectare was required in 1951 compared to 24.89 man-days in 1938. By 1953 labor efficiency was slightly above the 1938 level. In 1953 24.76 man-days were required per sown hectare. Despite the apparent stability of labor efficiency in total sown crops there have been gains and losses as between crops. Total labor savings in 1951 over 1938 amounted to about 158 million man-days, because of increases in mechanization. Gains in efficiency registered by labor for most grain crops, potatoes, cotton, hemp, sunflowers, and hay crops were offset by losses of labor efficiency (labor added) for corn, rice, fruits, sugar beets, flax, the minor oil crops (including soya beans), and the silage crops and feed roots. Apparently the achievement of increased production among these latter crops was regarded as more important than the reduction of man-power.

* The estimates and conclusions contained in this report represent the best judgment of the responsible analyst as of 1 July 1954.
** All references in this report to Soviet agricultural statistics for 1938 are in terms of the area included within the postwar boundaries of the USSR.

Of the total 9.5 billion man-days expended in 1951, 7.2 billion man-days were expended in the socialist sector (6.2 billion on the kolkhozy and 1 billion on the sovkhozy) and 2.3 billion man-days were expended on the individual plots (1.8 billion on the plots of the kolkhozniki and 0.5 billion on the plots of workers and employees).

In 1938, labor expenditure in Soviet agriculture included almost 1.5 billion man-days spent by about 9.6 million private peasant farmers. By 1951 these farmers and their farms had been collectivized. The decline in this sector of individual agriculture was largely offset by increases from 1938 to 1951 of 15 percent in kolkhoz labor inputs, of 29 percent in sovkhoz labor inputs, and of 47 percent in the part-time farming (on plots) of about 17 million workers and employees.

By converting man-days to man-years, a total labor force of 54.8 million man-equivalents can be estimated for Soviet agriculture in 1951 as compared with about 56.3 million man-equivalents in 1938. By 1953 the total had surpassed the 1938 level to reach 56.6 million man-equivalents. When the part-time operations of workers and employees are excluded from these figures, the labor force proper for 1951 is estimated to be 51.4 million compared with 54 million in 1938. By 1953 the labor force proper had increased to 53.1 million workers.

Permanent salaried staff workers on the sovkhozy numbered almost 2 million workers and employees in 1951 compared with 1.5 million in 1938. Similar machine tractor station (MTS) workers totalled almost 1 million in 1951 compared with 817,000 in 1938. The kolkhozniki numbered 48.1 million in 1951 compared with 41.7 million in 1938.

I. Introduction.

The agricultural labor force in the USSR is a subject about which little has been published in the postwar period. The readiness of the Soviet press to boast of the extent and the capabilities of the industrial labor force contrasts markedly with its reluctance to release data which might reveal total numbers of agricultural workers or of man-days worked per year per worker.

Scattered references in newspapers and journals to labor force data for agriculture apply to limited areas, often within an oblast, or more often to a single collective or state farm.

This report makes two major contributions in data on agricultural labor for 1938 and 1951 which are of intelligence value. It provides, first, detailed distributions of man-day inputs for all the major agricultural activities. Second, it presents a detailed distribution of the persons employed in agriculture. Both of these contributions are new in the area of intelligence research.

These contributions are useful in several ways. By comparing man-day inputs per activity (labor required per hectare of wheat or per head of cows), an answer can be provided to the question of what changes in efficiency have taken place in agricultural labor in the USSR since the prewar period.

It is also possible to determine changes in labor productivity (yield per man-day or per man). With additional research effort it would be possible to derive the labor cost factor for a study of costs of production in agriculture. It is easier to evaluate future Soviet progress in agricultural efficiency and productivity, the urgency of which was emphasized in the August and September speeches 1/* of Malenkov and Khrushchev, in the subsequently adopted farm programs of the Soviet republics, and in frequent progress reports since late 1953.

This report is also useful in providing a more positive estimate of the total agricultural labor force than has been heretofore available for the USSR. The method used in determining currently published estimates is to derive agricultural labor as a residual of the total labor force, the latter being derived from age and sex estimates of the Soviet population. 2/ Since data on industrial labor are published in the Soviet press, total agricultural labor may be estimated by subtraction.

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The more positive methods employed in this study are based on man-day input requirements. They yield estimates both of the total agricultural labor force and, more significantly, of labor by agricultural sector and type of worker. The complexity of the organizational inter-relations of the labor force in Soviet agriculture, measured in man-days, may be observed in the chart.*

The problem of estimating from man-day data the number of persons employed is complicated by the fact that the same man might work at various activities on the same day. For example, he might milk cows, drive a tractor in the field, cultivate his private garden plot after supper, and tally up after dark his month's labor expenditures, all on the same day. From summaries of man-day inputs for all activities, total personnel may be determined by agricultural sector. The determination is accomplished in terms of man-years. One man-year is equivalent to the number of man-days** worked per year per worker.

Explanations of two terms are desirable at this point. The first term is the "year." For the most part data apply to 1938 and 1951. Exceptions are noted. The 1938 data are in terms of the area included within the postwar boundaries of the USSR. The cut-off date of the agricultural year, 1938 or 1951, is the end of the year (December). The agricultural year, of course, begins with fall plowing in the preceding year. Labor force data in this study apply to the end of the year. This is contrary to the usual practice in population research of using first-of-the-year figures. According to the usual practice the labor force data of this study would be denoted 1939 and 1952 figures (first of the year).

The second term is the agricultural "sector." This is a farm sector, or a sector of agricultural organization in which work is accomplished on a type of farm. In the USSR there are two major sectors, the socialist and the individual. The socialist sector includes two subsectors, the kolkhoz or collective farm subsector and the sovkhoz or state farm subsector. A third type of organization might be described as a subsector but not as a farm.

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* The chart follows p. 4 .

** A "man-day" is a 10-hour day. 3/

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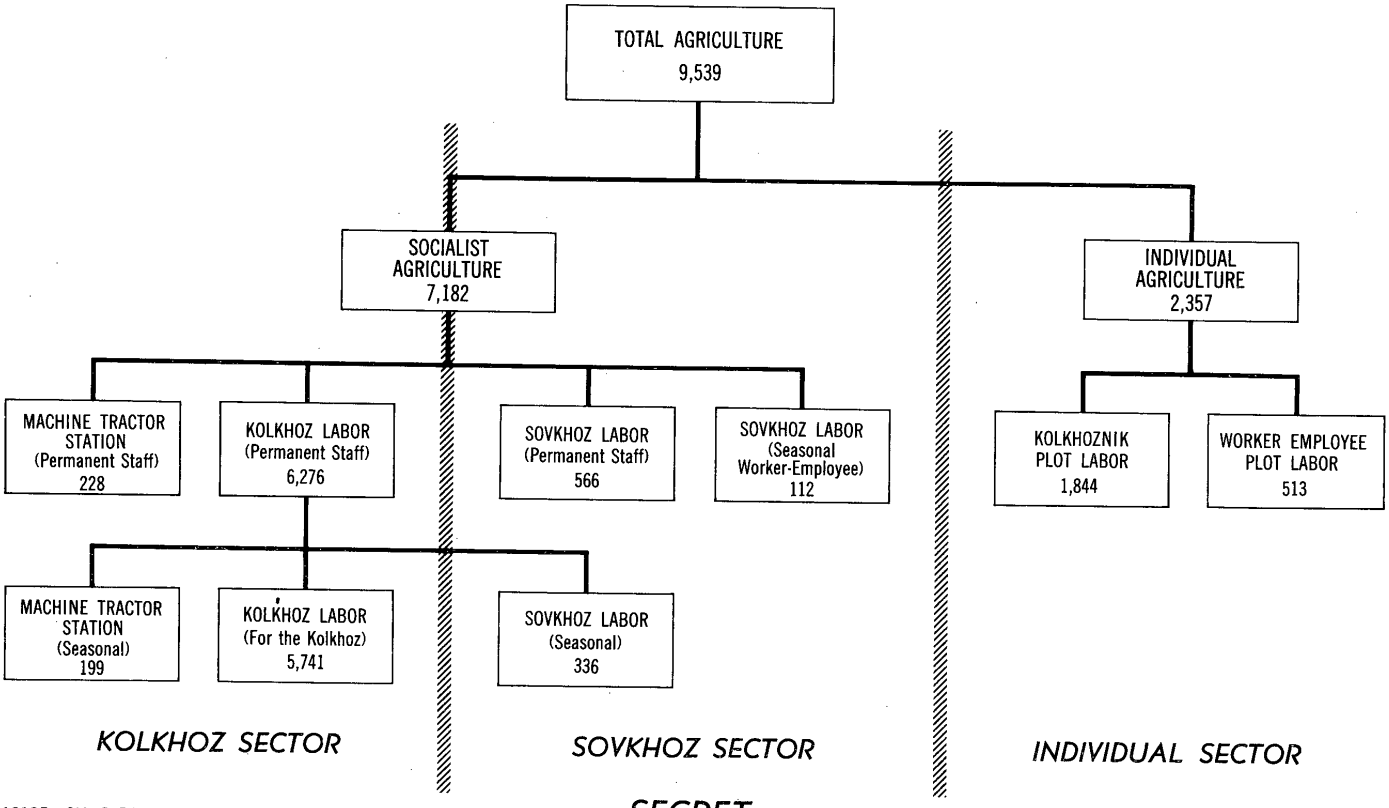
AGRICULTURAL LABOR FORCE

(Million Man-days Expended by Agricultural Sector.)

1951



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This is the machine tractor station (MTS), which was designed as a state device to play a leading role in the mechanization of the several kolkhozy in the vicinity of which it was established. The MTS, therefore, is included in the kolkhoz subsector. The individual sector includes the kolkhoznik plots, the worker-employee plots, and, before the war, the private peasant farms.*

II. Changes in Labor Inputs in Soviet Agriculture in 1951 Compared with 1938.

This section is divided into two parts. The first describes changes in labor inputs per crop and per type of livestock. The second analyzes changes in labor inputs by type of work per sector. The first part deals with one major category of work, husbandry, while the second deals with all categories.

A. Changes in Labor Inputs in Husbandry.

The labor inputs for each crop and type of livestock, 1938 and 1951, are shown below in Table 1** and Table 2*** respectively. These inputs are composite labor inputs. The usual practice of Soviet accountants in determining labor inputs for crops and livestock is to determine the inputs of only one type of labor. 4/ This is the labor of the kolkhozniki engaged in "horse-and-hand" methods for a particular crop or type of animal. Labor inputs for a crop or an animal which are associated with mechanical operations, such as tractor driving, are customarily regarded as MTS work. This accounting practice was adopted to distinguish clearly between kolkhoznik work for the kolkhozy and kolkhoznik work for the MTS.

The inputs in these tables are composites of inputs both in horse-and-hand work and in mechanical operations per crop or type of animal. They make allowance, furthermore, for the effect

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* These were negligible in number after 1950.
** Table 1 follows on p. 6.
*** Table 2 follows on p. 11.

Table 1

Man-Day Inputs in Field Husbandry in Soviet Agriculture
1951 Compared with 1938 a/*

Type of Field Crop	Man-Day Inputs Based on Hectare Requirements						Percent Increase in Man-Days per Hectare from 1938 to 1951
	1938			1951			
	Hectares (Thousands)	Man-Days per Hectare	Total Man-Days Required (Thousands)	Hectares (Thousands)	Man-Days per Hectare	Total Man-Days Required (Thousands)	
Grains							
Winter Crops							
Wheat	15,000	14.80	222,057	15,000	14.71	220,623	- .65
Rye	24,600	14.90	366,439	26,800	14.33	383,934	-3.83
Total Winter Crops	39,600	14.86	588,496	41,800	14.45	604,557	-2.77
Spring Crops							
Wheat	27,100	13.26	359,428	27,900	12.34	344,303	-6.95
Barley b/	10,760	12.37	133,074	8,800	12.64	105,921	-2.68
Oats	20,030	12.66	253,633	17,300	12.27	212,320	-3.08
Corn	4,050	16.82	68,127	2,900	17.43	50,556	+3.64
Rice c/	155	23.66	3,667	180	24.09	4,336	+1.82
Other d/	12,005	15.03	180,391	7,320	14.80	108,356	-1.49
Total Spring Crops	74,100	13.47	998,320	64,400	13.82	825,792	-4.82
Total Grains	113,700	13.96	1,586,816	106,200	13.47	1,430,349	-3.50

* Footnotes for Table 1 follow on p. 9.

Table 1

Man-Day Inputs in Field Husbandry in Soviet Agriculture
1951 Compared with 1938 a/
(Continued)

Type of Field Crop	Man-Day Inputs Based on Hectare Requirements: 1938 Hectares (Thousands)	1938 Man-Days per Hectare	1938 Total Man-Days Required (Thousands)	1951 Hectares (Thousands)	1951 Man-Days per Hectare	1951 Total Man-Days Required (Thousands)	Percent Increase in Man-Days per Hectare from 1938 to 1951
Fruits and Vegetables							
Fruits							
Orchard	1,292	8.00	10,336	845	8.00	6,760	0.00
Other e/	225	10.00	2,250	540	10.00	5,400	0.00
Total Fruits	1,517	8.30	12,586	1,385	8.78	12,160	5.82
Potatoes	9,001	66.27	596,535	9,470	65.54	620,682	-1.11
Vegetables	1,462	241.40	352,930	1,400	241.37	337,922	- .01
Cucurbits f/	627	181.40	113,740	600	181.37	108,823	- .02
Total Fruits and Vegetables	12,607	85.33	1,075,791	12,855	83.98	1,079,587	-1.58
Technical Crops							
Sugar Beets	1,289	138.56	178,608	1,336	142.06	189,795	2.53
Tobacco	208	53.05	11,034	206	53.00	10,918	-0.09

Table 1

Man-Day Inputs in Field Husbandry in Soviet Agriculture
1951 Compared with 1938 a/
(Continued)

Type of Field Crop	Man-Day Inputs Based on Hectare Requirements						Percent Increase in Man-Days per Hectare from 1938 to 1951
	1938			1951			
	Hectares (Thousands)	Man-Days per Hectare	Total Man-Days Required (Thousands)	Hectares (Thousands)	Man-Days per Hectare	Total Man-Days Required (Thousands)	
Oil-Bearing Crops							
Cotton g/	2,083	143.49	298,883	2,687	135.25	363,412	-5.74
Flax	2,503	85.12	213,051	2,100	85.52	179,597	.47
Hemp	691	83.87	57,957	608	83.72	50,903	- .18
Sunflowers	3,302	16.26	53,695	3,913	15.77	61,720	-3.00
Soya Beans	282	73.71	20,787	274	74.11	20,306	.54
Other Oil-Bearing Crops h/	1,015	73.70	74,802	1,023	74.06	75,767	.50
Total Oil-Bearing Crops	9,876	72.82	719,175	10,605	70.88	751,705	-2.66
Total Technical Crops	11,373	79.91	908,817	12,147	78.41	952,418	-1.88
Fodder and Forage							
Silage Crops	828	17.06	14,129	1,059	17.15	18,160	.50
Feed Roots	972	133.22	129,488	1,275	133.48	170,188	.20
Sown Grass	16,300	10.004	163,066	20,366	9.50	193,477	-5.04

Table 1

Man-Day Inputs in Field Husbandry in Soviet Agriculture
1951 Compared with 1938 a/
(Continued)

Type of Field Crop	Man-Day Inputs Based on Hectare Requirements: 1938 Hectares (Thousands)	1938 Man-Days per Hectare	1938 Total Man-Days Required (Thousands)	1951 Hectares (Thousands)	1951 Man-Days per Hectare	1951 Total Man-Days Required (Thousands)	Percent Increase in Man-Days per Hectare from 1938 to 1951
Fodder and Forage (Continued)							
Meadow Hay	58,300	5.005	291,780	66,506	4.80	318,916	-4.19
Pasture	348,000	1.00	348,000	348,000	1.00	348,000	0.00
Total Fodder and Forage	424,400	2.23	946,463	437,206	2.40	1,048,741	7.56
Total Sown Crops i/	155,780	24.89	3,878,107	153,902	24.98	3,844,179	.33
Total Crops	562,080	8.04	4,517,887	568,408	7.94	4,511,095	-1.26

a. The method for deriving the man-day data for this table is generally as follows: (1) Published figures (1937) on man-days per hectare were assembled for most crops. 7/ CIA estimates were used for rice, fruit crops, and for fodder and forage crops. The method involved in the use of Soviet figures for vegetables and cucurbits is a special problem which is explained in Appendix A, Part 2, Problem 1. (2) Savings of labor (in horse-and-hand work) per crop, due to increases in mechanization on the kolkhozy from 1938 to 1951, were then determined and subtracted for each crop for 1951. (See Appendix A, Part 1). Labor savings on the sovkhozy were assumed to be negligible from 1938 to 1951, since most sovkhoz operations were mechanized before the war. 8/ (3) Labor inputs per crop in work associated with mechanical operations were then calculated and added to derive the total man-days, both for 1938 and 1951, shown for each crop in this table. (4) Total inputs as determined by the preceding three steps were then divided by the total hectares per crop, for both 1938 and 1951, to derive the columns of figures on man-days per hectare in this table. The estimates for fruits and fodder and forage crops are probably less reliable than those for other crops. See Appendix A, Part 2, Problem 2 and Problem 3.

Table 1

Man-Day Inputs in Field Husbandry in Soviet Agriculture
1951 Compared with 1938 a/
(Continued)

b. About 10 percent of the barley crop is winter barley. As far as can be determined the error in lumping all barley as spring barley is very small.
c. Rice in the USSR is primarily dry field rice.
d. "Other" spring crops include grain legumes, millet, buckwheat, and similar crops.
e. "Other" fruits include vineyard crops and subtropical crops (tea, citrus, tung, and aromatics). Vineyard crops predominate, particularly since the war.
f. Cucurbits are field vegetables such as squash, pumpkins, cucumbers, melons, and similar crops which are grown on more extensive land areas than the usual truck garden varieties.
g. Allowance has been made for the different labor requirements of the hectares assigned to irrigated and nonirrigated cotton. (See Appendix A, Part 2, Problem 4).
h. "Other" oil-bearing crops include castor, mustard, camelina, and other similar crops.
i. Total sown crops include all crops listed, except meadow hay and pasture.

Table 2

Man-Day Inputs in Animal Husbandry in Soviet Agriculture
1951 Compared with 1938

Type of Animal	Man-Day Inputs Based on Head Requirements a/*						Percent Increase in Man-Days per Head from 1938 to 1951
	1938			1951			
	Head (Thousands)	Man-Days per Head	Total Man-Days Required b/ (Thousands)	Head (Thousands)	Man-Days per Head	Total Man-Days Required (Thousands)	
Horses							
Work Horses	12,875	30.00	386,250	8,864	30.00	265,920	0
Others	7,025	21.00	147,525	4,836	21.00	101,556	0
Total Horses	19,900	26.82	533,775	13,700	26.82	367,476	0
Cattle							
Cows	26,640	46.00	1,225,440	24,200	45.937	1,111,672	- .14
Others	32,560	21.00	683,760	33,000	21.00	693,000	
Total Cattle	59,200	32.25	1,909,200	57,200	31.55	1,804,672	-2.17
Swine							
Adults (9 months or older)	7,332	21.70	159,104	5,591	21.70	121,325	0
Shoats (4 to 9 months)	10,396	16.70	173,613	7,929	16.70	132,414	0
Piglets	13,872	11.20	155,366	10,580	11.20	118,496	0
Total Swine	31,600	15.45	488,083	24,100	15.45	372,235	0

* Footnotes for Table 2 follow on p. 12.

Table 2

Man-Day Inputs in Animal Husbandry in Soviet Agriculture
1951 Compared with 1938
(Continued)

Type of Animal	Man-Day Inputs Based on Head Requirements a/						Percent Increase in Man-Days per Head from 1938 to 1951
	1938			1951			
	Head (Thousands)	Man-Days per Head	Total Man-Days Required b/ (Thousands)	Head (Thousands)	Man-Days per Head	Total Man-Days Required (Thousands)	
Sheep and Goats							
Adults (9 months or older)	46,053	4.00	184,212	62,370	3.995	249,165	-.13
Lambs and Kids	27,047	3.00	81,141	36,630	3.00	109,890	0
Total Sheep and Goats	73,100	3.63	265,353	99,000	3.63	359,055	0
Poultry c/							
Chickens	183,000	2.00 d/	366,000	207,730	2.00 d/	415,460	0
Others	55,000	1.00 d/	55,000	62,270	1.00 d/	62,270	0
Total Poultry	238,000	1.77 d/	421,000	270,000	1.77 d/	477,730	0
Total Animals			3,617,411			3,381,168	

a. Animals in each category of livestock, except in cattle and poultry, are distributed by age for both 1938 and 1951 according to constant percentage relationships prevalent in 1938. The data for the numbers of poultry may be regarded as being less reliable than those for other types of livestock.
b. All the data on 1938 man-day requirements, except those for poultry, were taken from published sources for 1937. 9/ Since mechanization in animal husbandry was at a very low level before the war, man-day inputs on animals in 1938 are regarded as labor only in horse-and-hand work. [redacted] the types and numbers of facilities which were regarded as elements of mechanization in

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Table 2

Man-Day Inputs in Animal Husbandry in Soviet Agriculture
1951 Compared with 1938
(Continued)

animal husbandry, 10/ and which were employed on kolkhoz livestock fermy on 1 January 1940. These include motor-driven windmills and pumps, water supply lines, automatic milkers, overhead trolleys (for manure), automatic water fountains for cows, and electroshearing apparatus for sheep shearing.

After the war, slight advances in mechanization occurred in animal husbandry, primarily for dairy fermy and for sheep. Labor savings because of increased mechanization totalled 1,528,000 man-days for cows, and 315,000 man-days for sheep. See Appendix A, Part 2, Problem 5 and Problem 6.

c. The numbers of poultry for 1938 [redacted] cites 183 million chickens for 1940 11/ and about 55 million other poultry (principally ducks and geese) for 1939. 12/ Poultry numbers for 1951 depend on a Soviet report for 1951 of a 14-percent increase in chickens over the number in 1940. 13/ This percentage applied to the 1940 chicken figure yields about 208 million chickens. The number of other poultry for 1951 is calculated on the basis of the percentage of other poultry in the poultry population in 1939. 50X1

d. [redacted] 14/ Requirements for other poultry were estimated as half those for chickens. 50X1

of labor savings* arising from increases in mechanization** in 1951 over 1938.

1. Changes in Total Inputs in Husbandry.

The two major branches of husbandry apparently experienced changes in labor inputs, 1951 as compared with 1938, which were at variance with each other. Table 1 shows that inputs in field husbandry in 1951 were slightly less than those in 1938, with over 4.5 billion man-days being expended for each year. The decline was only about 6 million man-days. In animal husbandry, according to data in Table 2, there was a larger decline of about 240 million man-days. Thus the labor expended in animal husbandry in 1951 was less than 3.4 billion man-days while in 1938 it was over 3.6 billion.

In field husbandry, a large decrease in inputs on grain crops was counterbalanced by increases in inputs on technical crops, and fodder and forage crops. These changes reflect in part corresponding changes in the hectares*** of these broad crop groupings. Thus only 106 million hectares of grains were sown in 1951 as compared with 114 million in 1938. For fruits and vegetables the number of hectares sown increased to about 12.9 million in 1951 as compared with about 12.6 million in 1938. For technical crops, the number of hectares sown advanced to 12.1 million in 1951 compared with 11.4 million in 1938. Finally, for fodder and forage crops, the total number of hectares rose to 437 million in 1951 as compared with 424 million in 1938.

* Labor savings [redacted] signify reductions in man-days required per hectare or per animal in the use of horse-and-hand methods which are accomplished through the introduction of machinery. 5/ The amount of labor saved in 1951 over requirements in 1938 totalled 158 million man-days. (See p. 75 below).

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** Soviet use of the term "mechanization" usually means in practice the employment of tractors and associated machines in agricultural operations such as plowing. Practically all Soviet statements of the percentage of mechanization involve the use of tractors. 6/ The use of electricity, however, is also included under the term.

*** One hectare is equivalent to 2.47 acres of land.

By crops, increases in total man-day inputs occurred for rye and rice among the grains; for vineyard crops* and for potatoes among fruits and vegetables; for sugar beets, cotton, sunflower, and other (minor) oil-bearing crops among the technical crops; and for silage crops, feed roots, and hay crops among the fodder and forage crops. These input increases, in part, result from increases in the numbers of hectares planted to these crops.**

The above increases in labor inputs may reflect Soviet concern for increased production of these crops, although increases in concern do not automatically result in increased production.*** The increased labor inputs for rye would certainly reflect the need of the growing population for more bread. Increased inputs for vineyard fruits, potatoes, sugar beets, cotton, sunflowers, and the minor oil-bearing crops would undoubtedly be due to Soviet interest in increasing the production and use of these crops for industrial and military purposes. Vineyard products, potatoes, and sugar beets are processed into industrial alcohol. Products derived from oil-bearing crops may be used for paints. Increases in labor inputs on fodder and forage crops probably reflect the government's interest in increasing the production of these crops for use in feeding the rapidly expanding kolkhoz herds. 15/

The declines in total man-day inputs in animal husbandry in 1951 as compared with 1938 reflect declines in the numbers of horses, cattle (notably cows), and swine. These declines outweigh the effects of large increases in numbers of sheep and goats and of poultry, primarily because labor inputs per head for these animals and fowls and small compared with those for horses, cattle, and swine.

Animal husbandry in the postwar USSR must have been a costly enterprise for socialist agriculture. World War II devastated a large proportion of this agricultural enterprise. 16/ The restoration of animal numbers, while rapid, has meant large investments (in the maintenance of young stock) and heavy sacrifices in

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* Vineyard crops constitute the major portion of "other" fruit crops.

** For some of these crops, such as rye, sugar beets, minor oil crops, and the silage and feed root crops, part of the increases in inputs are due to increases in man-days expended per hectare.

*** In reality, the 1951 production of vineyard fruits, potatoes, sunflowers, and fodder and forage crops was below that of 1938.

the supplies of current meat and milk products. Slaughterings, at the behest of state pressure, must have been kept at a minimum throughout the postwar years. But they could not have been kept at too low a level because the demands of a growing population, especially for beef and pork, probably would not permit it. The result, undoubtedly influenced by other causes* -- for example, low real wages for animal husbandry work 17/ -- has been that cattle and swine numbers, in particular, are not yet up to the 1938 level.

2. Changes in Man-Day Requirements Per Hectare and Per Head.

Certain important changes have occurred in labor-input efficiency** since 1938 in Soviet husbandry. These changes, which may be observed in the final columns of Table 1 and Table 2, reflect labor savings or labor losses in inputs per hectare or per head, as a result of increases in the use of machinery in work operations.*** Labor savings and an increase in efficiency are implied wherever a decrease in man-days per hectare or per head is observed in the tables listed above. Losses in efficiency are implied where an increase in man-days is observed.

Few increases in labor-input efficiency have apparently occurred in animal husbandry, and these have been minor advances. Increases in the mechanization of dairy fermy**** (in water supply and the milking of cows), and in the electroshearing of sheep have resulted in slight reductions in man-days per head of cows and of sheep respectively.

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* The decline in horse numbers since 1938 normally should have made more grain feed available for beef, dairy, and pork animals. This apparently has not occurred, however. The numbers of hectares of feed grains such as barley, oats, corn, and "other" spring grains have actually declined while numbers of hectares in food grains and technical crops have increased.

** In economic terms, "efficiency" is a relative concept referring to the allocation of cost factors including labor costs, over a period of time. By an increase in "labor efficiency" is meant a reduction in man-days per hectare of crops or per head of animals.

*** It should be made clear that labor savings apply to reductions in man-days required per hectare or per head of animals in horse-and-hand work as a result of the increased use of machinery. They are calculated principally for the kolkhozy.

**** A "ferma" in Soviet agriculture is a livestock section to which usually a brigade of workers is assigned. 18/

Most of the changes have occurred in field husbandry. The effect of these changes has not been great enough, however, to reduce the average man-days required per hectare of sown crops. Although there was a slight reduction in total man-days expended on total sown crops in 1951 compared with 1938, this reduction was caused by a corresponding reduction of about 2 million in the number of hectares sown. There was actually a loss in efficiency. Thus the average for 1951 was 24.98 man-days per hectare required for sown crops, while that for 1938 had been 24.89 man-days.

The 1951 average of man-days per hectare of sown crops appears to be only slightly below that required before collectivization,* when the peasants farmed without the numerous heavy tractors currently in use in agricultural areas.**

The large number of man-days required per sown hectare in Soviet agriculture since 1938 -- around 25 -- compares unfavorably with the number required on farms in the US. In the US the average for 1935-39 was less than 8 man-days per hectare of sown crops. This average was reduced by 1945-48 to less than 6 man-days. 21/

Shifts in efficiency between crops are the important changes occurring in labor efficiency in field husbandry. Savings in labor have been made for 12 of the 26 crops listed, losses for 8 crops, while little change was registered for six.

All types of grains, except corn and rice, required less labor per hectare in 1951 than in 1938. Labor savings were greatest among the spring crops, especially spring wheat. These savings were

* A recent Soviet publication 19/ states that in 1922-25 the number of man-days spent per hectare on private peasant farms was 20.8 per year. It is clear that this figure refers to labor on grain hectares, however. Since in 1938 the number of man-days per hectare of grain per year was about 14 (including labor by mechanical methods as well as horse-and-hand methods), the number of man-days expended in 1922-25 was, on the average hectare of sown crops, probably about 30 per year.

** According to Soviet data, the average tractor used in agriculture in the USSR had a draft of about 28 horsepower in 1951 compared with about 20 in 1940. 20/

primarily accomplished through the increased use of combines.* Decreases in labor inputs per hectare of winter wheat were achieved despite increases in deep plowing** on land fallowed for fall winter wheat sowing.*** Increases in the mechanization of plowing and sowing of corn,**** and of plowing, sowing, and harvesting of rice apparently did not result in reductions in man-days required per hectare of these crops.

Labor savings in the category of fruits and vegetables were accomplished primarily for potatoes, as a result of the increased mechanical plowing, sowing, and harvesting of potatoes.***** Labor in fruits as a group seems less efficient in 1951 than in 1938. Almost 6 percent more labor per hectare was required in 1951. This loss in efficiency is a reflection of the fact that a larger proportion of the hectares of fruit crops were in 1951 "other" fruit crops -- notably vineyard crops. These required 25 percent more man-days per hectare than the orchard fruit crops.

Labor in technical crops generally was more efficient in 1951 than in 1938. Thus, 78.4 man-days per hectare were expended on these crops in 1951 as compared with 79.9 in 1938. The increase in efficiency was due primarily to over-riding input reductions (per hectare) in cotton and sunflowers, almost 6 percent for cotton and 3 percent for sunflowers. The size of the savings for cotton is somewhat deceptive, because postwar cotton production in the USSR has been marked by a proportional increase in the hectares of nonirrigated

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* About half the man-days expended per hectare of grain crops are spent during harvest. See data provided in Appendix A. It is clear that advances in the mechanization of the harvesting processes for almost any type of crop are most important for reducing labor requirements. This is especially true for grains.

** Deep plowing is regarded in Soviet agriculture as plowing to a depth of 22-25 centimeters (8.7 to 9.8 inches). 22/

*** A Soviet monograph claims that deep plowing was carried out on 16.4 million hectares in 1951 compared to only 2.5 million hectares in 1950. Before the war, hardly any deep plowing was done in the USSR. 23/

**** In the USSR the mechanization of corn harvesting is in its infancy. 24/

***** Mechanical harvesting has been introduced only for potatoes, and then only on 6 percent of the kolkhoz potato hectares.

cotton.* These hectares require only half the man-days per hectare required for irrigated cotton.** The mechanization of sunflowers resembles that possible for grains generally, although there are more problems in their harvest mechanization.***

Mechanization of sugar beets and flax, particularly in harvest, apparently is at a lower level than it was before the war. Deep plowing has also increased for these crops and for soya beans and for other minor oil-bearing crops. These changes have been responsible for larger man-days inputs per hectare of these crops in 1951 than in 1938.****

Among the fodder and forage crops, input reductions per hectare of 5 percent were accomplished for sown grass and 4.2 percent for meadow hay. The savings were due primarily to large increases in mechanized hay-cuttings in 1951 over those in 1938.***** Apparently the large increases in kolkhoz herds of recent years and the resultant increase in feed requirements for the herds inspired the MTS to increase the hay areas cut by tractor-drawn mowers.

Although labor savings were effected in hay crops, labor was generally less efficient for total forage and fodder crops in 1951 than in 1938. Thus 2.4 man-days were required per hectare of these crops in 1951 as compared with 2.23 in 1938. This amounts to a loss in efficiency of 7.6 percent.

The size of the loss in efficiency among fodder and forage crops would seem to be due to the mathematical peculiarities of averaging. The average man-days required per hectare of fodder and forage are few for both 1938 and 1951. The absolute increase of .17 man-days per hectare of fodder and forage from 1938 to 1951

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* See Appendix A, Part 2, Problem 4.

** [redacted] in 1940 the kolkhozy used 160 man-days per hectare of irrigated cotton and that in 1937 the kolkhozy used 81.76 man-days per hectare of nonirrigated cotton. 25/ 50X1

*** Harvest of sunflowers in the USSR presents the problem of collecting the heads in baskets. Use of a regular grain combine would prematurely crush the seed from which oil is later extracted.

**** See Appendix A.

***** [redacted] tractors in 1938 participated in haying and the harvesting of flax and potatoes to the extent of less than 1 percent. By 1951 the MTS was cutting 27.7 percent of the natural and tame hay on the kolkhozy. 26/ 50X1

is also small, but it constitutes a relatively large increase as a percentage. An increase of .26 man-days per hectare of feed roots, on the other hand, represents a proportionately small increase because the total number of man-days required per hectare in both years is so large. Nevertheless this relatively small increase in man-days required per hectare of feed roots not only outweighs the labor saved for hay crops but is also responsible for the large loss in efficiency among total fodder and forage.

It follows that, while important advances in the labor efficiency on fodder and forage crops may be achieved by the increased mechanization of hay crops, much larger and probably more important advances could be achieved by mechanizing to a greater degree the various operations for feed roots. So far the USSR has made but little progress in mechanizing its labor-consuming crops such as potatoes, vegetables, cucurbits, sugar beets, and feed roots.*

B. Changes in Labor Inputs by Type of Work and Sector.

This section describes changes in inputs in Soviet agriculture by type of work and by sector. See chart above, for a pictorial description of the organization of Soviet agriculture by sector. Six tables** are used in this section. Table 3 provides changes for total agriculture; Tables 4-6, changes for the subsectors in socialist agriculture; and Table 7, changes for individual agricultural subsectors. Table 8 provides a comparison of the changes for all sectors.

There are three major types of work, as shown in Table 3 and subsequent tables. The first is labor in husbandry by horse-and-hand methods. This type does not include work involved in tractor or combine operations for husbandry. Labor in horse-and-hand methods may include labor in the use of kolkhoz-owned equipment and instruments. The use of the threshing machine may be regarded as the use of horse-and-hand methods.

* These are all vegetable-type crops that do best with deep plowing, a technique which is more labor-consuming than ordinary plowing. The cultivation of these crops in the USSR has required large inputs of hand labor. Harvesting machines apparently do more damage than good for most of these crops. The mechanization of these crops -- even in the US -- is at a relatively low level. Most of the harvesting, cultivating, and sowing machines for these crops are in experimental stages in the USSR.

** Table 3 follows on p.21; Table 4 on p.24; Table 5 on p.26; Table 6 on p.27; Table 7 on p.29; Table 8 on p.32.

Table 3

Man-Day Inputs in Soviet Agriculture,
by Type of Work, 1951 Compared with 1938

Type of Work	Man-Days Expended in Soviet Agriculture		Percent Increase from 1938 to 1951
	1938	1951	
Horse-and-Hand Work in Husbandry a/*			
Field Husbandry	4,123,064,000	4,048,775,000	- 1.80
Animal Husbandry	3,617,411,000	3,381,168,000	- 6.54
Total Horse-and-Hand Work in Husbandry	7,740,475,000	7,429,943,000	- 4.01
Other Work			
Farm Administration, Maintenance, etc. b/	1,590,233,804	1,601,916,315	.73
Work for Mechanical Operations c/			
Operations for Husbandry			
Tractor-Combine	296,827,115	347,571,542	17.10
Work Auxiliary to Tractor-Combine	97,995,659	114,748,621	17.10
Total Operations for Husbandry	394,822,774	462,320,163	17.10

* Footnotes for Table 3 follow on p. 22.

Table 3

Man-Day Inputs in Soviet Agriculture
by Type of Work, 1951 Compared with 1938
(Continued)

Type of Work	Man-Days Expended in Soviet Agriculture		Percent Increase from 1938 to 1951
	1938	1951	
Slack-Season, Communal Operations	38,793,539	45,425,534	17.10
Total Work for Mechanical Operations	433,616,313	507,745,697	17.10
Total Other Work	2,023,850,117	2,109,661,697	4.24
Total Work	9,764,325,117	9,539,604,697	-2.30

a. The data for husbandry in this table are different from those in Table 1 and Table 2, in which the data include man-days associated with mechanical operations as well as work in horse-and-hand methods. The data for husbandry in this table do not include man-days associated with mechanical operations.
b. "Farm Administration, Maintenance, etc." includes in addition to man-days expended in administrative and maintenance work, man-days expended in cultural services, subsidiary enterprises (such as blacksmith shops), road repairs for the state, conservation work, and other types of activities not related to husbandry. 27/
c. In Soviet accounting practice, mechanical labor for kolkhoz work is calculated separately from that for work directly related to horse-and-hand methods. The main purpose for this procedure is to determine the work productivity of the MTS workers supporting the kolkhozy. The work productivity or output of the MTS is determined on the basis of "soft-plowing" units, and not in terms of agricultural yield or value of the yield which might be attributed to mechanical operations. The soft-plowing unit is a common measure for comparing various agricultural operations in terms of the fuel expended by tractors on these operations.

Table 3

Man-Day Inputs in Soviet Agriculture
by Type of Work, 1951 Compared with 1938
(Continued)

One hectare of plowing of old land (plowed year after year) is taken as the standard. One hectare of sowing, for example, is normally equivalent to .3 soft-plowing hectare, because the fuel required is only .3 as much for the hectare of old-plowed land. 28/ Mechanical labor for the kolkhozy by the MTS apparently includes (1) all the work of permanent MTS staff members (salaried workers and employees) and of seasonal kolkhoznik tractor and combine operators; (2) all seasonal kolkhoznik labor in auxiliary support of tractor and combine operations (such as water and fuel hauling); and (3) other work by permanent MTS staff members which occurs during slack seasons (such as tractor overhauls, canal and road work, afforestation, and the like). The amount of this labor totals approximately 40 man-days per year per permanent staff worker. (See Appendix A for explanation and derivation.) It is not known just how the sovkhozy calculate work associated with mechanical operations. However, it is believed they use the same procedure as the MTS. Some of the work for the sovkhozy is performed by seasonal workers and employees. It is estimated that in 1938 such "seasonal" workers for the sovkhozy numbered 600,000, and "temporary" workers, in addition, numbered 400,000 more. 29/

Table 4

Man-Day Inputs in the Socialist Sector of Agriculture, by Type of Work 1951 Compared with 1938 a/*

Type of Work	Man-Days Expended in Socialist Agriculture		Percent Increase from 1938 to 1951
	1938	1951	
Horse-and-Hand Work in Husbandry			
Field Husbandry	3,170,030,800	3,423,044,000	7.98
Animal Husbandry	1,181,709,580	1,649,690,000	39.60
Total Horse-and-Hand Work in Husbandry	4,351,740,380	5,072,734,000	16.57 b/
Other Work			
Farm Administration, Maintenance, etc.	1,374,233,804	1,601,916,000	16.57 b/
Work for Mechanical Operations			
Operations for Husbandry			
Tractor-Combine	296,827,115	347,571,542	17.10
Work Auxiliary to Tractor-Combine	97,995,659	114,748,621	17.10
Total Operations for Husbandry	394,822,774	462,320,163	17.10

* Footnotes for Table 4 follow on p. 25.

Table 4

Man-Day Inputs in the Socialist Sector
of Agriculture by Type of Work
1951 Compared with 1938 a/
(Continued)

Type of Work	Man-Days Expended in Socialist Agriculture		Percent Increase from 1938 to 1951
	1938	1951	
Slack-Season, Communal Operations	38,793,539	45,425,534	17.10
Total Work for all Mechanical Operations	433,616,313	507,745,697	17.10
Total Other Work	1,807,850,115	2,109,661,697	16.69
Total Work	6,159,590,497	7,182,395,697	16.61

a. Socialist agriculture includes the kolkhoz and sovkhoz sectors. Data for individual agriculture are shown in Table 7.
b. The percent of increase in the man-day inputs in Total Horse-and-Hand Work in Husbandry is the same as that of the man-day inputs in Farm Administration, Maintenance, etc., because, as explained in the text, man-days for the latter are computed for both years at a constant percentage relationship to man-days for the former.

Table 5

Man-Day Inputs in the Kolkhoz Subsector of Soviet Agriculture, by Type of Work, 1951 Compared with 1938

Type of Work	Man-Days Expended in Kolkhoz Agriculture		Percent Increase from 1938 to 1951
	1938	1951	
Horse-and-Hand Work in Husbandry			
Field Husbandry	2,873,222,700	2,996,021,000	4.27
Animal Husbandry	943,722,500	1,367,544,000	44.91
Total Horse-and-Hand Work in Husbandry	3,816,945,200	4,363,565,000	14.32
Other Work			
Farm Administration, Maintenance, etc.	1,205,351,116	1,377,968,000	14.32
Work for Mechanical Operations			
Operations for Husbandry			
Tractor-Combine	241,881,868	291,960,096	20.70
Work Auxiliary to Tractor-Combine	79,855,822	96,388,841	20.70
Total Operations for Husbandry	321,737,690	388,348,937	20.70
Slack-Season, Communal Operations	31,612,522	38,157,448	20.70
Total Work for Mechanical Operations	353,350,212	426,506,385	20.70

Table 5

Man-Day Inputs in the Kolkhoz Subsector of Soviet Agriculture, by Type of Work, 1951 Compared with 1938 (Continued)

Type of Work	Man-Days Expended in Kolkhoz Agriculture		Percent Increase from 1938 to 1951
	1938	1951	
Total Other Work	1,558,701,328	1,804,474,385	15.77
Total Work	5,375,646,528	6,159,590,497	14.58

Table 6

Man-Day Inputs in the Sovkhoz Subsector of Soviet Agriculture, by Type of Work, 1951 Compared with 1938

Type of Work	Man-Days Expended in Sovkhoz Agriculture		Percent Increase from 1938 to 1951
	1938	1951	
Horse-and-Hand Work in Husbandry			
Field Husbandry	296,808,100	427,023,000	43.87
Animal Husbandry	237,987,080	282,146,000	18.56
Total Horse-and-Hand Work in Husbandry	534,795,180	709,169,000	32.61

Table 6

Man-Day Inputs in the Sovkhoz Subsector of Soviet Agriculture, by Type of Work, 1951 Compared with 1938 (Continued)

Type of Work	Man-Days Expended in Sovkhoz Agriculture		Percent Increase from 1938 to 1951
	1938	1951	
Other Work			
Farm Administration, Maintenance, Etc.	168,882,688	223,948,000	32.61
Work for Mechanical Operations			
Operations for Husbandry			
Tractor-Combine	54,945,247	55,611,446	1.21 a/
Work Auxiliary to Tractor-Combine	18,139,837	18,359,780	1.21 a/
Total Operations for Husbandry	73,085,084	73,971,226	1.21 a/
Slack-Season, Communal Operations	7,181,017	7,268,086	1.21 a/
Total Work for Mechanical Operations	80,266,101	81,239,312	1.21 a/
Total Other Work	249,148,789	305,187,312	22.49
Total Work	783,943,969	1,014,356,312	29.39

a. Increases in inputs on all types of mechanical operations are the same because relationships between all these types are held constant, 1938 and 1951. See Appendix A for an explanation of the methods used for deriving man-day inputs in work associated with mechanical operations.

Table 7

Man-Day Inputs in the Individual Sector of Soviet Agriculture, by Type of Work and by Individual Subsector, 1951 Compared with 1938

Type of Work	Man-Days Expended in Individual Agriculture by Individual Subsector a/* 1938	1951	Percent Increase from 1938 to 1951
Kolkhoznik Plots			
Horse-and-Hand Work in Husbandry			
Field Husbandry	510,402,025	489,649,000	-4.07
Animal Husbandry	1,304,452,915	1,354,921,000	3.87
Total Horse-and-Hand Work in Husbandry	1,814,854,940	1,844,570,000	1.02
Worker-Employee Plots			
Horse-and-Hand Work in Husbandry			
Field Husbandry	98,398,662	136,082,000	38.30
Animal Husbandry	251,481,018	376,557,000	49.74
Total Horse-and-Hand Work in Husbandry	349,879,680	512,639,000	46.52

* Footnote for Table 7 follows on p. 31.

Table 7

Man-Day Inputs in the Individual Sector of Soviet Agriculture, by Type of Work and by Individual Subsector, 1951 Compared with 1938 (Continued)

Type of Work	Man-Days Expended in Individual Agriculture by Individual Subsector a/ 1938	1951	Percent Increase from 1938 to 1951
Private Peasant Farms			
Horse-and-Hand Work in Husbandry			
Field Husbandry	344,232,513		-100.00
Animal Husbandry	879,767,487		-100.00
Total Horse-and-Hand Work in Husbandry	1,224,000,000		-100.00
Farm Administration, Maintenance, etc.	216,000,000		-100.00
Total Work on Private Peasant Farms	1,440,000,000		-100.00
Total Individual Agriculture			
Horse-and-Hand Work in Husbandry			
Field Husbandry	953,033,200	625,731,000	-34.34
Animal Husbandry	2,435,701,420	1,731,478,000	-28.91

Table 7

Man-Day Inputs in the Individual Sector of Soviet Agriculture, by Type of Work and by Individual Subsector, 1951 Compared with 1938 (Continued)

Type of Work	Man-Days Expended in Individual Agriculture by Individual Subsector a/		Percent Increase from 1938 to 1951
	1938	1951	
Total Horse-and-Hand Work in Husbandry	3,388,734,620	2,357,209,000	-30.44
Farm Administration, Maintenance, etc.	216,000,000		-100.00
Total Work	3,604,734,620	2,357,209,000	-34.61

a. See Appendix A, Part 2, Problem 7.

Table 8

Percent Increase in Man-Day Inputs in Soviet Agriculture, by Sector and by Type of Work 1951 Compared with 1938 a/*

	Socialist Sector			Individual Sector				
	Kolkhoz Agriculture	Sovkhoz Agriculture	Total Socialist Agriculture	Kolkhoznik Plots	Worker-Employee Plots	Private Peasant Farms	Total Individual Agriculture	Total Sectors
Horse-and-Hand Work in Husbandry								
Field Husbandry	4.27	43.87	7.98	-4.07	38.30	-100.00	- 34.34	-1.80
Animal Husbandry	44.91	18.56	39.60	3.87	49.74	-100.00	- 28.91	-6.54
Total Horse-and-Hand Work in Husbandry	14.32	32.61	16.57	1.02	46.52	-100.00	- 30.44	-4.01
Other Work								
Farm Administration Maintenance, etc.	14.32	32.61	16.57	N.R. b/	N.R.	-100.00	-100.00	.73
Work for Mechanical Operations								
Operations for Husbandry								
Tractor-Combine	20.70	1.21	17.10	N.R.	N.R.	N.R.	N.R.	17.10
Work Auxiliary to Tractor to Tractor-Combine	20.70	1.21	17.10	N.R.	N.R.	N.R.	N.R.	17.10
Total Operations for Husbandry for Husbandry	20.70	1.21	17.10	N.R.	N.R.	N.R.	N.R.	17.10

* Footnotes for Table 8 follow on p. 38.

Table 8

Percent Increase in Man-Day Inputs in Soviet Agriculture, by Sector and by Type of Work 1951 Compared with 1938 a/*
(Continued)

	Socialist Sector			Individual Sector				
	Kolkhoz Agriculture	Sovkhoz Agriculture	Total Socialist Agriculture	Kolkhoznik Plots	Worker-Employee Plots	Private Peasant Farms	Total Individual Agriculture	Total Sectors
Slack-Season, Communal Operations	20.70	1.21	17.10	N.R.	N.R.	N.R.	N.R.	17.10
Total Work for Mechanical Operations	20.70	1.21	17.10	N.R.	N.R.	N.R.	N.R.	17.10
Total Other Work	15.77	22.49	16.69	N.R.	N.R.	100.00	-100.00	4.24
Total Work	14.58	29.39	16.61	1.02	46.52	-100.00	- 34.61	-2.30

a. This table summarizes the percentages of increase contained in Tables 3-7.
b. N.R. means "not relevant."

In recent years there are references, however, to increases in mechanized threshing and in mechanized threshing floors.*

The second type of work is the labor involved in "farm administration, maintenance, etc." This type of labor is credited only to the kolkhoz, sovkhoz, and private peasant farm subsectors. It is derived as a percentage of a total of inputs which includes this type of labor and labor in husbandry work using horse-and-hand methods. The percentage is 24 percent for the kolkhozy and sovkhozy and 15 percent for the private peasants. 31/

The third type of work is associated with mechanical operations and breaks down into several different types. The method by which this type of labor is derived is explained in Appendix A.

1. Total Agriculture.

In 1951 the number of man-days expended in Soviet agriculture as a whole totalled about 9.5 billion, about 200 million -- or 2.3 percent -- less than the input figure for 1938. The decrease in man-days, as shown in Table 3, reflects the influence of decreased inputs of labor in horse-and-hand methods in field and animal husbandry, particularly in animal husbandry. There was an over-all decline for total horse-and-hand work in husbandry of about 4 percent, but in animal husbandry the decline was about 6.5 percent. The over-riding influence of declines in husbandry is due to the fact that inputs in husbandry constitute dominant proportions of the total inputs in agriculture for both years compared -- about 78 percent in 1951 and about 79 percent in 1938.

Labor inputs in mechanical operations in 1951 increased 17 percent over those in 1938, but these inputs were minor proportions of total inputs in both years -- 5.3 percent in 1951 and 4.4 percent in 1938. Total inputs in farm administration, maintenance, and similar work remained fairly stable over the compared years, with those in 1951 showing less than a 1-percent increase over those in 1938.

[redacted] over 19,000 mechanized threshing floors in use in the USSR in 1951. 30/ 50X1

Although there were sizable increases in inputs in this type of work for both socialist subsectors, there was a complete disappearance of inputs in it on the part of the individual subsectors, with the complete collectivization of all private peasants. The influence of these changes tended to balance out in the total.

2. Socialist Agriculture.

Changes in labor inputs in socialist agriculture may be observed in Tables 4-6. Those for total socialist agriculture are shown in Table 4, those for kolkhoz agriculture in Table 5, and those for sovkhoz agriculture in Table 6.

Labor inputs in total socialist agriculture in 1951 increased 16.6 percent over those in 1938. The increases in inputs in mechanical operations were slightly larger than average at about 17 percent in all the various categories. The greatest increase in inputs, however -- about 40 percent -- was registered in horse-and-hand work in animal husbandry, while the increase in inputs in field husbandry was only about 8 percent. It is clear that socialist agriculture, in particular the kolkhozy, has been expanding its emphasis on labor-consuming activities. Although inputs of the kolkhozy in grain crops have increased only slightly, inputs of the kolkhozy in technical crops and in silage and feed root crops have gone up more. These crops are more labor-consuming than grain crops. There has been a slight decrease in the number of horses on the kolkhozy (which require larger than average labor inputs among livestock) and only a slight increase in the number of sheep and goats (which require small labor inputs), but there has been a doubling of the number of cattle and swine (which require large labor inputs). Kolkhoz poultry numbers have doubled also, but these require little labor per head.

a. Kolkhoz.

On the whole, as may be seen from the data in Table 5, labor inputs in the kolkhoz subsector of socialist agriculture increased for the years compared -- from 5.4 billion man-days in 1938 to 6.2 billion in 1951, or 14.6 percent. The largest increase occurred

in animal husbandry, a 400-million-man-day increase or an increase of 45 percent. This contrasts with the 4.3-percent increase registered in horse-and-hand work in field husbandry. Mechanical (MTS) operations for the kolkhozy required a labor input for 1951 almost 21 percent greater than that for 1938.

b. Sovkhoz.

The sovkhozy expanded their labor inputs more rapidly than the kolkhozy. The former increased total inputs from about 784 million man-days in 1938 to over 1 billion in 1951, or about 29.4 percent. Contrary to the trend for the kolkhozy, the sovkhozy expanded their inputs most in horse-and-hand work for field husbandry -- an increase of 44 percent, compared with only a 19-percent increase for animal husbandry. This expansion in labor inputs in horse-and-hand work in sovkhoz field husbandry contrasts sharply with only a 1.2-percent increase in labor inputs in mechanical operations. Like the kolkhozy, the sovkhozy, particularly those outside the Ministry of State Farms*, are turning their attention to the production of labor-consuming crops, in particular to the production of potatoes, vegetables, and cucurbits.** This trend has been confirmed by reports of greater diversification in enterprises among the sovkhozy 33/ and of the use of sovkhoz farm land for experimentation.***

3. Individual Agriculture.

Labor inputs, 1938 and 1951, are shown in Table 7 below for the three subsectors in individual agriculture. It is characteristic of all subsectors of individual agriculture that husbandry operations**** almost completely predominate. It is also characteristic that animal husbandry assumes well over 70 percent

* Sovkhozy outside the Ministry of State Farms, which are connected with industries, are termed "subsidiary economies" in FBIS translations. They might better be called subsidiary farms.

** A Soviet publication reports that in 1944, 1,317,000 hectares were sown to potatoes and vegetables in "state economies." 32/ This figure, cut to 1,310,000 hectares, is carried for 1951 for sovkhozy.

*** A Soviet official document specifically speaks of sovkhozy as centers at which new agrotechnology is tested before it is channeled for productive use on the kolkhozy. 34/

**** Horse-and-hand work in husbandry.

of the total man-days expended in all sectors.

The labor inputs of two subsectors of individual agriculture -- the kolkhoznik and worker-employee plots -- are expended entirely on husbandry operations. In 1938, however, there were almost 10 million private peasants in the USSR.* These peasants were credited with over 200 million man-days expended on farm administration, maintenance, etc., an amount which is 15 percent of their total man-days.**

Individual agriculture has experienced a great decline since 1938. Thus labor inputs totalled about 3.6 billion man-days in 1938 compared with 2.4 billion in 1951, a decrease of 34.6 percent. Nevertheless individual agriculture is still a large part of the total labor in Soviet agriculture, about 25 percent of the total man-days spent compared with about 37 percent in 1938.***

The primary factor in the decline of the individual sector is the disappearance of the private peasant farm sector from 1951 Soviet agriculture. 36/ This subsector in 1938 required an input of almost 1.5 billion man-days in 1938. Labor inputs on the kolkhoznik plots increased from 1,815 million man-days in 1938 to 1,845 million in 1951, or an increase of about 1 percent. More attention is apparently being given to animal husbandry by the kolkhozniki at the present time than in 1938. There was actually a 4-percent decline in inputs in field husbandry, compared with a 4-percent increase in animal husbandry. This change in emphasis is apparently a reflection of the relative scarcity of meat and meat products for the Soviet population. 37/

The severity of the declines in individual agriculture was partially offset by large increases in labor inputs in husbandry operations on the worker-employee plots.**** The increase totalled about 46.5 percent. Thus inputs totalled only 350 million man-days on these plots in 1938, but 513 million in 1951. This increase was largely effected by the 50-percent increase in inputs in animal husbandry.

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* See Table 9 below, p. 38.

** This percentage is based on the experience of individual farmers in the US. 35/

*** See Table 3, for the total man-days spent in Soviet agriculture for 1938 and 1951.

**** See Appendix A, Part 2, Problem 7.

Table 9

Distribution of the Soviet Agricultural Labor Force,
by Type of Work and by Sector,
1951 Compared with 1938

Type of Labor per Sector	Distribution of Soviet Agricultural Labor Force						Percent Increase in Labor Force from 1938 to 1951
	1938			1951			
	Man-Days	Man-Days per Year a/*	Man-Years	Man-Days	Man-Days per Year a/	Man-Years	
Socialist Agricultural Sector							
Kolkhoznik Socialist Labor							
Seasonal MTS Labor	164,648,650 b/	N.R.	N.R.	198,737,580 b/	N.R.	N.R.	
Seasonal Sovkhoz Labor	260,113,172 c/	N.R.	N.R.	336,118,871 c/	N.R.	N.R.	
Kolkhoz Labor	5,022,296,316 d/	N.R.	N.R.	5,741,533,000 d/	N.R.	N.R.	
Total Kolkhoznik Socialist Labor	5,447,058,138	130.54 e/	41,727,000 e/	6,276,389,451	130.54	48,080,006	15.23
Sovkhoz Permanent Staff Labor	437,126,407 f/	288.00 f/	1,517,800 f/	566,197,818 g/	288.00	1,965,965	29.53
Sovkhoz Seasonal Worker-Employee Labor	86,704,390 c/	288.00 f/	301,057 f/	112,039,623 c/	288.00	389,026 f/	29.22
MTS Permanent Staff Labor	188,701,562 h/	231.10 h/	816,536 h/	227,768,805 i/	231.10	985,585	20.70
Total Socialist Agricultural Sector Labor	6,159,590,497	138.85	44,362,393	7,182,395,697	139.68	51,420,582	15.91

* Footnotes for Table 9 follow on p. 39.

Table 9

Distribution of the Soviet Agricultural Labor Force,
by Type of Work and by Sector,
1951 Compared with 1938
(Continued)

Type of Labor per Sector	Distribution of Soviet Agricultural Labor Force: 1938 Man-Days	1938 Man-Days per Year a/	1938 Man-Years	1951 Man-Days	1951 Man-Days per Year a/	1951 Man-Years	Percent Increase in Labor Force from 1938 to 1951
Individual Agricultural Sector							
Kolkhoznik Plot Labor	1,814,854,940	j/	j/	1,844,570,000	j/	j/	46.52
Worker-Employee Plot Labor	349,879,680	150.00	2,332,531	512,639,000	150.00	3,417,593 f/	-100.00
Private Peasant Farm Labor	1,440,000,000	150.00	9,600,000				
Total Individual Agricultural Sector Labor	3,604,734,620	j/	j/	2,357,209,000	j/	j/	
Total Agricultural Labor	9,764,325,117	173.45	56,294,924	9,539,604,697	173.96	54,838,175	- 2.59
Agricultural Labor Proper (Total Agricultural Labor less Worker-Employee Plot Labor)	9,414,445,437	174.46	53,962,393	9,025,965,697	175.53	51,420,582 k/	- 4.71

a. In the absence of data to the contrary, the number of man-days worked per year is assumed, in this case, to remain constant for both 1938 and 1951. The totals, however, are derived by division.
b. The length of the work year for seasonal kolkhoznik labor for the MTS varies according to type of work. Seasonal combine operators and their auxiliary help probably work about 23 days per harvest. The seasonal tractor drivers and their auxiliary help apparently work about

Table 9

Distribution of the Soviet Agricultural Labor Force,
by Type of Work and by Sector,
1951 Compared with 1938
(Continued)

116 days per year. (See Appendix A for more extensive explanation of the derivation of these data). Although data were available in 1938 on the number of seasonal workers of these types, there were none for 1951. Seasonal labor in 1951 was therefore derived on the basis of man-days expended in mechanical operations per tractor that year. (See Problem 9, Appendix B for the number of workers working per day per tractor).

c. Seasonal labor for the sovkhozy was determined in this report for both 1938 and 1951 on the basis of man-days per year associated per MTS tractor. It was then distributed among the kolkhozniki and the workers and employees (seasonal) on the basis of a 3 to 1 ratio. (See Problem 10, Appendix B).

d. Kolkhoznik labor for the kolkhoz consists of the sum of husbandry labor using horse-and-hand methods and of work in farm administration, maintenance, etc.

e. The total number of man-years (workers) in socialist kolkhoznik labor, 41,727,000, apparently includes all kolkhozniki participating in the work of the kolkhozy who are 12 years old or older. This figure may be broken down into 2 age groups, 5,174,000 children aged 12 to 15, and 36,553,000 adults 16 and older. The figure for the total number of kolkhozniki is dated 1 January 1939. 38/

The average number of man-days worked per year is derived by division. It compares favorably with a published figure of 129 man-days worked per kolkhoznik per year for 1937 in socialist agriculture. 39/

f. The total number of man-days worked by permanent staff workers of the sovkhozy is derived from the multiplication of the number of permanent workers, 1,517,800, 40/ by the maximum number of man-days which able-bodied workers could work in the year. 41/ Sovkhoz workers, probably more than other types in agriculture, are expected to approach the limit of 288 man-days worked per year. The number of seasonal workers and employees working for the sovkhozy is calculated at the full-year rate of the permanent staff worker or employee. The number of these workers is therefore somewhat fictitious. The same may be said of the number of workers and employees shown to be working on individual plots. This number is figured at the rate of 150 man-days per year (as explained in footnote a/ for Table 7).

g. The derivation of the number of man-days expended in 1951 by workers of the sovkhozy is explained in Appendix A.

h. The number of permanent staff workers and employees for the MTS in 1938 is calculated on the basis of the distribution of man-days expended in 1937 in mechanical operations, according to type of operation, for permanent and seasonal workers. In 1937 (end of the year) there were 758,304 permanent MTS workers and employees. 42/ More extensive explanation of the data for these workers, including that for the man-days rate per year, is given in Appendix A.

Table 9

Distribution of the Soviet Agricultural Labor Force,
by Type of Work and by Sector,
1951 Compared with 1938
(Continued)

i. Total man-days by the MTS permanent staff for 1951 is calculated, as indicated in footnote b/ above, on the basis of man-days worked per tractor per year.

j. No data are filled in at this point because to do so would result in double-counting the labor force. For example, the kolkhozniki who on the average work 130.5 days a year in socialist labor are the same kolkhozniki who cultivate their garden plots.

k. The agricultural labor force "proper" does not include the labor of workers and employees on their garden plots. Man-year units of such labor are quite fictitious. The practice of omitting or including workers of this type in the labor force is variable in the US. The Bureau of Census is more likely to omit such labor in the agricultural labor force, while the Department of Agriculture is more likely to include it. 43/ For the most part, these workers are better classified as industrial workers who have garden plots.

4. Comparative Changes in Inputs by Type of Work.

Comparison for all sectors of the changes in man-day inputs in agriculture may be summarized as in Table 8. It is seen that the subsectors showing the greatest expansion are the worker-employee plots and the sovkhozy, the former expanding by 46.5 percent and the latter by 29.4 percent.* Both of these subsectors registered great expandions in field husbandry, the worker-employee plots about 38 percent and the sovkhozy about 44 percent from 1938 to 1951.

In animal husbandry, the worker-employee subsector increased labor inputs since 1938 by 50 percent, followed by the kolkhoz subsector which increased inputs by 45 percent. The sovkhoz subsector registered a moderate increase of about 19 percent in animal husbandry.

The decline of labor inputs in husbandry on the private peasant farms is responsible for the slight total decline in inputs affecting total Soviet agriculture. Inputs on the kolkhoznik plots increased 1 percent, but those on the private peasant farms disappeared entirely.

The tenacity by which the kolkhozniki maintain their labor inputs in animal husbandry is significant in view of a great drop in animal numbers. 44/ This tenacity undoubtedly reflects (1) a trend toward intensification of effort by the kolkhozniki to produce good-quality animal products and (2) a better demand on the kolkhoz market for animal products than for crop products.

The subsector with the greatest expansion of inputs in mechanical operations is the kolkhoz subsector (which includes the MTS operations). Inputs in mechanical operations on the kolkhozy by the MTS increased by 21 percent, whereas those in the sovkhoz subsector increased by only about 1.2 percent. This difference probably reflects the fact that sovkhoz mechanization, according to Soviet definition, was already near completion before the war; 45/ whereas kolkhoz mechanization was recognized as being far from complete, and therefore could show greater progress.

* Both of these subsectors receive state approval for their expansion.

III. Changes in the Labor Force in Soviet Agriculture.

A. Problems in the Estimation of Workers.

On the basis of the foregoing data, changes in the agricultural labor force are estimated in this section. The nature of the data, however, requires that (1) persons must be measured as man-year equivalents in units of man-days worked per year per worker, and (2) the number of man-days worked per year per worker must be recognized as variable with the type of worker.

The variation in the composition of the man-year is seen in Table 9 in which the kolkhozniki are shown to average 130.5 days per year in socialist work for the kolkhozy, the MTS, and the sovkhozy; the sovkhoz workers and employees to average 288 days per year in sovkhoz employment; the MTS workers and employees to average 231 days per year in MTS work; and the private peasants to average 150 days per year on their farms.

Table 9 also shows the extent to which the Soviet agricultural labor force is an interlocking structure. This structure must be taken into account to avoid the problem of double-counting the workers. Many workers are employed in different subsectors during the same year. Thus the kolkhozniki are employed on their own plots, on their kolkhozy, and seasonally for the MTS and for the sovkhozy. 46/ MTS workers consist of permanent staff workers and employees, plus seasonal kolkhoznik labor engaged directly in mechanical operations. Sovkhoz workers comprise permanent staff workers and employees, plus seasonal kolkhozniki and seasonal workers and employees from towns and villages.

Worker and employee labor which is either seasonal or occurs on plots is difficult to fix in terms of persons. Those who worked their own plots in 1950 numbered around 17 million, and consisted primarily of urban industrial workers with family gardens.* Some of these undoubtedly were personnel on the permanent staffs of the MTS and of the sovkhozy who were allocated plots by these organizations. The seasonal sovkhoz workers and employees may include some of the 17 million urban workers, but also will include other entirely

* See Appendix A, Part 2, Problem 7.

different people, who live in rural areas working for local government agencies or in the handicraft trades. The use of the man-year measure helps to reduce these types of labor to useful proportions, and also helps to facilitate the approximation of total agricultural employment.

Double-counting the workers, which might occur because of the interlocking of the structure, is avoided by organizing the data as in Table 9. The last column on the right contains the mutually exclusive labor staffs of the various agricultural subsectors.

B. Changes in the Agricultural Labor Force by Type of Worker.

The total agricultural labor force in 1951, including labor on worker-employee plots, was almost on a par with the force in 1938. Thus there were about 54.8 million total worker equivalents in 1951 as compared with 56.3 million in 1938. This is about a 2.6 percent decrease. If we exclude the labor on worker-employee plots as non-bona fide agricultural labor we obtain a larger decrease in the labor force of about 4.7 percent. The total number of workers in agriculture proper stood at 51.4 million in 1951 as compared with almost 54 million in 1938.

[redacted] 50X1

[redacted] As shown in Table 9, the 50X1

estimate of the present report is 48.1 million collective farmers (kokhozniki) for 1951. [redacted] 50X1

[redacted] 50X1

The two largest changes in the labor force, by type of labor, involve the labor on private peasant farms and on worker-employee plots. The former disappeared entirely, of course, by 1951, from a total of 9.6 million in 1938. The number of man-year equivalents on worker-employee plots, on the contrary, increased from about 2.3 million in 1938 to 3.4 million in 1951, or about 46.5 percent. The great decline of private peasant labor is responsible, however, for the size of the decline in the total labor force, over-riding influences of increases for all other types of workers.

The labor force in socialist agriculture increased from 44.4 million workers in 1938 to 51.4 million in 1951, or about 16 percent. (All workers in agriculture proper were, of course, in socialist agriculture). Within socialist agriculture the work force in state-owned agriculture increased more rapidly than did that in the kolkhoz subsector, although the latter must be recognized as the predominant socialist force, constituting 94 percent of the total socialist force in 1938 and 93 percent in 1951. Thus the sovkhoz permanent staff workers and employees increased from 1.5 million to almost 2 million, or 30 percent; the seasonal sovkhoz worker-employee man-years increased from 301,000 to 389,000, or 29 percent; and the MTS permanent staff workers and employees increased from 817,000 to over 985,000, or 21 percent. The kolkhozniki increased relatively the least among the socialist subsectors, from about 41.7 million in 1938 to 48 million in 1951, or about 15 percent.

These data seem to indicate that the USSR, despite large increases in the amount of machinery in use in Soviet agriculture, has made only nominal progress toward reducing the total labor force.

C. Changes in Specific Sectors.

As indicated above, the agricultural labor force is an interlocking structure, many workers being employed in more than one subsector of the agricultural economy. The discussion above has centered on analysis of changes in the numbers of workers of the mutually exclusive staffs. This has been done to avoid the possibility of double-counting.

It is also important, however, to describe changes affecting kolkhoznik, MTS, and sovkhoz labor, each regarded independently and disregarding the fact that the labor forces of all three sectors are interrelated.

1. Kolkhoznik Labor.

By the method adopted in this study, the number of kolkhozniki in the USSR is determined on the basis of the 1938 rate of 130.5 man-days work per year per kolkhoznik in socialist agriculture. This rate, applied for 1951, gave 48 million kolkhoznik man-equivalents for 1951 agriculture.

On this basis it may be deduced that the kolkhozniki equalled 74 percent of the total agricultural man-equivalents (and 77 percent of the agricultural force proper) in 1938, but 88 percent of the total man-equivalents (94 percent of the total force proper) in 1951. These figures would demonstrate (1) the numerical predominance of the kolkhoznik labor force in Soviet agriculture, and (2) that this predominance has increased since 1938. It seems logical that any effort, such as recently initiated in the USSR, to tighten control over agricultural labor and to lead it forward toward more rational methods of work and of organization, must begin with steps that will affect positively the motives and sensibilities of the kolkhozniki. 48/

The data in Table 10* also indicate certain changes in the work effort of the kolkhozniki. The most important change is a decline of 5.1 man-days labor on the kolkhoznik plots; in 1938 the kolkhozniki put in 43.5 man-days per worker on the plots as compared with only 38.4 in 1951. This decline is reflected in a similar decline in the total man-days of labor per year, from 174.0 in 1938 to 168.9 in 1951, since the number of man-days in socialist agriculture is held constant. The decline of labor on the plots seems consistent with (1) state pressure on the kolkhozniki that they maintain or increase their kolkhoz participation 49/; (2) the increased proportion of women in the kolkhoznik labor force, 50/ who, of course, work a shorter work-year than men, 51/ and (3) state measures reducing the number of kolkhoznik livestock. 52/

2. Machine Tractor Station Labor.

The total labor force for the Machine Tractor Stations (MTS) increased from about 1.5 million man-equivalents in 1938 to over 1.8 million in 1951, or about 21 percent. (See Table 11** below, in which workers are measured in terms of 231 man-days per year per worker). At the same time the work output of the MTS had increased from 206 million to 382.5 million soft-plowing hectares*** or by about

* Table 10 follows on p. 47 .
** Table 11 follows on p. 48 .
*** The soft-plowing unit is a common measure for comparing the work output of machines in various operations, based on fuel expenditures in these operations. See p. 22 for further explanation.

Table 10

Man-Day Inputs of the Kolkhoznik Labor Force in Soviet Agriculture, by Type of Kolkhoznik Labor, 1951 Compared with 1938 a/*

Type of Kolkhoznik Labor	1938 Total Man-Days Worked	1938 Man-Days Worked Per Year Per Kolkhoznik (for 41,727,000 Kolkhozniki)	1951 Total Man-Days Worked	1951 Man-Days Worked Per Year Per Kolkhoznik (for 48,080,006 Kolkhozniki)
Socialist Agricultural Labor				
Kolkhoz Labor	5,022,296,316	120.36	5,741,533,000	119.42
Seasonal Labor	424,761,822	10.18	534,856,451	11.12
Total Socialist Agricultural Labor	5,447,058,138	130.54	6,276,389,451	130.54
Kolkhoznik Plot Labor	1,814,854,940	43.49 b/	1,844,570,000	38.36
Total Kolkhoznik Labor	7,261,913,078	174.03	8,120,959,451	168.90

* Footnotes for Table 10 follow on p. 48.

Table 10

Man-Day Inputs of the Kolkhoznik Labor Force in Soviet Agriculture, by Type of Kolkhoznik Labor, 1951 Compared with 1938 a/ (Continued)

a. Most of the data for this table are taken from Table 9.
b. This estimate of man-days per year per kolkhoznik is less than that published for 1939 because this estimate includes the labor of youth 12 to 15 years old, whereas the published figure, about 49 man-days per year, refers to the labor only of able-bodied kolkhozniki. 54/

Table 11

Man-Day and Man-Year Inputs of the Machine Tractor Station Labor Force in Soviet Agriculture, by Type of Machine Tractor Station Labor, 1951 Compared with 1938 a/

Type of MTS Labor	Amount of MTS Labor				Percent Increase from 1938 to 1950
	Man-Days		Man-Years		
	1938	1951	1938	1951	
Permanent Staff	188,701,562	227,768,805	816,536	985,585	20.70
Seasonal Kolkhoznik	164,648,650	198,737,580	712,457	859,964	20.70
Total Labor	353,350,212	426,506,385	1,528,993	1,845,549	20.70

a. Most of the data for this table are taken from Table 9.

86 percent from 1938 to 1951. 53/ Of the total force, almost 47 percent was seasonal kolkhoznik labor for both 1938 and for 1951. The seasonal force (at 231 days per year) totalled 712,000 man-years in 1938 and 860,000 in 1951.

3. Sovkhoz Labor.

The total labor force in the sovkhozy increased from 2.7 million man-equivalents in 1938 to over 3.5 million in 1951. (See Table 12* below, in which workers are measured at the rate of 288 man-days per year.) At the same time, the soft-plowing work output of the sovkhozy had increased by about 56 percent, an increase not quite as large as that in the MTS. (See Appendix A, Part 2, Problem 11.) Seasonal labor for the sovkhozy constitutes about 44 percent of the total sovkhoz force. (See Appendix A, Part 2, Problem 12.) This seasonal force totalled about 1.6 million man-equivalents in 1951, as compared with only 1.2 million in 1938, increasing therefore by 29.4 percent. Of this seasonal force, 75 percent is kolkhoznik labor; the remainder is worker-employee labor. (See Appendix A, Part 2, Problem 10.)

IV. Changes in Soviet Agricultural Labor Since 1951.

The analyses in the two major sections above make it possible to determine changes in labor expenditures from 1951 to the end of the agricultural year 1953. In this section the focus of our attention is on these changes for agriculture as a whole and for the total agricultural labor force. No attempt is made to determine man-day inputs by agricultural sector.

The method employed is to start with CIA estimates of the number of hectares per crop and the number of animals by type for 1953. Next, using the 1951 composite hectare and head requirements** of man-days (including both horse-and-hand labor and labor associated with mechanical operations), man-day expenditures in field and animal husbandry are determined for 1953. Then on the basis of the 1951 distribution of man-days expended by type of work,*** the 1953 distribution by type of work is determined. Upon completion of these steps the 1953 labor force in agriculture can be derived.

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* Table 12 follows on p. 50.

** See Table 1 and Table 2, pp. 6, 11.

*** See Table 3, p. 21.

Table 12

Man-Day and Man-Year Inputs of the Sovkhoz Labor Force in Soviet Agriculture, by Type of Sovkhoz Work, 1951 Compared with 1938 a/

Type of Sovkhoz Labor	Amount of Sovkhoz Labor				Percent Increase from 1938 to 1951
	Man-Days		Man-Years		
	1938	1951	1938	1951	
Permanent Staff	437,126,407	566,197,818	1,517,800	1,965,965	29.53
Seasonal Kolkhoznik	260,113,172	336,118,871	903,171	1,167,079	29.22
Seasonal Worker-Employee	86,704,390	112,039,623	301,057	389,026	29.22
Total Sovkhoz Labor	783,943,969	1,014,356,312	2,722,028	3,522,071	29.39

a. Most of the data for this table are taken from Table 9.

A. Changes in Labor Inputs in Husbandry.

Changes in labor inputs since 1951 in field and animal husbandry may be determined from Table 13* and Table 14** respectively. The first observation is that total hectares, principally sown hectares, have increased by about 3.7 million hectares. As a result there has been an increase of 57 million man-days which is an increase of less than 1 percent. At the same time livestock numbers, except those for cattle, have also increased so that total man-days in animal husbandry registers an increase of 190 million or about 5.7 percent. Inputs in field husbandry in 1953 are above the 1938 level, while in animal husbandry they are slightly under the 1938 level.

In field husbandry, certain shifts between crops are noticeable, some of these being part of the continuous shift. The postwar shift toward wheat crops is accelerated, with a 1.9 million increase in hectares in winter wheat and a 3.4 million increase in hectares of spring wheat. The acreage in rye, however, has fallen by 4.8 million since 1951. The expansion in wheat is responsible for the .4 million increase in grain hectares and means that, with drops in barley, oats, and corn hectares, there has been a trend away from the production of feed grains in favor of the better types of food grains (wheat).

Labor efficiency in both winter and spring grains declined slightly from 1951 to 1953. There was, however, little change in labor efficiency for total grains. This stability is due to the fact that spring grains were increased by 3.3 million hectares while winter grains were decreased by 2.9 million hectares, on the one hand, and to the fact on the other hand that spring grains require less labor, on the whole, than winter grains. The shifts had a counter-balancing effect for labor efficiency in total grains.

The postwar shift toward increases in fodder crops is also continuing, there being in 1953 about 25.7 million hectares of sown fodder 56/ which is about 13 percent above the 1951 level. It may be that increases in sown fodder hectares are meant to replace, with coarse feed, the declines in feed grain hectares. At any rate the result of this exchange is to make total agriculture slightly less efficient than in 1951 but slightly more efficient than in 1938 when over 8 man-days were required per hectare of total crops.

* Table 13 follows on p. 52.
** Table 14 follows on p. 56.

Table 13

Man-Day Inputs in Field Husbandry in Soviet Agriculture, 1953 Compared with 1951

Type of Field Crop	Man-Day Inputs Based on 1951 Hectare Requirements: 1951 a/ Man-Days per Hectare 1951 a/*	1951 a/ Number of Hectares (Thousands)	1951 a/ Total Man-Days (Thousands)	1953 Number of Hectares b/ (Thousands)	1953 Total Man-Days (Thousands)	Percent Increase in Total Man-Days 1951 to 1953	Man-Days per Hectare 1953	Percent Increase in Man-Days per Hectare 1951 to 1953
Grains								
Winter Crops								
Wheat	14.71	15,000	220,623	16,900	248,569	12.67	N.R. c/	N.R.
Rye	14.33	26,800	383,934	22,000	315,170	-17.91	N.R.	N.R.
Total Winter Crop	14.45	41,800	604,557	38,900	563,739 d/	- 6.75	14.49	.28
Spring Crops								
Wheat	12.34	27,900	344,303	31,300	386,261	12.19	N.R.	N.R.
Barley	12.04	8,800	105,921	8,200	198,699	- 6.82	N.R.	N.R.
Oats	12.27	17,300	212,320	16,100	197,592	- 6.94	N.R.	N.R.
Corn	17.43	2,900	50,556	2,800	48,813	- 3.45	N.R.	N.R.
Rice	24.09	180	4,336	180	4,336	N.C. e/	N.R.	N.R.
Other	14.80	7,320	108,356	9,120	135,000	24.59	N.R.	N.R.
Total Spring Crop	12.82	64,400 64,400	825,792 825,792	67,700	870,701 d/	5.44	12.86	.31
Total Grains	13.47	106,200	1,430,349	106,600	1,434,440 d/	.29	13.46	-.07

* Footnotes for Table 13 follow on p. 55.

Table 13

Man-Day Inputs in Field Husbandry in Soviet Agriculture, 1951 Compared with 1951
(Continued)

Type of Field Crop	Man-Day Inputs Based on 1951 Hectare Requirements							
		1951 [a]		1953				
	Man-Days per Hectare 1951 [a]	Number of Hectares (Thousands)	Total Man-Days (Thousands)	Number of Hectares [b] (Thousands)	Total Man-Days (Thousands)	Percent Increase in Total Man-Days 1951 to 1953	Man-Days per Hectare 1953	Percent Increase in Man-Days per Hectare 1951 to 1953
Fruits and Vegetables								
Fruits	8.78	1,385	12,160	1,385	12,160	N.C.	N.R.	N.R.
Potatoes	65.54	9,470	620,682	9,308	610,064	-1.71	N.R.	N.R.
Vegetables	241.37	1,400	337,922	1,330	321,026	-5.00	N.R.	N.R.
Cucurbits	181.37	600	108,823	570	103,382	-5.00	N.R.	N.R.
Total Fruits and Vegetables	83.98	12,855	1,079,587	12,593	1,046,632 [d]	-3.05	83.11	-1.04
Technical Crops								
Sugar Beets	142.06	1,336	189,795	1,500	213,093	12.28	N.R.	N.R.
Tobacco	53.00	206	10,918	210	11,130	1.94	N.R.	N.R.
Oil Bearing Crops								
Cotton	135.25	2,687	363,412	2,687	363,412	N.C.	N.R.	N.R.
Flax	85.52	2,100	179,597	2,100	179,597	N.C.	N.R.	N.R.
Hemp	83.72	608	50,903	608	50,903	N.C.	N.R.	N.R.
Sunflowers	15.77	3,913	61,720	4,200	66,247	7.33	N.R.	N.R.

Table 13

Man-Day Inputs in Field Husbandry in Soviet Agriculture,
1953 Compared with 1951
(Continued)

Type of Field Crop	Man-Day Inputs Based on 1951 Hectare Requirements							
		1951 a/		1953				
	Man-Days per Hectare 1951 a/	Number of Hectares (Thousands)	Total Man-Days (Thousands)	Number of Hectares b/ (Thousands)	Total Man-Days (Thousands)	Percent Increase in Total Man-Days 1951 to 1953	Man-Days per Hectare 1953	Percent Increase in Man-Days per Hectare 1951 to 1953
Oil Bearing Crops (Continued)								
Soya Beans	74.11	274	20,306	300	22,233	9.49	N.R.	N.R.
Other (minor) crops	74.06	1,023	75,767	1,100	81,470	7.53	N.R.	N.R.
Total Oil Bearing Crops	70.88	10,605	751,705	10,995	763,862 d/	1.62	69.47	-1.99
Total Technical Crops	78.41	12,147	952,418	12,705	988,085 d/	3.74	77.77	- .82
Fodder and Forage								
Silage Crops	17.15	1,059	18,160	1,199	20,561	13.22	N.R.	N.R.
Feed Roots	133.48	1,275	170,188	1,446	193,012	13.41	N.R.	N.R.
Sown Grass	9.50	20,366	193,477	23,055	219,023	13.20	N.R.	N.R.
Meadow Hay	4.80	66,506	318,916	66,506	318,916	N.C.	N.R.	N.R.

Table 13

Man-Day Inputs in Field Husbandry in Soviet Agriculture,
1953 Compared with 1951
(Continued)

Type of Field Crop	Man-Day Inputs Based on 1951 Hectare Requirements: 1951 a/ Man-Days per Hectare 1951 a/	1951 a/ Number of Hectares (Thousands)	1951 a/ Total Man-Days (Thousands)	1953 Number of Hectares b/ (Thousands)	1953 Total Man-Days (Thousands)	Percent Increase in Total Man-Days 1951 to 1953	Man-Days per Hectare 1953	Percent Increase in Man-Days per Hectare 1951 to 1953
Fodder and Forage (Continued)								
Pasture	1.00	348,000	348,000	348,000	348,000	N.C.	N.R.	N.R.
Total Fodder and Forage	2.40	437,206	1,048,741	440,206	1,099,512 d/	4.84	2.50	4.17
(Total Sown Crops)	(24.98)	(153,902)	(3,844,179)	(157,598)	(3,901,753) d/	(1.50)	(24.76)	-(.88)
Total Crops	7.94	568,408	4,511,095	572,104	4,568,669 d/	1.28	7.99	.63

a. The data for 1951 are taken from Table 1, pp. above. Man-days required per hectare include labor associated with mechanical operations, as well as labor in horse-and-hand methods, for field crops.
b. Meadow hay and pasture hectares are carried from 1951 to 1953 without change. The number and distribution of hectares of sown fodder crops for 1953 was calculated by applying the percentage distribution of sown fodder crops in 1951 to the published total (a residual) of 25.7 million hectares for 1953. 55/
c. N.R. means "not relevant."
d. This number is a total derived by summation.
e. N.C. means "no change."

Table 14

Man-Day Inputs in Animal Husbandry in Soviet Agriculture, 1953 Compared with 1951

Type of Animal	Man-Days Required a/* per Head 1951	Man-Day Inputs Based on 1951 Head Requirements: 1951 a/ Head (Thousands)	1951 a/ Total Man-Days (Thousands)	1953 Head b/ (Thousands)	1953 Total Man-Days (Thousands)	Percent Increase in Total Man-Days 1951 to 1953
Horses						
Work Horses	30.00	8,864	265,920	9,899	296,970	11.68
Others	21.00	4,836	101,556	5,401	113,421	11.68
Total Horses		13,700	367,476	15,300	410,391	11.68
Cattle						
Cows	45.937	24,200	1,111,672	24,300	1,116,269	.41
Others	21.00	33,000	693,000	32,300	678,300	-2.12
Total Cattle		57,200	1,804,672	56,600	1,794,569	- .56
Swine						
Adults (9 months or older)	21.70	5,591	121,325	6,611	143,459	18.26
Shoats (4 to 9 months)	16.70	7,929	132,414	9,377	156,596	18.26

* Footnotes for Table 14 follow on p. 58.

Table 14

Man-Day Inputs in Animal Husbandry in Soviet Agriculture,
1953 Compared with 1951
(Continued)

Type of Animal	Man-Day Inputs Based on 1951 Head Requirements					
		1951 a/		1953		
	Man-Days Required a/ per Head 1951	Head (Thousands)	Total Man-Days (Thousands)	Head b/ (Thousands)	Total Man-Days (Thousands)	Percent Increase in Total Man-Days 1951 to 1953
Swine (Continued)						
Piglets	11.20	10,580	118,496	12,512	140,134	18.26
Total Swine		24,100	372,235	28,500	440,189	18.26
Sheep and Goats						
Adults (9 months or older)	3.995	63,370	249,165	69,237	276,602	11.01
Lambs and Kids	3.00	36,630	109,890	40,663	121,989	11.01
Total Sheep and Goats		99,000	359,055	109,900	398,591	11.01
Poultry						
Chickens	2.00	207,730	415,460	230,700	461,400	11.09
Other	1.00	62,270	62,270	69,300	69,300	11.09
Total Poultry		270,000	477,730	300,000	530,700	11.09
Total Animals			3,381,168		3,574,440	5.72

Table 14

Man-Day Inputs in Animal Husbandry in Soviet Agriculture,
1953 Compared with 1951
(Continued)

a. These data are taken from Table 2. The man-day data include only labor using horse-and-hand methods, as in Table 2.
b. The numbers of animals according to age were distributed for each type on the basis of 1938 percentages.

The postwar shift toward more technical crops is also continuing, with about 560,000 more hectares in these crops in 1953 than in 1951. Total inputs have increased but labor efficiency has improved. The decline in man-days required per hectare of technical crops from 1938 to 1951 has continued to 1953. This continuance of improvement in labor efficiency is due principally to shifts toward more sunflowers, soya beans, and other minor oil crops while the area in the labor-consuming crops, sugar beets and cotton, has remained stable from 1951 to 1953.

The postwar increase toward more potatoes, vegetables, and cucurbits, evident in 1951, seems to have been reversed by 1953. No firm data as to the source of this decline by sector since 1951 are available. It may be, however, that the decline which has been evident since 1947 in the numbers of workers and employees with garden plots may have continued past 1951 into 1953.* The Khrushchev report seems to place much of the blame for decline in these crops on the kolkhozniki. 57/

The largest absolute increase in labor inputs in animal husbandry since 1951 is registered for swine, an increase of about 70 million man-days out of the total increase of 190 million man-days. Horses, which are more labor-consuming than swine, have continued to increase in number in 1953, requiring about 40 million more man-days than in 1951. Sheep and goats, which have increased by over 10 million head since 1951, are also the least labor-consuming of the four major groups of animals, and therefore register only 40 million man-days more than in 1951. Cattle, which are the most labor-consuming of the animal groups, seem to have changed but little in number, actually requiring fewer inputs in 1953 than in 1951. This decline seems to have been caused by the increased slaughtering of cattle other than cows, and possibly by a sharper competition than existed in 1951 for the use of feed grains.

At this point, it is pertinent to evaluate the effects of recent changes in mechanization in Soviet agriculture since 1951. 58/ The method employed in the above analysis assumes that these recent changes in mechanization have resulted in only minor amounts of labor saved. Labor savings from 1938 to 1951 totalled only about 158 million

* Appendix A, Part 2, Problem 7.

man-days because of increases in mechanization.* These savings were effected during a period when increases in mechanization were much larger than they were from 1951 to 1953.

Increases in tractor power seem comparatively large since 1951.** Increases in the mechanization of the cultivation of row crops such as corn, sunflowers, sugar beets, cotton, and vegetables are probably important. 60/ On the other hand, the amount of deep plowing has continued to increase, 61/ and the hectares in technical crops and in sown fodder (especially feed roots) have also increased faster than hectares in other crops. These increases, because they involve large labor consumption, would seem partially to offset labor savings due to increased mechanization.

B. Changes in Labor Inputs by Type of Work.

Table 15*** summarizes changes in man-days expended in Soviet agriculture by type of work. Total input in 1953 exceeded 9.8 billion man-days and was 300 million more than the total in 1951, an increase amounting to 3.2 percent. Most of this increase was contributed by labor in husbandry which required 8.1 billion man-days in 1953 compared with 7.9 billion in 1951 (including both inputs in horse-and-hand methods and inputs in mechanical operations). Labor inputs in farm administration and maintenance and in slack-season, communal work with machines were calculated to increase at the same rate as labor in husbandry.

C. Changes in the Total Agricultural Labor Force.

An approximation of the number of the number of agricultural workers is shown in Table 16,**** which indicates that the number of man-equivalents in total agriculture increased by about 1.7 million workers from 1951 to 1953. Thus there were 54.84 million man-equivalents in 1951, and 56.58 million in 1953. The 1953 total is about 280,000 greater than the 1938 figure of 56.3 million.

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* See Appendix A.

** In mid-1951 the MTS had 790,000 tractors of 15 horsepower (hp) each while at the end of 1953 they had 959,000. 59/

*** Table 15 follows on p. 61.

**** Table 16 follows on p. 62.

Table 15

Man-Day Inputs in Soviet Agriculture,
by Type of Work, 1953 Compared with 1951

Type of Work	Man-Days Expended in Soviet Agriculture: 1951 a/ (Thousands)	1953 a/ (Thousands)	Percent Increase from 1951 to 1953
Husbandry			
Field Husbandry	4,511,095	4,568,669 b/	1.28
Animal Husbandry	3,381,168	3,574,440 b/	5.72
Total Husbandry	7,892,263	8,143,109 b/	3.18
Farm Administration, Maintenance, etc.	1,601,916	1,652,831 c/	3.18 c/
Slack Season, Communal Activities with Machines	45,426	46,869 c/	3.18 c/
Total Work	9,539,605	9,842,809 c/	3.18 c/

a. Data for 1951 are taken from Table 3. The data for husbandry for both 1951 and 1953 include labor associated with mechanical operations, which was assigned to husbandry.
b. Data for 1953 husbandry are taken from Table 13 and Table 14.
c. These data are derived on the basis of 1951 percentage relationships.

Table 16

Man-Day and Man-Year Inputs of the Total Labor Force in Soviet Agriculture, 1953 Compared with 1951

	Man-Days		Man-Years	
	1951	1953	1951	1953
Total Agriculture	9,539,605,000 a/	9,842,809,000 b/	54,838,175 a/	56,581,137 d/
Agriculture Proper	9,025,966,000 a/	9,312,845,000 c/	51,420,582 a/	53,054,921 e/

a. From Table 9, p. 38.
b. From Table 15, p. 61.
c. Derived on basis of 1951 relation to total.
d. Derived on basis of 173.96 days per man-equivalent in 1951.
e. Derived on basis of 175.53 days per worker (in agriculture proper) in 1951.

Workers in the agricultural labor force proper increased from 51.4 million in 1951 to about 53.1 million in 1953, or about 3.2 percent, or an absolute increase of about 1.6 million workers. If we assume that increases in mechanization since 1951 effected labor savings amounting to 300,000 man-equivalents, the labor force proper in agriculture would have increased by 1.3 million by the end of 1953.*

* No attempt is made in this report to assess the significance of recent changes of policy which undoubtedly have resulted in additional increases in agricultural labor.

V. Capabilities, Vulnerabilities, and Intentions.

Soviet intentions for agricultural labor seem broadly encompassed in the objective of rapidly improving its efficiency -- that is, of reducing the quantity of labor inputs required per hectare per crop and per head of animals. The principal means adopted to promote this objective is the progressive substitution of machine methods in place of manual methods in the work operations of various agricultural enterprises. The desired results of this substitution are the release of agricultural workers for work in industry, the decrease in labor costs for agriculture, and the increase in the work productivity of the remaining farm workers -- that is, increase in output of agricultural products per man.

The USSR has not apparently accomplished this substitution on a large scale at present. In 1951 the use of mechanical methods probably saved about 158 million man-days from the amount of labor which would have been required had the work been performed according to practices in effect in 1938. This saving would represent a reduction equal to the labor of about 1.2 million kolkhozniki when calculated at the rate of 130 man-days per year.

Progress in the substitution of machine for manual methods has been most pronounced in grain crops (except corn and rice) and in hay crops. Machine methods seem to be most easily adapted to these crops. It is also true, however, that these crops, when compared with vegetable and row-type crops and with swine and dairy enterprises, required relatively small quantities of labor even before the substitution of machine methods. Some further improvement in the efficiency of labor in grain and hay crops is undoubtedly possible, especially in harvest operations, but great quantities of labor savings would be achieved if the substitution of machine for manual methods could be successfully applied in the vegetable and row-type crops and in swine and dairy enterprises.

Despite the labor savings achieved in Soviet agriculture in 1951, labor efficiency per hectare of sown crops was apparently below the level attained in 1938. That is, the average number of man-day inputs per hectare of sown crops in 1951 was slightly higher than the average in 1938. This fact occurred because the USSR expanded acreages in certain technical crops, especially sugar beets and cotton, and in feed roots and silage crops, while they reduced acreages in grain crops.

Since the former crops require much more labor inputs than grain crops the effect was to increase the average labor inputs per hectare of sown crops in 1951 over those in 1938. It is likely that the effect of the recent expansion in grain acreage in the USSR east of the Urals and in the Central Asian Republics will in 1954 and 1955 reduce average labor requirements per hectare of sown crops considerably below those in 1938.

There are certain important obstacles which may seriously limit progress in the reduction of labor requirements in Soviet agriculture. The first is the climate. The limitations imposed on agricultural operations by this factor are of such considerable scope that it will probably require much more machinery in the USSR per unit of acreage to achieve timeliness in farm operations than it has in the US where mechanization has aided in great reductions in labor requirements. The climate is ideal in the US for farming, compared to what it is in the USSR.

The USSR also lacks adequate types and amounts of machinery for the mechanical farming of vegetable and row-type crops, although there has been continual experimentation with machines for these crops. Existing types of machines have frequently been damaging to yields. Certain types of farm operations in these crops will probably never be mechanized.

Similar observations seem applicable to the mechanization of livestock enterprises. Reductions in labor requirements in dairy and swine fermy will undoubtedly be achieved by machine milking, by water fountains for cows and hogs, by overhead trolleys for manure disposal, and by the mechanical preparation of feed. But the fact remains that labor requirements in dairy and swine fermy will still be high after these improvements have been successfully fulfilled.

Finally, the problem of the mechanization of on-the-farm transportation seems an important limitation to progressive reductions in labor inputs, especially in the activities of harvest, in which -- for most crops -- the dominant proportion of labor inputs are expended. At the present time carts and wagons are relied on as the principal means of transporting the harvest in Soviet agriculture. The mechanization of transportation in harvest operation (and in other field operations as well) would undoubtedly be an

important means for reducing labor requirements. Progress in the substitution of truck for horse-and-wagon methods of transportation would, however, depend on increasing the supply of trucks, truck parts, and petroleum products for on-the-farm transportation purposes.

APPENDIX A

PART I

METHODOLOGY

I. Method for Determining Labor Saved in Horse-and-Hand Work* on the Kolkhozy.

The problem of determining the amount of labor saved in horse-and-hand work due to increases of mechanization from 1938 to 1951 involves the use of percentages, averages, and ratios. These are applied to each crop in field husbandry. Since increases in the mechanization of animal husbandry are so minor, our interest is primarily in savings for crops.** While this method is used for each crop, it is illustrated in this appendix for one crop only, winter wheat, and on a step-by-step basis. The procedure is the same for each crop, but different percentages, averages, and ratios are applicable.

A. Step One: To Determine Total Man-Day Inputs in Soviet Winter Wheat in 1938 and 1951, Assuming No Changes in Mechanization.

The first step is to determine the man-days expended on winter wheat in total agriculture. This step involves the assumption that the rate of inputs per man-day per hectare of winter wheat is the same for 1938 and 1951, and that the rate of mechanization is also the same for each year. These data are tabulated in Table 17***:

B. Step Two: To Derive Average Man-Days per Hectare Per Field Operation in 1938.

Savings of labor in horse-and-hand work in plowing, sowing, and harvesting have been determined. The evidence indicates that

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* "Horse-and-Hand Labor Savings" denotes savings of human labor using horse-and-hand methods.

** Mechanization of dairy fermy and electroshearing of sheep and the resultant labor savings are discussed in Appendix A, Part 2, Problem 5 and Problem 6.

*** Table 17 follows on p. 68.

Table 17

Computation of Total Man-Days in Horse-and-Hand Work
in Soviet Agriculture
1938 and 1951

Year	Number of Hectares in Winter Wheat	Average Man-Days per Hectare in Horse-and-Hand Work (1937 Data) 62/	Total Man-Days in Horse-and-Hand Methods
1938	15,000,000 a/	11.7 b/	175,500,000 b/
1951	15,000,000 a/	11.7 b/	175,500,000 b/

a. See Table 1, p.
b. The total man-days employed in horse-and-hand methods in this table and for all crops and animals in this report are based on rates (man-days per hectare or per animal) most of which were reported in official Soviet studies conducted under the jurisdiction of Gosplan for 1937. The data in these studies were obtained from investigations of 430 kolkhozy sampled in 10 oblasts and kray. 63/

advances were greatest in the mechanization of these operations for the kolkhozy from 1938 to 1951. 64/

1. Average Man-Days Required per Hectare of Plowing for Winter Wheat on the Kolkhozy in 1938.

50X1
50X1

There are 3 kinds of plowing stressed in Soviet reports. The first is fallow plowing, which is defined as the plowing of land which is left idle from crops for a varying period of time, but which usually undergoes cultivation in the interim in preparation for seeding of such winter crops as winter wheat and rye.* The several types of fallow plowing are distinguished by the season of the year when the soil is lifted by the plow. They all have in common the fact, however, that the crop is usually sown in the fall of the year. 66/

* This report assumes all winter crop hectares are fallow plowed.

The other 2 kinds of plowing are fall plowing and spring plowing, the crops for which are sown in the spring. There are other types of plowing, such as deep and shallow plowing,* but these are not of primary interest in a study of the mechanization of plowing.

It is important to distinguish fallow plowing from fall and spring plowing because in 1938 more man-days per hectare were expended on fall and spring plowing than on fallow plowing. The averages are .85 man-days required per hectare for fall and spring plowing and .70 man-days per hectare for fallow plowing. [redacted] 50X1

[redacted] 50X1

[redacted] on the average, 2.04 man-days labor in horse-and-hand work 50X1 are required per hectare of plowing which is nonmechanized, and .41 man-days are required per hectare which is mechanized. The labor ratio is 5 to 1. That is, five times as much labor is required on the first type of hectare (in horse-and-hand work) as on the second type of hectare.

The derivation of the general average of .70 man-days per hectare of fallow plowing was developed by obtaining the percentage of winter wheat hectares plowed mechanically in 1938, on the kolkhozy, which is given as 82.5 percent. 67/ With this percentage the kolkhoz winter wheat hectares may be divided into those which are mechanically and those which are nonmechanically plowed. These figures may then be multiplied by the average man-days required for these two types of hectares, the totals (in man-days) added and the grand total divided by total hectares. This procedure provides the data in Table 18.**

2. Average Man-Days Expended Per Hectare in Sowing and Harvesting in 1938.

The derivations of (1) the general average of man-days in horse-and-hand work required per hectare on the kolkhozy for the seeding of winter wheat, and (2) the general average for the harvesting of winter 50X1

* Increases in deep plowing or shallow plowing, usually given in absolute rather than relative (percentage) numbers, are cited [redacted] as evidence of progress in agrotechnology, not in mechanization. 50X1 Deep plowing is defined on p. 18 (footnote **). Shallow plowing, unlike ordinary plowing, is more like discing or harrowing (spring-toothing) the stubblefields.

** Table 18 follows on p. 70.

Table 18

Computation of Average Man-Days of Horse-and-Hand Work per Hectare Expended on Plowing in Kolkhozy in Soviet Agriculture 1938

	Number of Hectares	Average Number of Man-Days Per Hectare	Total Number of Man-Days Required
Mechanized Hectares	9,869,000	.41	4,046,000
Nonmechanized Hectares	2,093,000	2.04	4,270,000
Total	11,962,000	.70	8,316,000

wheat were processed differently from the derivation of the general average for plowing. For sowing and harvesting both the labor ratios and the rates per mechanized and per nonmechanized hectares were lacking. Use of US experience was therefore relied on. According to US data about 8 percent of the time spent on winter wheat was occupied in seeding, and about 50 percent in harvesting. 68/ These percentages, applied to the total average (for all agricultural operations) of 11.7 man-days in horse-and-hand work per hectare of kolkhoz winter wheat, yield an average of .94 man-days per hectare required for seeding, and 5.85 man-days for harvesting. The average for harvesting lies about midway between a range [redacted] of from 4 to 7 man-days required per hectare of wheat in harvesting. 69/ 50X1

C. Step Three: To Derive Average Man-Days per Mechanized Hectare and per Nonmechanized Hectare per Field Operation in 1938.

From Step One, above, the averages given for plowing are: .41 for mechanized hectares and 2.04 for nonmechanized hectares. Similar averages are needed in this step for sowing and harvesting. The averages for sowing may be derived from US experience. It was found that in winter wheat farming areas of the US the input of labor

in sowing, using horse-and-hand methods, on nonmechanized hectares was 1.75 times as great as on mechanized hectares. Soviet experience for harvesting indicates that in 1938 the ratio of man-day inputs in horse-and-hand work on kolkhoz grains was 2.542 on the nonmechanized hectares to 1 on the mechanized hectares, that is, man-days per hectare expended in horse-and-hand methods on the nonmechanically harvested hectares were 2.542 times as great as on the mechanically harvested hectares.*

Completion of the process of the derivation of the general averages of labor inputs in seeding and harvesting operations per hectare requires obtaining the percentage of mechanically seeded hectares and that of mechanically harvested hectares in winter wheat on the kolkhozy. These are given for 1938 in sowing as 50.3 percent of the kolkhoz winter wheat hectares, and in harvesting as 45 percent. 71/

It is now possible, on the basis of the following algebraic formula, to determine how much labor in horse-and-hand methods is required per mechanized and per nonmechanized hectare for each of the sowing and harvesting operations in kolkhoz winter wheat in 1938:

$$A H_t = H_m X + H_{n-m} Y$$

Where A = the average man-days required in horse-and-hand work per hectare of winter wheat,
H_t = the total hectares in winter wheat,
H_m = the mechanized hectares in winter wheat,
H_{m-n} = the nonmechanized hectares in winter wheat,
X = the labor in horse-and-hand work on the mechanized hectare in man-days,
Y = the labor in horse-and-hand work on the nonmechanized hectare in man-days,
and where Y = 1.75 X in the case of sowing, and
Y = 2.542 X in the case of harvesting.

The application of these procedures and factors yields the data tabulated in Table 19** for sowing and harvesting of kolkhoz winter wheat:

* See Appendix A, Part 2, Problem 15.
** Table 19 follows on p. 72.

Table 19

Computation of Total Man-Days of Horse-and-Hand Work Required for Sowing and Harvesting Kolkhoz Winter Wheat in the USSR 1938

	Number of Hectares	Average Man-Days per Hectare	Total Man-Days Required
Sowing Operation			
Mechanized Hectares	6,017,000	.6847	4,120,000
Nonmechanized Hectares	5,945,000	1.1983	7,124,000
Total	11,962,000	.94	11,244,000
Harvesting Operation			
Mechanized Hectares	5,383,000	3.1654	17,040,000
Nonmechanized Hectares	6,579,000	8.0464	52,938,000
Total	11,962,000	5.85	69,978,000

D. Step Four: To Determine Labor Savings Due to Increased Mechanization, from 1938 to 1951.

1. Use of Average Man-Days Required per Hectare per Operation.

If it is assumed that there had been no change in the percentages of hectares mechanized for all three field operations from 1938 to 1951, and if the 1938 general averages* of man-days in horse-and-hand work required per hectare of winter wheat for the three

* These are from Table 18 for plowing, and from Table 19 for sowing and harvesting.

operations are applied, the following distribution of data results for the 13,571,000 hectares of kolkhoz winter wheat in 1951.*

Table 20

Computation of Total Man-Days of Horse-and-Hand Work Required for Plowing, Sowing, and Harvesting Kolkhoz Winter Wheat in the USSR (Based on 1938 Average Rates of Man-Day Inputs per Hectare)
1951

	Average Man-Days Required per Hectare	Total Man-Days Required
Plowing	.70	9,500,000
Sowing	.94	12,757,000
Harvesting	5.85	79,390,000
Total	N.R.	101,647,000

2. Use of Average Man-Days Required per Mechanized and Per Nonmechanized Hectare for Each Operation.

The assumption in the first part of Step Four that there had been no change in the percentage of hectares mechanized for all three field operations from 1938 to 1951 is not correct, of course. Mechanization of fallow plowing had advanced from 82.5 percent to

* The proportion of winter wheat hectares which were sown on the kolkhozy in 1938 was used to determine the number of kolkhozy winter wheat hectares in 1951. This percentage is 90.47 percent. 72/

to 95 percent;* 73/ mechanization of sowing from 50.3 percent to 85 percent; 74/ and mechanization of harvesting from 45 percent to 63 percent. 75/ Application of the 1938 averages for mechanized and nonmechanized hectares to the hectares in kolkhoz winter wheat in 1951 results in the data in Table 21.

Table 21

Computation of Total Man-Days of Horse-and-Hand Work Required for Sowing, Plowing, and Harvesting Kolkhoz Winter Wheat in the USSR (Based on 1938 Average Rates of Man-Day Inputs per Mechanized and Nonmechanized Hectare)
1951

	Number of Hectares	Average Number of Man-Days Per Hectare	Total Man-Days Required
Plowing Operation			
Mechanized Hectares	12,892,000	.41	5,286,000
Nonmechanized Hectares	679,000	2.04	1,385,000
Total	13,571,000		6,671,000
Sowing Operation			
Mechanized Hectares	11,535,000	.6847	7,898,000
Nonmechanized Hectares	2,036,000	1.1983	2,440,000
Total	13,571,000		10,338,000
Harvesting Operation			
Mechanized Hectares	8,550,000	3.1654	27,064,000
Nonmechanized Hectares	5,021,000	8.0464	40,401,000
Total	13,571,000		67,465,000
Total Man-Days Required			84,474,000

* The percentage mechanization of fallow plowing used in this study for 1951 is actually cited for 1950. No indication was discovered in the preparation of this study that 1951 mechanization was either higher or lower than in 1950.

3. Labor Savings

If, now, the total man-days derived in substep 2 just above are subtracted from the total derived in substep 1, a total reduction of 17,173,000 man-days is obtained. These 17 million man-days are the labor savings due to increased mechanization of winter wheat from 1938 to 1951. There is one major assumption. This is that the number of man-days required in horse-and-hand work in kolkhoz winter wheat on the mechanized hectare, and the number required on the nonmechanized hectare, have remained unchanged from 1938 to 1951 for each of the plowing, sowing, and harvesting operations. As already indicated, it is also assumed that changes in the percentage of hectares mechanized for other operations have been minor.

These savings may now be subtracted from the hypothetical for 1951 (based on 1937 man-day requirements) obtained in Table 17, to derive the actual total man-days expended in Soviet winter wheat areas. This total is 158,327,000 man-days labor in horse-and-hand work in 1951, instead of the 175.5 million which would have been used had there been no change in mechanization. The major assumption, in this subtraction, is that changes in mechanization on the sovkhozy are negligible.*

Similar methods were employed for all other crops. The total man-days in horse-and-hand work saved as a result of increases in mechanization were 157,655,000, which were distributed among the major crop groups as shown in Table 22.**

For the most part, the data below are almost self-explanatory. Labor savings were obtained principally from grain crops and from hay crops. There were no labor savings for total technical crops primarily because man-day inputs per hectare were increased from 1938 to 1951 in sugar beets to such an extent that total additional inputs in horse-and-hand work in sugar beets outweighed the labor saved due to the mechanization of other technical crops. The total additional labor required for sugar beet production in 1951 is calculated at 5,243,000 man-days.

* Most of the important operations on the sovkhozy were apparently mechanized both in the prewar era 76/ and in 1951. 77/

** Table 22 follows on p. 76.

Table 22

Distribution of Labor Savings Due to Increased Mechanization by Major Crop Group in the USSR 1951

Type of Crop	Subtraction of Man-Days Due to Mechanization
Winter Grains	- 49,634,000
Spring Grains	- 64,100,000
Total Fruits and Vegetables	- 8,986,000
(Potatoes)a/	- (8,665,000)
Total Technical Crops	648,000 (Labor Added)
(Oil-Bearing Crops)b/	- (4,532,000)
Total Fodder and Forage	- 35,583,000
(Hay Crops)c/	- (34,162,000)
(Total Sown)	-(136,110,000)
Total Crops	- 157,655,000

a. Potatoes are included also under total fruits and vegetables.
b. Oil-bearing crops are also included under total technical crops.
c. Hay crops are also included under total fodder and forage.

The additional labor required for sugar beets seems due to a decline in the percentage of mechanization of the harvesting of sugar beets from 1938 to 1951. While the percentage of mechanization of the plowing and sowing of sugar beet hectares increased,* (only slightly for sowing, from 95 percent 79/ to 98 percent),** the

* In this report, the percentage mechanization of the plowing of sugar beets is regarded as the same as the percentage mechanization of plowing for all spring crops. [redacted] 50X1
[redacted] 50X1
[redacted] Data are available for mechanized 50X1
plowing of sugar beets for 1938, however. 78/

** The percentage of mechanized sowing of sugar beets for 1951 actually is cited for 1952. 80/

percentage of mechanization of the harvesting of sugar beet hectares fell from 79.5 percent 81/ to 70 percent.* For most crops, slight advances or regressions in the mechanization of harvesting are much more significant for changes in the labor required in horse-and-hand work than advances or regressions in the mechanization of other operations.

II. Method for Determining Additional Labor (Required for Machine Operations.

In order to determine the labor associated with machinery and to distribute this labor by crops it was first necessary to analyze 3 published tables. The first of these deals with the labor savings accomplished on the kolkhozy in 1937 by the use of tractors and combines. 83/ This published table has been re-worked and presented (in essentially the original form) as Table 23.

Table 23

Computation of Labor Savings on the Kolkhozy in the USSR Due to Increased Mechanization 1937

	Million Man-Days Worked	Million Man-Years
A. Labor in MTS Tractor Work	220.8	1.9
B. Labor, if Work Done by Horse-and-Hand Methods, 1937	1,070.6	9.1
C. Labor, if Work Done by Peasants of 1925-26	1,505.8	12.8
D. Labor Saved:		
A Compared with B	849.8	7.2
A Compared with C	1,285.0	10.9

* Soviet statements indicate that by 1950 the level of mechanized sugar beet harvesting was below 70 percent mechanization. Other statements indicate that the level attained in 1951 is still considerably below the level achieved in 1938. 82/

The second and third tables deal with distributions of MTS workers for 1937. 84/ These were re-grouped (they deal with the same numbers of workers) as Table 24.

Table 24

Computation of the Distribution of MTS Workers in the USSR by Occupational Group 1937

	Number of MTS Workers
Agronomists	32,592
Administrative	98,488
Engineers, Mechanics	40,026
Repair Shop Workers	99,423
Truck, Auto Drivers	56,079
Combine Operators	82,413
Tractor Brigadiers	95,832
Tractor Drivers	40,371
Other Workers	213,080
Total Permanent MTS Workers	758,304 a/
Kolkhoznik Tractor Drivers a/	644,645
Total MTS Workers	1,402,949

a. See Appendix A, Part 2, Problem 16.

A. Step One: To Distribute Man-Days Expended by the MTS for 1937.

Analysis of Table 23 above shows that when the 220.8 million man-days worked by the MTS in tractor operations are divided by the number of man-years, we obtain an average work year of 116.2105 days worked per man-year. Since this table was intended to show the labor-

savings effects of machine operations and of the MTS over horse-and-hand methods in 1937 and over peasant methods prior to collectivization, it seems obvious that the MTS labor is cast in terms of kolkhoznik labor for the MTS, and in particular of kolkhoznik tractor-driver labor for the MTS. 85/ In other words, the 1.9 million man-years of Table 23 represent MTS work translated into kolkhoznik tractor-driver man-years. It is certain, from Table 24, that the 1.9 million workers are not the total labor force on the MTS. The total in Table 24 is 1.4 million. The man-year for the kolkhoznik tractor driver (seasonally for the MTS) is therefore assumed to be 116.2105 days per year. And the total labor worked by the 644,645 kolkhoznik drivers is about 75 million man-days.

Assuming that the average permanent MTS worker worked 231.1 man-days per year in 1937,* the distribution, as shown in Table 25,** can be computed.

The grand total of days worked, using the averages just described, is 250.2 million man-days worked. This total is 29 million more man-days than indicated [redacted] above. We may assume that these additional man-days represent the labor of permanent MTS workers in slack-season, communal activities in mechanical work not associated directly with agriculture. 50X1

The number of man-days worked per year by the permanent salaried workers of the MTS for agriculture may now be derived as well as the number of man-days worked per year by these workers in slack-season, communal activities in nonagricultural work. This calculation is done by subtracting the number of man-days worked by the kolkhozniki, about 75 million, from the published number of man-days worked by total MTS workers. This subtraction leaves exactly 145,885,556 man-days worked by the permanent salaried MTS workers. Since there were 758,304 of them, a rate of 192,384 man-days per permanent MTS worker in agricultural work on the kolkhoz is indicated. If we subtract this 192.384 from 231.1 (total permanent MTS worker year) we obtain 38.716 days per permanent MTS worker in slack-season, communal activities in nonagricultural work.

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* This average was obtained by substracting 48.9 man-days per kolkhoznik on his plot from 280 man-days, [redacted] 50X1
[redacted] the standard man-year. 86/ 50X1

** Table 25 follows on p. 80.

Table 25

Computation of the Distribution of Man-Day Expenditures in Mechanical Operations of MTS Workers in the USSR, by Occupational Group
1937

	Number of Workers		Number of Man-Days Worked	
	Permanent	Kolkhozniki	Permanent	Kolkhozniki
Agronomists	32,592		7,532,011	
Administrative	98,488		22,760,577	
Engineers, Mechanics	40,026		9,250,009	
Repair Shop Workers	99,423		22,976,655	
Truck, Auto Drivers	56,078		12,959,857	
Combine Operators	82,413		19,045,644	
Tractor Brigadiers	95,832		22,146,755	
Tractor Drivers				
Permanent	40,371		9,329,738	
Kolkhozniki		644,645		74,914,451
Other Workers	213,080		49,242,788	
Total Permanent Workers	758,304		175,244,054	
Total Permanent and Kolkhozniki Workers	1,402,949		250,158,505	

B. Step Two: To Distribute Man-Days Expended by Workers Associated with Mechanical Operations in 1938.

1. Distribution of Total MTS Work in 1937.

Further analysis of the data above suggests the omission of great amounts of seasonal labor. For one thing, only 82,413 combine drivers are included in the list of workers. These cannot be all, for there were about 105,000 combines in the MTS in 1937. 87/ It was estimated, therefore, that in all probability there were at least two kolkhoznik combine operators for every MTS operator.* Thus, 164,826 kolkhoznik seasonal combine operators should be added to the list.

The addition of these workers made it necessary to derive the work-year for seasonal combine operators. [redacted] the combine works about one-fifth as long as the tractor in the field. 88/ One-fifth applied to the kolkhoznik seasonal tractor-driver work year yields a seasonal combine-operator work year of 23.2421 days per harvest. 50X1

In addition, there were omissions of auxiliary helpers from the list of workers introduced above. These workers would be helpers for tractor drivers and for combine operators. The determination of the number of the these workers requires the following types of data: (1) the number of helpers auxiliary to the combine operator; and (2) the number of man-shifts worked per day per tractor.**

The first of these types of data is the easier to derive. A recent evaluation of a Soviet account of the labor associated with a harvesting brigade in [redacted] indicates the enormous amount of men working per combine harvester. 89/ For this better-than-average brigade, a total of 44 men were busy with 2 combines. In addition there was a tractor brigade consisting of 15 men. According to this report 8 men could be considered working in direct support of the combine operators. There were 2 sackers, 2 checkweighmen, and 4 weighers. On this basis, it was adjudged there were 4 auxiliary helpers for each combine operator. 50X1

* This assumes at least one assistant operator per kolkhoznik operator.

** A man-shift is a 10-hour shift worked by one man in work associated with tractors.

The second of the required types of data is more difficult to derive but more necessary, because of the greater absolute number of man-days involved. The number of man-shifts worked per day per tractor evolved out of the following findings for the MTS:

1. In 1938, the number of tractors, all sizes, was 394,000. 90/

2. In 1938, each tractor, all sizes, averaged 134 tractor shifts of 10 hours each or 1,340 hours per year. 91/

3. In 1938, the number of tractors of 15-hp was 496,000. 92/ They therefore averaged 1,064.4355 hours per year.

4. In 1938, the number of soft-plowing hectares averaged by 496,000 15-hp tractors was 447. 93/ Each soft-plowing hectare therefore required 2.3813 hours; and each 15-hp tractor averaged 4.1994 hectares of soft-plowing per 10-hour shift.

5. In 1937, the average hectares of soft-plowing per shift per 15-hp tractor was 3.8. 94/ Each soft-plowing hectare required therefore 2.6316 hours per 15-hp tractor. 95/ Each 15 hp tractor averaged 488 soft-plowing hectares per year and therefore averaged 1,284,21 hours. 96/

6. In 1940, each 15-hp tractor averaged 411 soft-plowing hectares per year and, at 1937 rates averaged 1,081.58 hours per year. 97/

If the number of tractor shifts per year per tractor for 1938, 134, is divided by the number of man-days averaged by the seasonal kolkhoznik tractor drivers, 116.2105 days per year, a figure of 1.1531 man-shifts per day per tractor in 1938 is obtained. The number of auxiliary workers per tractor per shift is still needed. This [redacted] is 1.2 men per tractor per shift.* Multiplying 1.1531 by 1.2, a figure of 1.3837 men

50X1

* See Appendix A, Part 2, Problem 17.

in auxiliary labor per tractor per tractor day (the whole day) is obtained.

The number of kolkhozniki who served as auxiliary help to combine operators and to tractor drivers in 1937 can now be determined. By multiplying the number of kolkhoznik combine operators (164,826) by 4, a figure of 659,304 auxiliary combine helpers is obtained for 1937. In 1937 the number of tractors was 365,900. 98/ If this number is multiplied by 1.3837, a product of 506,296 tractor auxiliary helpers working per day is calculated.

If respective man-years rates are applied to these additional workers and to those found in Table 25 above, the distribution of man-days worked for the MTS in 1937 as shown in Table 26* is obtained:

2. Distribution of Total MTS Work in 1938.

It is now possible to distribute MTS work for 1938 on the basis of the distribution for 1937 (Table 26), using percentage relationships. The starting point is the total of man-days worked in 1938 by skilled workers--that is, by kolkhoznik and MTS combine operators, kolkhoznik tractor drivers, and by the permanent MTS worker staff. This total is important because it can be directly related to the number of tractors and is found for 1937 to be 224,630,901** (by adding 218,884,548 and 5,746,353 as shown in Table 26). This sum, divided by 365,900 tractors in 1937*** yields 613.913367 man-days work by skilled workers per tractor.

Since the MTS had 394,000 tractors in 1938, a total of 241,881,868 man-days of skilled labor can be computed for 1938 by the use of this rate. Then, on the basis of 1937 percentage relationships, the distribution of 1938 man-day inputs of all MTS workers in mechanical operations can be determined as shown in Table 27.****

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* Table 26 follows on p. 84.

** This number is similar to the total given in Table 23, p. 77 above.

*** This figure is for tractors of all sizes, as of 1937.

**** Table 27 follows on p. 85.

Table 26

Computation of the Total Man-Day Expenditures in Mechanical Operations by Permanent and Seasonal MTS Workers in the USSR 1937

	Man-Days Allocated to Husbandry [a]					
	Combine Operators	Auxiliary Work		All Other Work for Husbandry	Other Work	Total Work of the MTS
		Combine	Tractor			
Permanent Staff	1,915,451			143,970,030	29,357,923	175,243,404
Seasonal Staff	3,830,902	15,323,610	58,836,911	74,914,518		152,914,941
Total	5,746,353	15,323,610	58,836,911	218,884,548	29,357,923	328,149,345

a. Combine operator man-days are calculated by multiplying the number of combine operators (164,826 kolkhoznik and 82,413 MTS combine operators) by 23.2421 days per man. Total man-days in auxiliary combine work are found by multiplying 659,304 by the same rate.

Man-days in auxiliary tractor work by the seasonal staff is found by multiplying 506,296 auxiliary tractor workers by 116.2105 man-days per year. Man-days in all other work for husbandry by the seasonal staff is derived by multiplying 644,645 kolkhoznik tractor drivers by the same factor.

Man-days in all other work for husbandry by the permanent staff is found by multiplying 758,304 permanent MTS staff workers by 192.384 man-days per year, and subtracting the man-days put in by MTS combine operators from the product.

Table 27

Computation of the Total Man-Day Expenditures in Mechanical Operations by Permanent and Seasonal MTS Workers in the USSR 1938

	Man-Days Allocated to Husbandry					
		Auxiliary Work				
	Combine Operators	Combine	Tractor	All Other Work for Husbandry	Other Work	Total Work of the MTS
Permanent Staff	2,062,552			155,026,488	31,612,522	188,701,562
Seasonal Staff	4,125,105	16,500,416	63,355,406	80,667,723		164,648,650
Total	6,187,657	16,500,416	63,355,406	235,694,211	31,612,522	353,350,212

3. Distribution of Total Sovkhoz Man-Days for 1938.

A similar disposition of man-day expenditures for mechanical operations can also be made for the sovkhozy in 1938. The assumption is that sovkhoz workers work with the same efficiency and at the same rates in mechanical work as workers for the MTS. Since there were 89,500 sovkhoz tractors in 1938,* man-day inputs in sovkhoz mechanical work are distributed as shown in Table 28.**

4. Distribution of Total Man-Days in Mechanical Work for Total Soviet Agriculture for 1938.

The total man-day expenditures for mechanical work in Soviet agriculture expended in 1938 may now be determined from Table 27 and Table 28. The data are distributed as shown in Table 29.***

C. Step Three: To Distribute Man-Days Required for Mechanical Operations in 1938 by Crops.

Since the goal was to determine the amount of labor used in mechanical operations which was to be added for each crop, the next step was to assign the labor distributed in Table 29 to the field crops. Assuming that the mechanization of animal husbandry was in its infancy, both in 1938 and 1951, it was decided to assign all labor in mechanical work to field husbandry. This procedure is subject to an indeterminate error. For one thing, the labor of zootechnicians and of veterinarians and their helpers (who are on the MTS permanent staff) should properly have been subtracted. The amount of labor involved in the work of these officials, however, was not large compared with the total labor expended.****

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* See Appendix A, Part 2, Problem 18.

** Table 28 follows on p. 87.

*** Table 29 follows on p. 88.

**** [redacted] there were, at the end of 1938, about 92,000 agrotechnicians and zootechnicians, 17,000 veterinarians and 65,400 veterinarian technicians and helpers, 99/ in all agriculture. Many of these were undoubtedly placed in the agricultural organs in official capacities above the level of the kolkhozy or the sovkhozy. 50X1

Table 28

Computation of the Total Man-Day Expenditures in Mechanical Operations by Sovkhoz Workers in the USSR 1938

	Man-Days Allocated to Husbandry					
		Auxiliary Work				
	Combine Operators	Combine	Tractor	All Other Work for Husbandry	Other Work	Total Work of the Sovkhozy
Permanent Staff	468,524			35,215,408	7,181,017	42,864,949
Seasonal Staff	937.048	3,748,191	14,391,646	18,324,267		37,401,152
Total	1,405,572	3,748,191	14,391,646	53,539,675	7,181,017	80,266,101

Table 29

Computation of the Total Man-Day Expenditures
in Mechanical Operations by All Workers
in Soviet Agriculture
1938

	Man-Days Allocated to Husbandry					
	Combine Operators	Auxiliary Work		All Other Work for Husbandry	Other Work	Total Work in Mechanical Operations
		Combine	Tractor			
Permanent Staff	2,531,076			190,241,896	38,793,539	231,566,511
Seasonal Staff	5,062,153	20,248,607	77,747,052	98,991,990		202,049,802
Total	7,593,229	20,248,607	77,747,052	289,233,886	38,793,539	433,616,313

The method adopted to distribute labor in mechanical operations to the field crops was to use the percentage distribution of soft-plowing hectares performed by the MTS in 1938. Since the hectares which were mechanized per crop for each of the three field operations--plowing, sowing, and harvesting--are already determined (See section I above on labor savings), the soft-plowing hectares performed by the MTS for these operations can be computed. The coefficients of tractor work for measuring soft-plowing hectares are given for each crop as follows in Table 30.* 100/

The hectares mechanized for each crop in these operations were multiplied respectively by the coefficients for each crop. The products for each of the three operations were then summed by crop to achieve a distribution of soft-plowing hectares for 1938. This distribution, converted to percentages, was then used to distribute 3 types of labor in Table 29. These types of labor were auxiliary tractor work, "all other work for husbandry" by the permanent staff, and "all other work for husbandry" by the seasonal staff.** Likewise the distribution of soft-plowing hectares for combining the grains was used to distribute the inputs in the combine work of combine operators and of auxiliary combine workers.

The labor additions due to work in mechanical operations were then totalled for each crop. The distribution of labor additions in 1938 is shown for the major crop groups in Table 31.***

This table shows that 342 million of the total 395 million man-days spent in mechanical work in 1938 were required for grain crops. These crops required 87 percent of the total labor inputs. These crops, in hectares, were only 73 percent of the total sown crops. It is clear that the mechanization of crops other than grains was considerably behind the mechanization of grains.

These data could now be added to the total determined as in Table 17 for 1938. Labor additions for winter wheat were 46,557,090 man-days. Total labor from Table 17 is 175,500,000 man-days. The total labor expended on winter wheat for 1938 was therefore 222,057,090 man-days.

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* Table 30 follows on p. 90.

** This "all other work for husbandry" by the seasonal staff consists entirely of kolkhoznik tractor driver man-day inputs.

*** Table 31 follows on p. 91.

Table 30

Coefficients for the Conversion of Soviet Tractor Work to Soft-Plowing Units, by Crop a/
1938

	Plowing	Sowing	Harvesting
Winter Wheat			
Deep Plowing	1.4		
Regular Plowing	1.0	0.3	0.5
Rye	1.0	0.3	0.5
Spring Wheat	1.0	0.3	0.5
Barley	1.0	0.3	0.5
Oats	1.0	0.3	0.5
Corn	1.0	0.36	N.R.
Rice	1.9	0.36	0.5
Other Spring Grains	1.0	0.3	0.5
Potatoes	1.4	0.9	1.0
Vegetables	1.4	N.R.	N.R.
Cucurbits	1.4	N.R.	N.R.
Sugar Beets	1.4	0.9	0.9
Tobacco	1.4	N.R.	N.R.
Cotton	1.4	0.36	N.R.
Flax	1.0	0.36	0.9
Hemp	1.0	0.36	N.R.
Sunflowers	1.0	0.3	0.5
Soya Beans	1.0	N.R.	N.R.
Other Oil Crops	1.0	N.R.	N.R.
Silage Crops	1.4	N.R.	0.9
Feed Roots	1.4	N.R.	N.R.
Sown Grass	N.R.	N.R.	0.23
Meadow Hay	N.R.	N.R.	0.23

a. These coefficients, it will be recalled, are used to compare in measurable terms the work required of tractors for each operation. They are based on fuel input costs.

Table 31

Computation of the Distribution of Labor Additions Due to Work in Mechanical Operations in the USSR, by Major Crop Groups 1938

	Man-Days Added
Winter Grains	125,176,173
Spring Grains	217,460,705
Fruits and Vegetables	13,499,953
(Potatoes)	(10,570,240)
Technical Crops	35,666,628
(Oil Bearing Crops)	(26,394,273)
Fodder and Forage	3,019,215
(Silage and Feed Roots)	(2,673,139)
Total Crops	394,822,774
(Total Sown Crops)	(394,542,333)

D. Step Four: To Distribute Man-Days Expended in Mechanical Operations in 1951.

The problem of determining labor additions for 1951 due to mechanized operations depends on the derivation of a series of factors which are pertinent for 1951 mechanized operations. Obviously many of the rates applicable in 1938 should have been changed by 1951 because of increases in the use of mechanical equipment. For the most part, the rates had been boosted upward. The series of factors upon which the derivation of labor additions depends are as follows:

1. In 1951 the MTS had 790,000 tractors of 15 horsepower each. 101/

2. The number of soft-plowing hectares accomplished per 15-hp tractor per 10-hour shift was 6.000 hectares. 102/ Each hectare required 1.6667 hours work.

3. The number of soft-plowing hectares per 15-hp tractor accomplished in 1951 was 484. 103/ The total hours per 15-hp tractor was, therefore, 806.6667 (484 times 1.6667). And the total hours worked by 790,000 tractors of 15 hp was 637,266,667.

4. The number of tractors, all sizes, in 1951, was 420,000. 104/ Each tractor averaged 151.3016 hours per year, or 1517.3016 shifts per year.

5. Since in 1937 there had been 613.913367 man-days expended per tractor in work associated with tractors and combines, not including auxiliary work and since in 1938 each tractor averaged 134 shifts per year, the number of man-days of skilled work per shift in 1938 was 4.58144.

The foundation on which to determine total man-days in mechanical operations for 1951 can now be computed. If the 1938 number of man-days per shift in labor associated with tractors and combines, 4.58144 (not including auxiliary labor), is multiplied by the 1951 number of shifts per year, 151.73016, we obtain 695.14309 man-days per tractor per year in such work in 1951. This number multiplied by the number of tractors, 420,000 all sizes, gives 291,960,097 man-days skilled labor in 1951 for the MTS.

Since there were also 80,000 sovkhoz tractors in 1951, 105/ the figure of 55,611,447 man-days skilled labor associated in such work on the sovkhozy is obtained.

On the basis of prewar percentage relationships, the distribution in Tables 32-34* of man-days in MTS mechanical operations is obtained.

The assignment of man-days in mechanical operations by crops can be accomplished for 1951, as in 1938, on the basis of the distribution of soft-plowing hectares** The distribution of soft-plowing hectares used, however, is a 1951 distribution. Like the 1938 distribution, the 1951 distribution made allowances for the different types of operations, used different coefficients of tractor work for different crops, and the man-day figure used applied only to work in field husbandry.

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* Tables 32-34 follow on pp. 93, 94, and 95 respectively.

** See the discussions for Table 30 and Table 31, Step Three, pp. 86-91.

Table 32

Computation of the Total Man-Day Expenditures in Mechanical Operations by Permanent and Seasonal MTS Workers in the USSR 1951

	Man-Days Allocated to Husbandry					
		Auxiliary Work				
	Combine Operators	Combine	Tractor	All Other Work for Husbandry	Other Work	Total Work of the MTS
Permanent Staff	2,489,575			187,121,782	38,157,448	227,768,805
Seasonal Staff	4,979,149	19,916,593	76,472,248	97,369,590		198,737,580
Total	7,468,724	19,916,593	76,472,248	284,491,372	38,157,448	426,506,385

Table 33

Computation of the Total Man-Day Expenditures in Mechanical Operations by Permanent and Seasonal Sovkhoz Workers in the USSR 1951

	Man-Days Allocated to Husbandry					
		Auxiliary Work				
	Combine Operators	Combine	Tractor	All Other Work for Husbandry	Other Work	Total Work of the Sovkhozy
Permanent Staff	474,205			35,642,387	7,268,086	43,384,678
Seasonal Staff	948,409	3,793,637	14,566,143	18,546,445		37,854,634
Total	1,422,614	3,793,637	14,566,143	54,188,832	7,268,086	81,239,312

Table 34

Computation of the Total Man-Day Expenditures
in Mechanical Operations by All Workers
in Soviet Agriculture
1951

	Man-Days Allocated to Husbandry					
		Auxiliary Work				
	Combine Operators	Combine	Tractor	All Other Work for Husbandry	Other Work	Total Work in Mechanical Operations
Permanent Staff	2,963,780			222,764,169	45,425,534	271,153,483
Seasonal Staff	5,927,558	23,710,230	91,038,391	115,916,035		236,592,214
Total	8,891,338	23,710,230	91,038,391	338,680,204	45,425,534	507,745,697

Using this method the distribution in Table 35 is obtained.

Table 35

Computation of the Total Man-Day Expenditures
in Mechanical Operations in Field Husbandry
in Soviet Agriculture
1951

	Total Man-Days in Mechanical Work for Husbandry
Winter Grains	165,130,941
Spring Grains	222,106,356
Fruits and Vegetables	15,916,048
(Potatoes)	(12,849,991)
Total Technical Crops	43,493,409
(Oil-Bearing Crops)	(34,422,683)
Fodder and Forage	15,673,409
(Silage and Feed Roots)	(5,308,616)
Total Crops	462,320,163
(Total Sown Crops)	(454,389,099)

Table 35 shows that grain crops in 1951 received the overwhelming proportion of man-days expended in mechanical operations, in fact a disproportionate amount relative to the number of hectares involved. Thus grain crops required 387 million man-days of the total 454 million devoted to sown crops. This number is 85 percent of the total sown crops. At the same time only 106 million out of the 154 million hectares of sown crops, or 69 percent, were devoted to grains. These proportions are similar to those for 1938 (see Table 31) when grain crops received 86 percent of the man-days devoted to mechanical operations and occupied only 73 percent of the sown hectares.

APPENDIX A

PART II

SPECIAL METHODOLOGICAL PROBLEMS

Problem 1. Determination of the Man-Day Inputs in Vegetables and Cucurbits.

In the vegetable-growing regions of the Central European part of the USSR from 1.5 to 2 man-days, on the average, are expended per centner of vegetables. 106/ If, according to CIA estimates, 120 centners are produced per hectare, then from 180 to 240 man-days in horse-and-hand work per hectare are required for production of vegetables. For the purposes of this report, it was estimated that the lower figure (180 man-days) could be used as the labor input required for cucurbits and the higher figure (240 man-days) for vegetables. These input data were used for both 1938 and 1951.

Problem 2. Determination of the Acreage in Fruit Crops.

For 1938, the determination of the number of hectares in fruit crops [redacted] (a) the orchard area in 1941 totalled 1,292,000 hectares, and (b) the total area in fruits at the start of the war was about 3,750,000 acres or 1,517,000 hectares. 107/ [redacted] support for the assumption that this latter figure represents the total hectares by stating that 600,000 hectares, or about 40 percent of the total fruit area, was in the private plots of the kolkhozniki and the workers and employees in 1940. 108/ If 1,292,000 hectares were in orchards, about 225,000 hectares remained as the number of hectares in other fruits. These other fruits were probably mostly vineyards. It has been shown that in 1929, out of a total of 1,261,000 hectares in fruits, 217,000 were in vineyards. 109/ The 1941 distribution of 1,292,000 hectares in orchards, and 225,000 hectares in other fruits, was applied to 1938 fruit crops.

50X1

50X1

The estimation of productive fruit hectares for 1951 had to allow for the almost complete destruction of the collectivized orchards during the war. 110/ If we allow 45,000 hectares as the remnants of the collectivized orchards, and if we add to these hectares, 300,000 hectares

of new orchards and berry patches planted since the war in collectivized areas, 111/ 420,000 hectares of vineyards (by 1948) on the kolkhozy, 112/ 120,000 hectares in subtropical crops (tea, citrus, tung, and aromatics) on the kolkhozy, 113/ and 500,000 hectares in the private orchards (in 1945), 114/ a total figure of 1,385,000 hectares in productive fruit crops is obtained.

This derived figure contrasts with a recently published figure of 2.18 million hectares in fruits in 1953. 115/ However, the accompanying statement admits that much of the area in fruits will not come into production for several years. It is, furthermore, probably difficult for Soviet officials to determine the exact area in fruits since at least half of the acreage is in the tiny plots of the kolkhozniki and the urban workers.

Problem 3. Determination of the Acreage in Fodder and Forage Crops.

Data as of 1940 were used for 1938 sown fodder crops, and data as of 1935 were used for 1938 meadow hay and pasture. The breakdown of sown fodder is given as follow: 116/ perennial grasses (alfalfa, clover, timothy, and other tame hays), 12.1 million hectares; annual grasses, 4.2 million hectares; and silage and feed-root crops, 1.8 million hectares. The total is 18.1 million. 117/ Silage crops and feed roots were distributed on the assumption that prewar hectares in silage crops were about 45.4 percent of the total acreage of silage crops and feed roots. 118/

Land in meadow hay totalled 53,274,000 hectares in the USSR in 1935. 119/ To this figure must be added 5,054,000 hectares in 1938 from the acquired territories. The result is about 58.3 million hectares of meadow hay for 1938. There were 344,050,000 hectares in pasture in 1935. In addition the acquired territories contributed 3,961,000 hectares. The total number of hectares in pastures in 1938 would thus amount to 348 million hectares.

The data for the hectares in fodder and forage for 1951 are very scanty. The starting point for differentiating these hectares by crops is a statement late in 1949 that the kolkhozy sowed nearly 700,000 hectares in 1949 to silage crops. 120/ This figure is used for 1951. On the basis of the percentage relationship of silage crops to feed crops for the kolkhozy in 1938, 121/ kolkhoz feed root hectares were calculated to be 745,000 hectares. Total silage crops (1,059,000 hectares) and total feed roots (1,275,000 hectares) were calculated

on the basis of the percentage of these crops in the kolkhozy in 1938. 122/ The acreage in sown grass was then obtained by subtracting total silage and feed roots from the total estimate of sown fodder crops for 1951. 123/ This sown-grass acreage was thus calculated to be 20,366,000 hectares for 1951.

The derivation of the total Soviet meadow hay hectares for 1951 involves two necessary factors: (1) the total kolkhoz hay hectares for 1951, and (2) the percentage that this total is of the total Soviet hay hectares. The first factor is derived in the following manner. [redacted] (1) that over 18 million hectares of hay field had been cut by the MTS for the kolkhozy in 1951 and (2) that over 19 million hectares had been cut. 124/ [redacted] it is assumed that 18.5 million hectares had been cut for the kolkhozy by the MTS in 1951. [redacted] in 1951 the MTS had cut 27.7 percent of the natural grasses and tame hay on the kolkhozy. 125/ If this percentage is applied to 18.5 million hectares, a total of 66,787,000 hectares of hay (natural and tame) is obtained for the kolkhozy in 1951. 50X1 50X1 50X1

The second factor is obtained from crop acreage relationships existing in the USSR in 1938 (using postwar boundaries). In 1938 the total sown grass hectares in the USSR numbered 12,685,000 hectares. 126/ To this number add the total meadow hay hectares of 53,274,000 hectares, and a total of 65,909,000 hectares is thus obtained for 1938. Of this total 41 million hectares were in kolkhoz meadow hay and 9,709,000 hectares were in kolkhoz sown grass, 127/ which add to a total of 50,709,000 hectares on the kolkhozy in hay. This number of kolkhoz hay hectares is 76.9 percent of the total hay hectares in 1938.

If this percentage is applied to the 66,787,000 hectares of kolkhoz hay in 1951, a total of 86,872,000 hectares of hay is obtained for the USSR as a whole. Finally, if the 20,366,000 hectares of sown grass for the USSR in 1951 is subtracted from this total, 66,506,000 hectares of meadow hay is obtained for the USSR as a whole.

Problem 4. Determination of Man-Day Inputs in Cotton.

The derivation of total man-day inputs in cotton did not involve great difficulty for either 1938 or 1951. The number of hectares is estimated to be 1,570,000 hectares of irrigated and 513,000 hectares of nonirrigated cotton, for 1938; and 1,723,000 hectares of irrigated and

964,000 hectares of nonirrigated cotton for 1951. Man-day inputs per hectare in 1938 were officially reported as about 160 man-days for irrigated cotton 128/ and about 82 man-days for nonirrigated cotton. 129/

The principal question was to decide whether the quantity of man-day inputs per hectare had changed by 1951. This question was resolved by deciding that little change had actually occurred. [redacted] 50X1
[redacted] the load area of cotton per able-bodied 50X1
worker (aged 16 to 59) in irrigated areas near the Turkmen Canal was from 1.1 to 1.2 hectares per worker in 1951. 130/ [redacted] 50X1
[redacted] the average number of man-days worked per year by 50X1
able-bodied workers (aged 16 to 59) in the prewar era for socialist agriculture was 185 man-days. 131/ If this number is divided by 1.2 hectares (the load area per man), about the same number of man-days per year per hectare of irrigated cotton is obtained for 1951 as in 1938, or about 160 man-days in horse-and-hand methods. It is also assumed, therefore, that the man-day requirements for nonirrigated cotton in 1951 were also the same as in 1938, or about 82 man-days per year per hectare.

Problem 5. Determination of Labor Savings in Dairy Fermy Because of Increased Mechanization.

The determination of labor savings for dairy fermy on the basis of increased mechanization, 1938 to 1951, involves determining several types of data. The first are the total numbers of cows on the kolkhozy and on the sovkhozy. These were found in 1938 to be 4,207,000 on the kolkhozy and 1,351,000 on the sovkhozy; 132/ and in 1951 7,900,000 on the kolkhozy and 1,178,000 on the sovkhozy.

The second types of data required were the numbers of cows subject to mechanization. These are estimated as approximate numbers. On 1 January 1940, automatic water fountains for cows had been established on 327 kolkhoz dairy fermy and milking machines on 44. 133/ At the same time the average cattle ferma had 35 cows. 134/ If we assume that mechanized dairy fermy had larger than average numbers of cows, we may estimate that as many as 2,000 kolkhoz cows were subject to mechanization in 1938. Assuming that the rate of mechanization for sovkhoz dairy fermy was 3 times as fast as on the kolkhozy, about 6,000 sovkhoz cows were subject to mechanization in 1938. In the postwar era, it is estimated that, on the basis of recently published reports, about 100,000 cows were subject to mechanization in 1951. 135/ Of these the sovkhozy would have 75,000 cows and the kolkhozy about 25,000.

The final types of data required are the number of man-days required per milk cow per dairy maid under (1) average conditions, (2) mechanized conditions, and (3) nonmechanized conditions. Before the war, it was officially reported that one milk cow required on the average, 28.3 man-days of work by milkmaids per year. 136/ [redacted] in 1946 50X1
[redacted] in the mechanized fermy one milkmaid could serve 27 50X1
head of cows, while in the nonmechanized fermy she could serve only 10 or 12 cows. 137/ About 2.25 times as much labor is thus required in the nonmechanized fermy as in the mechanized fermy per head of cows.

By algebraic means, explained in Appendix A, Part I, the labor savings for 1951 over 1938 in dairying totalled 1,528,000 man-days.

Problem 6. Determination of Labor Savings in Sheep and Goat Fermy Because of Increased Mechanization.

The determination of labor savings for sheep and goat fermy on the basis of increased mechanization from 1938 to 1951 was accomplished using data for sheep fermy similar to those used for dairy fermy. The number of sheep and goats on the kolkhozy and on the sovkhozy was first determined. These were found to be 15,240,000 on the kolkhozy and 4,707,000 on the sovkhozy for 1938, 138/ and 45,600,000 on the kolkhozy and 5,963,000 on the sovkhozy for 1951.

The number of sheep subject to mechanization was then determined. On 1 January 1940, apparatus for the electroshearing of sheep was in use on 204 kolkhoz sheep fermy. 139/ The average kolkhoz sheep ferma contained 216 sheep, about two-thirds of which were adults. The average sheep ferma in the prewar era contained 168 adults which could have been sheared. 140/ The total number of kolkhoz sheep subject to mechanization is calculated, then, to be about 33,600 in 1938. If the ratio of sovkhoz sheep to kolkhoz sheep subject to mechanization is assumed to be the same as for cows, 3 to 1, about 100,000 sovkhoz sheep would have been subject to mechanization in 1938.

Large increases in the numbers of sheep subject to electroshearing are apparent for 1951. During this year about 4.1 million sheep on the kolkhozy had been electrosheared by the MTS and the machine livestock stations (MZhS). 141/ The 1954 Plan includes the prospect for the electroshearing of 9 million head distributed almost equally between the kolkhozy and the sovkhozy. 142/ On the basis of this Plan the total sheep sheared in 1951 in both the kolkhozy and the sovkhozy would have been 7,850,000, of which 3,750,000 would have been on the sovkhozy.

The determination of labor savings because of the increase in electroshearing of sheep now requires 2 additional factors. The first factor is the time required to shear one sheep by manual methods, which [redacted] would be about 30 minutes. 143/ [redacted] the manual shearing of 580 sheep takes up to 30 working days, or 19.3 sheep per day per man. One sheep would thus require about 30 minutes time by manual methods. [redacted] electroshearing increases labor productivity 5 to 6 times. If the lower figure of 5 times is accepted, about 6 minutes per sheep is calculated as required for electroshearing. Using algebraic methods (see Appendix A, Part I) the labor savings for sheep due to increased mechanization may now be calculated. 50X1 50X1 50X1

Problem 7. Determination of Data on the Individual Plots.

This problem may be divided into 4 parts.

1. The Labor Force and Hectares of the Urban Workers and Employees.

In 1938 the workers and employees held about 1,133,000 hectares of sown land in garden plots. [redacted] Meadow hay of the workers and employees is estimated to be 14 percent of the total nonsocialized meadow hay or about 549,000 hectares. Using this same percentage, worker-employee pastures are estimated to be about 482,000 hectares. 50X1 50X1 50X1

Since the start of World War II the activities of the workers and employees in garden plots increased considerably. Estimates of this study include a total sown acreage of over 2 million hectares for 1951 for the workers and employees, in addition to which they held about 1.2 million hectares of meadow hay and about 831,000 hectares of pasture. The sown hectares include about 537,000 hectares of grains, 55,000 hectares in fruits, 62,000 hectares in technical crops, about 1,292,000 hectares in potatoes and vegetables, about 1,000 hectares in silage, about 43,000 hectares in feed roots, and about 27,000 hectares in sown grass. Most of these data were determined on the basis of prewar relationships or on the basis of residual analysis.

The important crops for which independent estimates were made for 1951 are the potatoes and vegetables. Determination

of the hectares of the workers and employees in these crops involves data for several years. 145/ Beginning with 1942, the data published are that in this year 5 million workers and employees had 500,000 hectares in potatoes and vegetables. 146/ [redacted] in 1943, 11.6 million workers and employees had 768,000 hectares in these crops. In 1944 about 16.5 million workers 147/ had sown 1.4 million hectares in potatoes and vegetables. 148/ In 1945, the estimates were that 18.5 million workers and employees had sown 1.6 million hectares in these crops. 149/ The same estimates were made for 1946, 150/ the last year when estimates of numbers of hectares are given. However, it was reported that in 1947 about 19.5 million workers and employees had garden plots, 151/ and that in 1950 over 17 million had plots. 152/

50X1

If, now, the 1942-46 average of hectares in potatoes and vegetables is divided by the 1942-50 average of workers and employees, an average number of about 0.75 hectares per worker for potatoes and vegetables is obtained. This average when applied to the 1950 number of workers and employees yields about 1,292,000 hectares in potatoes and vegetables as an estimate for 1951. This acreage is about 50 percent more land held by workers and employees than the amount held in 1938, when they had less than 900,000 hectares in these crops. 153/

2. The Hectares of the Kolkhozniki.

The kolkhozniki are reported to have about 5,877,000 hectares of sown acreage in 1938, including less than 600,000 hectares in fruits and berries 154/ plus about 2.5 million hectares in pasture, 155/ and about 2,846,000 hectares in meadow hay. The estimate for meadow hay is determined for 1938 on the basis of an estimate that 75 percent of the nonsocialized meadow hay hectares were held by the kolkhozniki. It is certain the kolkhozniki had access to this hay. 156/

Kolkhoznik hectares for 1951 are derived principally on the basis of prewar relationships, with certain exceptions. Potatoes and vegetables are one of these. The individual sector as a whole is estimated to have sown a residual amount of hectares of 5.7 million hectares in these crops. This was determined on the basis of the estimates that the sovkhozy had sown 1.3 million hectares in these crops, 157/ and that the kolkhozy had sown not more than 3.5 million hectares of potatoes. 158/ With vegetables and cucurbits held at a constant relation to potatoes since 1938, about 4,454,000 hectares of all these crops are calculated for the kolkhozy for 1951. The workers

and employees were shown above to have sown 1.3 million hectares in these crops in 1951. Since the total hectares in potatoes, vegetables, and cucurbits in Soviet agriculture was 11.5 million hectares in 1951, the kolkhozniki must have sown a residual of about 4.4 million hectares in these crops.

The second exception is the number of hectares in pasture. The figure, 2.5 million hectares, is carried over from 1938 to 1951 for the kolkhozniki.

The estimates for number of hectares used by the kolkhozniki in 1951 are as follows: grains, 1.6 million hectares; fruits, 499,000 hectares; potatoes and vegetables, 4.4 million hectares; technical crops, 211,000 hectares; silage, 12,000 hectares; feed roots, 304,000 hectares; sown grass, 225,000 hectares; meadow hay, 3.4 million hectares; and pastures, 2.5 million hectares. The total acreage amounted to about 13.2 million hectares, including about 7.3 million sown hectares. The number of sown hectares in 1951 is about 24 percent greater than the number sown in 1938 by the kolkhozniki.

3. The Emphasis of the Kolkhozniki on Animal Husbandry.

The emphasis of the kolkhozniki on the production of animal products before the war was very great. 159/ The total agricultural production of the kolkhozniki in 1938 (measured in 1926-27 ruble values) amounted to about 3.6 billion rubles. Of this amount 2.3 billion rubles or about 65 percent were in "livestock products" and "increase in herds."

4. The Labor Expenditures of the Kolkhozniki.

The prewar figure of from 1.9 to 2.0 billion man-days worked by the kolkhozniki [redacted] was undoubtedly obtained by multiplying the average man-days per year per person worked by able-bodied kolkhozniki (aged 16 to 59) on their plots--48.9 man-days 161/--by the number of kolkhozniki, 40,716,000, 162/, as of 1 January 1938. 50X1

[redacted] the number of man-days estimated for the kolkhozniki for 1938 and 1951 is estimated in each case to be slightly over 1.8 billion. This estimate is based on changing rates of man-day inputs per hectare of sown crops, in particular, for the 50X1

kolkhozniki. These workers are estimated to have averaged about 306 man-days per hectare of sown crops in 1938 as compared with about 251 man-days per hectare in 1951.

The labor spent on animals is included in these figures. Because kolkhoznik livestock numbers declined in 1951 below the 1938 levels, the drop in labor inputs on the kolkhoznik plots from 1938 to 1951 may be due largely to declines in animal numbers. Another reason, however, may be the increased number of women in the kolkhoznik labor force. [redacted] in 1939, 52 percent of all able-bodied workers in agriculture had been women, but that by 1943 this percentage had climbed to 71 percent. 163/ According to CIA estimates this high female percentage during the war years had fallen by 1947 to about 56 percent of the kolkhozniki. 164/ Women, of course, are less able to work consistently than men. It is possible also that current requirements that all youth attend school as far at least as the 7th grade and encouragement that they attend higher grades may also influence the decline of kolkhoznik man-day inputs per hectare on individual plots. 50X1

Problem 8. Derivation of the Labor Force of Independent Peasants in 1938.

In the USSR (prewar boundaries) there were about 1.3 million independent peasant families who in 1938 had not yet been collectivized. 165/ On the basis of 2 workers per peasant family, an estimate of 2.6 million peasant workers is obtained for the USSR proper for 1938. To this number is added an estimated 7 million private peasant workers, acquired later from territory added to the USSR. According to the official census for 1939, the total Soviet population numbered 170,467,186 people. 166/ Postwar statements estimate that the 1940 population (postwar boundaries) totalled about 193 million people. 167/ Thus about 22.5 million people had been added from the acquired territories. CIA estimates that of this number, 14.7 million were rural people, and of this latter number about 7 million were peasant farm workers.

Problem 9. Derivation of the Number of Workers per Tractor per Day.

In 1938, this report estimates that 5.3 skilled workers were required per day per tractor to keep it operating during the agricultural seasons, as compared with about 6 skilled workers in 1951. These figures refer to tractor drivers, their assistants and brigadiers,

repair workers, combine operators and assistants, and MTS administrative and service workers. The estimate for 1938 was obtained by dividing the total number of man-days skilled labor for agriculture for 1937, which was about 244.6 million man-days, by the number of tractors, 365,900, thus obtaining about 614 man-days skilled labor per tractor per year.* Division of this number by the tractor work year of 116.2 days yields about 5.3 skilled workers per day per tractor.

The estimate for 1951 was obtained similarly by dividing 695 man-days skilled labor per tractor per year by the tractor work year.** The result was 6 skilled workers per day per tractor.

Problem 10. The Labor of Kolkhozniki for State and Cooperative Organizations.

It has been stated that each able-bodied kolkhoznik (aged 16 to 59) worked 22 days for state and cooperative organizations in 1939. 168/ [redacted] the kolkhozniki average 22 man-days per year for the sovkhozy, and using his estimate of 38,103,000 able-bodied kolkhozniki for 1 January 1938, arrives at a total estimate of 846 million man-days worked by these workers for the sovkhozy in seasonal work in 1938. 169/ This interpretation would seem erroneous in view of our estimate that both the kolkhozniki and the workers and employees together contributed only 350 million man-days in 1938 and 448 million in 1951. The term "state and cooperative organizations" probably includes state agencies other than sovkhozy (state farms), for example, the "leskhozy" sometimes referred to as forestry sovkhozy.

50X1

Problem 11. Determination of the Work Output of Sovkhoz Tractors.

The tractor work output of the sovkhozy is calculated at the same rate as for the MTS, that is, on the basis of the performance of MTS tractors, all sizes. At the end of 1938 the MTS had 394,000 tractors, all sizes, the sovkhozy, 89,500. 170/ Since the MTS performed 206 million soft-plowing hectares of work in 1938, 171/ each tractor, all sizes, averaged 523 soft-plowing hectares. The sovkhoz tractors, therefore, totalled 46,795,000 hectares of soft-plowing work in 1938.

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* See Appendix A, Part I, p. 83.
** See Appendix A, Part I, p. 92.

In 1951 the 420,000 tractors, all sizes, in the MTS 172/ performed 382.5 million hectares of soft-plowing work, 173/ or 911 soft-plowing hectares per tractor. At this rate the 80,000 sovkhoz tractors, all sizes, in 1951, 174/ performed 72,857,000 hectares of soft-plowing work. The increase in the tractor work output of the sovkhozy in 1951 over the output in 1938 would be 56 percent.

Problem 12. The Proportion of Seasonal Workers on the Sovkhozy.

[redacted] 50X1

about 30 percent to 40 percent of all workers of the sovkhozy are seasonal workers. 175/ The context of the discussion apparently refers to the worker category of the workers and employees. About this, it is stated that from 87 percent to 90 percent of the sovkhoz laborers are workers. Most of the rest are employees, while a small proportion are junior employees. The estimate of our report that 44 percent of the laborers on the sovkhozy are seasonal would not seem at variance with this Soviet report.

Problem 13. Estimate of the Mechanization of Row-Crop Cultivation.

It has been estimated that in 1937 about 35 percent of the corn, 27 percent of the sunflowers, 40 percent of the nonirrigated cotton, and 35 percent of the sugar beets on the kolkhozy were cultivated with tractor power. 176/ These row crops require extensive cultivation after planting. Other row crops are largely the vegetable varieties.

Since the war, very little mention has been made of progress in the mechanization of row crop cultivation. The plan of mechanization for 1955, however, indicates that the cultivation of potatoes according to the square nest, inter-row, and criss-cross methods is to be increased up to 55 percent to 60 percent. 177/ [redacted] in 1951, 50X1
however, only 300,000 hectares of potatoes had been planted by the square nest method. In 1952, almost 1.7 million hectares of corn and over 1 million hectares of sunflowers had been sown by this method. No mention is made as to how much acreage was covered or what the output was in soft-plowing hectares in the actual postplanting cultivation of these crops.

Problem 14. Labor Requirements for Mechanized and Nonmechanized Plowing.

[redacted] the data for determining the averages of 50X1
man-day inputs in horse-and-hand labor in plowing on the mechanized and

on the nonmechanized hectare. [redacted] comparisons in terms of percentages. 178/ Thus if labor inputs for plowing by the private peasants in 1922-25 are taken as 100, the inputs required for the kolkhozy in horse-and-hand methods of 1937 was 80 percent, and for kolkhozy using wheel tractors 16.1 percent. The ratio between labor inputs in horse-and-hand methods on kolkhozy in 1937 on the nonmechanized hectare and labor inputs in horse-and-hand methods on the mechanized hectare was 5 to 1. 50X1

[redacted] it took 2.55 man-days per hectare for plowing by the individual peasants of 1922-25 but only 0.41 man-days per hectare for plowing on the kolkhozy, using the wheel tractor, in 1937. If, therefore, 2.55 is taken as 100, then 80 percent is 2.04 man-days per nonmechanized hectare in 1937, while 16.1 percent is 0.41 for the mechanized hectare in 1937. 50X1 50X1

Problem 15. Determination of the Labor Ratio for the Harvesting of Grains.

The ratio of labor requirements in harvest on the nonmechanized grain hectare to those on the mechanized grain hectare was obtained from analysis of the following discussion. [redacted] it required (presumably under the peasant economy of 1922-25) about 20 days to harvest one hectare of grain with simple tools--that is, to mow, tie in sheaves, to shock, to stack. to transfer to the threshing floor for threshing, to thresh, and to clean the grain. 180/ In 1937 in the kolkhoz harvest without the combine, the kolkhozy were 4.09 man-days per hectare of grain more efficient than the private peasants. They expended 4.09 man-days less. But in the harvest with the combine they saved 13.74 man-days per hectare. By methods of subtraction, the rate of input for the kolkhozy of 1937 without the combine in harvest is calculated to be 15.91 man-days per hectare, and with the combine 6.26 man-days. 181/ The ratio of labor in the grain harvest on the nonmechanized hectare to labor on the mechanized hectare is 2.542 to 1 man-days. While these rates are not the ones used in this study--they seem extremely high in man-day inputs--the labor ratio is applied. This ratio is not only repeated [redacted] but also seems to agree with the ratio from comparable agricultural areas in the US. 50X1 50X1

Problem 16. The Number of Kolkhoznik Tractor Drivers in 1937.

The figure of 1,402,909 workers is often cited for the MTS labor force in 1937. 182/ This number includes 644,645 kolkhoznik tractor

drivers. This number is found by subtraction. In 1937 the MTS employed 758,304 permanent, salaried workers and employees. 183/ Of the total number of 685,016 tractor drivers cited as being in the MTS labor force, 40,371 were paid by the MTS. Therefore, 644,645 must have been kolkhoznik drivers. This number, furthermore, subtracted from the total, 1,402,909, leaves 758,304.

Problem 17. Determination of the Auxiliary Labor Requirements per Tractor per Shift.

[redacted] the labor requirements for water and fuel hauling for 100 soft-plowing hectares of work for the STZ-NATI tractor are 10 man-days of auxiliary labor. 184/ This number undoubtedly includes the work of cooks. 185/ The total man-days required of all men associated with the tractor are about 51 per 100 hectares of soft-plowing. Since the tractor example is probably a model tractor--it accomplished 7.7 hectares of soft-plowing per shift--these data cannot be regarded as important figures in their absolute numbers. They may be used, however, to establish relationships. It would seem that the inputs of auxiliary labor are about 20 percent of the total labor inputs. From Appendix A, Part I, it is observed that 4.6 man-days in skilled labor were expended in 1938 per tractor shift. Dividing 80 percent into this number yields about 5.8 man-days total labor requirements per tractor shift. It follows that about 1.2 man-days per tractor shift are required in auxiliary tractor work, such as hauling water and fuel and cooking. 50X1

Problem 18. Sovkhoz Tractors in 1938.

In 1938 the sovkhozy actually had 85,000 tractors. 186/ In addition to 394,000 other tractors in the MTS, 4,500 tractors are listed as in "other" organizations. These are residual. They may have been on the kolkhozy; but more probably they were on the koopkhozy, a type of sovkhoz more prevalent in the early 1930's. This residual number has been allocated to the sovkhozy in this study.

Problem 19. Derivation of the Daily Work Productivity of 15-HP Tractors.

[redacted] in 1948 the average daily productivity of a 15-hp tractor was from 4 to 5 soft-plowing hectares, and that during the spring of 1949 the average productivity had risen 20 percent above this level. 187/ If we take 5 hectares as the output per day for 1948, then the output for 1949 may be estimated as 6 hectares of soft-plowing per day per 15-hp tractor. 50X1

This figure is used in this report for 1951. It would seem that since 1949 the average productivity by 1951 had not increased above 6 hectares per day. 188/ During the second half of field work for 1952, output per 15-hp tractor averaged 6 to 7 hectares of work per 24-hour period, while during the spring, output was from 3 to 4 hectares. [redacted] the average shift output per 15-hp tractor was from 3.4 to 3.8 hectares of soft-plowing in 5 oblasts--Voronezh, Khar'kov, Odessa, Stalingrad, and Penza. 189/ This performance presumably occurred in the spring of 1952. The fact that the size of tractors had advanced from 20-hp to 30-hp from 1938 to 1951 is regarded as influential in the estimate that the average output of 15-hp tractors had advanced from 4 to 6 soft-plowing hectares during this period. This estimate of tractor performance in the USSR is probably not low.

50X1

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