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The Soviet Tractor Industry: Progress and Problems

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Table of Contents

	<u>Page</u>
Introduction	1
Production	1
Composition of Output: An Unsettled Controversy	4
Key Subsectors: Tractor Engines	7
...And Spare Parts and Repair	9
Technology	12
Design	12
Durability	14
Power	15
Uses	17
Agriculture	17
Industry	21
Export	22
Goals for the Seventies	25
1971-75	25
1976-80	28
General Conclusions	28

Figure

Figure 1: Major World Producers of Tractors	31
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Table of Contents (continued)

Page

Tables

Table 1: US & USSR: Production of Tractors, by Major Type	32
2: USSR: Major New Tractor Models Intro- duced During 1971-75	33
3: USSR: Unit Production of Tractors, by Model, 1974	34
4: US & USSR: Estimated Average Horse- power of Tractors Produced	35
5: US & USSR: Deliveries, Inventory, & Retirement of Tractors in Agriculture	36
6: USSR: Exports of Tractors	37

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Introduction

1. The Soviet tractor industry is an industry in transition. Since 1970, the theme has been tractor modernization. The old historic (since World War II) emphasis upon growth in output with insufficient regard for the needs of agricultural and industrial users has been suspended, if only temporarily, to permit greater emphasis on quality and performance. Still, old habits die hard and goals for technical improvements are proving more difficult to achieve than monotonic increases in output.

2. The purpose of this study is to put the new trend into context. The paper discusses production, technology, and uses of Soviet tractors, and the technical goals and achievements of the modernization program. It provides a detailed comparison of Soviet and US tractors in terms of output, parts, horsepower, and use; assesses the general quality and maintainability of Soviet and US tractors; and evaluates the importance of Western technology and foreign trade to the Soviet tractor industry.

Production

3. The USSR is the world's largest producer of tractors. In 1975, the USSR produced about 550 thousand tractors, more than double that of the United States (see Table 1). However,

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the average Soviet tractor is less powerful than its US counterpart. Thus, measured in total horsepower 1/ (estimated), Soviet output exceeded that of the US by only about 60 percent. Soviet tractor output in 1975 was about 13 percent larger than the combined output of the United States, United Kingdom, and West Germany, three of the leading producers in the non-Communist world (see Figure 1).

4. Soviet tractors are highly standardized, and unlike those in the United States, are seldom built to the user's custom specifications. Production is characterized by long runs of a relatively few models produced in mass volume in a relatively few huge plants. Nine major plants account for more than four-fifths of all tractors produced annually in the USSR. 2/

5. By standardizing models, and keeping models in production long after designs of new and improved models had become available, the Soviets have been able to achieve high and steady growth in output. During 1951-65, for example, output climbed steadily at an average annual rate of about 8 percent.

1/ Unless otherwise indicated, horsepower in this paper refers to engine horsepower at the rated revolutions per minute of the engine.

2/ In the ascending order of size (by unit output) with the share of total output given in parenthesis, these are: Chelyabinsk (5%), Vladimir (5%), Pavlodar (5%), Rubtsovsk (7%), Lipetsk (10%), Dnepropetrovsk (10%), Kharkov (12%), Volgograd (14%), Minsk (16%).

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6. However, as production grew, tractor quality, design, and technology were neglected, making major adjustments sooner or later inevitable if other goals, such as improvement in the average life of the tractor park, were not to be sacrificed. During 1966-70, the Soviets tried to have it both ways -- sustain the previous high growth rate while upgrading tractor quality -- but failed; the growth rate fell off from 8.3 percent in 1961-65 to 5.3 percent in 1966-70 and output fell short of plan by about 25 percent.

7. In the 1971-75 Plan period the Soviets lowered their production sights and launched a major effort to upgrade the quality and technical capabilities of tractors. Planned output for 1975 was set at 575,000 units, implying an annual growth rate of only 4.6 percent, the lowest of any post war plan period. This slowing in the rate of growth was intended to facilitate a retooling and reequipping program for the production of several new and improved tractor models. Apparently, new models were to make up one-third to one-half of total tractor output. However, none of the goals of this program were fully achieved: actual output fell short of plan by about 25,000 units or about 5 percent; and new models accounted for only about one-sixth of production. Major new models that were introduced into production by 1975 are listed in Table 2. Models currently in production are shown in Table 3.

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8. Newer tractor models have greater horsepower ratings than older models and improved performance characteristics generally, but they also cost more. Moreover, new prices are high relative to claimed tractor productivity. For example, the current price of the new 150-horsepower T-150 tracklaying tractor is 135 percent greater than that of the T-74 model it is replacing, but its productivity in power consuming operations is only 40 percent to 80 percent higher.

Composition of Output: An Unsettled Controversy

9. For many years the USSR favored the production and use of tracklaying, rather than wheeled, tractors. Although tracklaying types are more expensive to produce and operate and lack the speed and mobility of wheeled types, they have better traction in most soils, compact the soil less, consume less fuel per hectare, and are more easily adapted to non-agricultural (e.g., construction) applications. During the late 1950s and early 1960s, however, influenced by expansion in sown acreage of row crops in the USSR (which favors the use of wheels rather than tracks) and a personal directive by Premier Khrushchev to copy US practice (in which wheeled tractors predominate), the production of wheeled tractors was given a spectacular boost. Output of wheeled tractors increased from 21 percent of tractor output in 1953 to a peak of 57 percent in 1964.

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10. Khrushchev's decision to push output of wheeled tractors generated an intense, and sometimes bitter, controversy over product mix that continues to be reflected in the ebb and flow of relative output shares. During 1964-72, the share of tracklaying types crept steadily upward to a post-1964 high of 48 percent in 1972. The economic justification for the shift away from the wheeled version was a gradual decline in acreage of row crops, and the promise of powerful new engines for tracklaying types capable of offsetting the speed advantages of wheeled tractors. Since 1972, however, the share of tracklaying tractors has again declined, as the output of heavy-duty wheeled types, especially the T-150K and K-700 series, has rapidly accelerated. Apparently, the Soviets are now persuaded that wheeled tractors are superior to tracklaying types in many agricultural applications. For example, wheeled tractors are especially useful in Soviet agriculture for trailer-transport of farm products and other materials. In the US, trucks are normally used for this purpose.

11. Currently, the USSR produces about 20 percent more wheeled than tracklaying tractors (291,600 wheeled and 239,500 tracklaying in 1974). Larger and heavier tractors, 90 horsepower and greater, primarily are of tracklaying design; smaller and lighter tractors, less than 50 horsepower, are wheeled. In the intermediate horsepower ranges (50 to 89 horsepower) wheeled tractors outweigh tracklaying by a margin

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of 2:1. In the United States, 85 percent to 90 percent of all tractors produced annually are wheeled and include a more even representation of light, medium, and heavy types.

12. Tractor output is heavily biased toward light and medium-powered types of less than 90 horsepower. Only about one-third of production in 1974 consisted of large, heavy-duty types and about two-thirds of these were relatively low powered (no more than 108 horsepower). Very powerful tractors (200 horsepower and up) are produced in relatively small quantities (about 20,000 in 1974) and nearly all are wheeled tractors for use, primarily, in agriculture; high-powered tractors for industrial applications are in extremely short supply.

13. To plug the gap in heavy-duty tractors, the Soviets are building a large new plant at Cheboksary for the production of special-purpose industrial-type tractors in 330 hp and 500 hp models. Although originally planned for construction during 1966-70, ground was not broken until 1972. By the end of 1975, the Soviets had managed to assemble a couple of tractors in one major building already completed. However, most of the components for these two tractors apparently came from the Chelyabinsk Tractor Plant where designs were developed and prototypes made. The first stage of production at Cheboksary -- several thousand units per year -- is still a long way off and may not be achieved before 1980 at the

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earliest. Clearly, it will be many years beyond 1980 before this plant will be able to meet growing Soviet needs for heavy tracklaying tractors for construction.

Key Subsectors: Tractor Engines . . .

14. Production of diesel engines for tractors 3/, paradoxically, has helped both to advance and to retard progress in the tractor industry. On the one hand, increasing specialization of engine production for more than a decade has freed production capacity at tractor plants, helping to sustain secular growth in tractor output. Whereas in 1960, tractor plants were, themselves, the major producers and suppliers of tractor engines, by 1974, seven major specialized producers provided roughly 70 percent of the engines used for new tractor production. 4/ Only three tractor plants -- Bryansk, Chelyabinsk, and Vladimir -- continue to produce engines. Bryansk and Chelyabinsk produce engines for their own tractors, for road and construction machinery, and for other industrial uses. The Vladimir plant, which produces far more engines than tractors, supplies engines to producers of wheeled tractors.

15. On the other hand, lags in the development of planned "families" of improved tractor engines have delayed introduction

3/ All tractor engines produced since 1957 have been diesel and virtually all tractors now in use are diesel powered.

4/ These specialized plants are located in Barnaul, Khar'kov (two plants), Minsk, Rybinsk, Yaroslavl, and Volgograd.

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of new tractor models, in some cases for ten years or more. For example, the first prototypes of the MTZ-80 (which is to replace the MTZ-50) were tested in 1963, but production didn't begin until the latter half of 1974. The first prototype of the T-130 (which is to replace the T-100M) were tested as far back as 1960, but the tractor still was not in full-scale production by the end of 1975. Reasons for lags in engine development are not clear; almost certainly they include: bureaucratic resistance to change, difficulties in getting engine plants retooled, and lack of a close working relationship between developers and producers.

16. Production of diesel engines in the USSR is characterized by an inadequate level of specialization and standardization in the production of major engine components and parts. There are complaints that components and parts are still produced in a relatively large number of enterprises with wide variations in output levels (and costs). For example, in the early 1970s, crankshafts for tractor engines were produced by ten plants with annual levels of output ranging from about 80,000 to 180,000 units; pistons were produced in ten plants with outputs ranging from 300,000 units to 3 million units. The quality of workmanship and the quality of metal inputs in component parts very often have varied from producer to producer.

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17. Standardization of engines often means only standardization of bore and stroke. Such standardization promotes the use of similar piston sizes but not wide interchangeability of parts. For example, the Soviet press reports that 75 horsepower engines produced by three different plants have the same number of cylinders, and the same cylinder diameters, but otherwise different engine designs. Thus, many other parts and accessories are not interchangeable. One factor retarding progress in standardization has been poor coordination among the seven ministries manufacturing diesels for all purposes, and among the plants within the same ministry.

. . . And Spare Parts and Repair

18. Soviet production of spare parts for tractors, relative to that of the United States, is huge, as may be seen from the following example: in 1974, the USSR produced spare parts valued at 1.02 billion rubles, representing about two-thirds of the value of output of new tractors. ^{5/} In the United States, production of spare parts amounted to a little over one-fourth of the value of new tractor output. On balance, the ratio of spare parts to output ought to be somewhat higher in the USSR, than in the US, because of the greater use of tracklaying tractors in agriculture. ^{6/} Even

^{5/} Estimated at 1.6 billion rubles.

^{6/} More spare parts are required to maintain tracklaying tractors than wheeled. For example, in the United States the value of spare parts shipped for tracklaying tractors amounted to 51 percent of the value of complete units in the period 1970-74, compared with 71 percent for wheeled tractors.

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taking this factor into account, however, under comparable US standards spare parts production in the USSR probably would not exceed 35% to 40% of the value of output of new tractors.

19. In effect, Soviet spare parts production in 1974 was roughly equivalent to 350,000 new tractors, whereas US spare parts production, for the same year, was the equivalent of about 64,000 tractors. ^{7/} This comparison is especially striking in view of the fact that the US park of tractors in agriculture is about 2 million units larger than the Soviet park, and the average age of the US park is about double that of the USSR.

20. Despite the exceptionally large volume of spare parts production, Soviet output still is not able to meet domestic needs. To take one example: in 1970, output amounted to about 800 million rubles, but this was only 73 percent of 1.1 billion rubles worth of new parts that Soviet officials estimated were needed for that year. Moreover, nearly 20 percent of the parts classified as "especially important" were produced in below-plan quantities. An official of the USSR Ministry of Tractor and Agricultural Machine Building expressed the dilemma of spare parts production in a Pravda article (22 March 1972) as follows:

^{7/} Based on the estimated unit value of the tractors produced in each country in 1974.

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"The more spare parts we turn out, the greater the need for them becomes. Expenditures of metal on spare parts now come to a good one-half of the metal earmarked for the manufacture of new machines. But we are still told that there aren't enough spare parts."

21. To offset persistent shortfalls in new parts production, repair enterprises have accelerated the reconditioning of worn parts. In 1970, reconditioned tractor parts were valued at 170 million rubles, or 21 percent of the value of new parts production. Reconditioned parts are said to be 40 percent to 60 percent cheaper than new parts, and service life is said to be good.

22. The exceptionally large need for spare parts, which uniquely dramatizes the technological lag of the Soviet tractor industry, stems from both engineering and managerial deficiencies. Engineering deficiencies include: mediocre construction quality, mediocre quality of many parts and uneven durability of a significant share of production. Managerial deficiencies include: overproduction of easily made parts and under-production of the more complex ones; faulty distribution which results in receipts of unwanted parts;

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poor field maintenance; the tendency of farms and tractor repair organizations to overstock parts to be on the safe side; and, finally, over-repair or the tendency to replace unworn parts along with those that are worn. The tendency to replace unworn parts apparently has increased in recent years with the development of a large number of assembly-line type facilities for major overhaul work. Since every tractor that enters one of these shops is totally disassembled, technicians are tempted to replace internal parts that normally are hard to get to just to be on the safe side.

Technology

23. Historically, Soviet tractors have lagged behind those of the United States in design, durability and power; hence, they have been less versatile and reliable. Although some new models of Soviet tractors have greatly narrowed the gap in one or more of these aspects during the past five years, it remains generally true that US tractors, on the average, can do more work, perform more efficiently, and last longer than their Soviet counterparts.

Design

24. Soviet tractor design has tended to follow, sometimes with a substantial timelag, changes in Western technology. Native innovations have been few. Most of the complex features of Western tractor technology such as automatic transmission, power steering, and turbocharging are incorporated

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into certain of the current Soviet models, but they are found on a much smaller share of total output than is the case in the US. One additional feature that has been copied and very widely applied is the four-wheel drive; the USSR produces more tractors with this feature than the United States or any other Western country. Recently, the Soviets have modified four-wheel drive to provide for automatic engagement at a predetermined level of slippage. Automatic engagement is in use on some type of motor vehicles in the United States but has not yet been applied to tractors, apparently to keep down the price.

25. For many years the Soviets have not copied US models outright, although a number of new Soviet wheeled tractors bear a close resemblance to US counterparts. Some tracklaying models still in production, such as the DT-54A and the T-100M, are only slightly modified versions of models developed in the United States more than 25 years ago.

26. The quasidependence of the Soviet tractor industry on the United States for design technology has its historical roots in the extensive assistance that US firms provided in the early 1930s in designing and equipping the first Soviet tractor plants in Chelyabinsk, Khar'kov, and Volgograd (then Stalingrad). However, a major shift away from reliance on US design technology appears imminent; industrial tractors to be built at the new Cheboksary plant have an innovative Soviet

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design of cab at the front of the tractor, and bear no resemblance to US tracklaying models.

Durability

27. Soviet tractors, though rugged, tend to break down more frequently than their US counterpart. For example, the average period of use before first major overhaul is about 4,500 hours compared with 6,000 hours in the US. 8/ Soviet tractors are not built to the precise tolerances of US equipment, generally do not incorporate high strength metal alloys to the same degree, are not serviced with comparable high-quality lubricants and oils, and are not assembled with the same degree of craftsmanship that characterizes US practice. In past years, thousands of newly built tractors have been rejected by agricultural equipment procurement representatives 9/ before leaving plant shipping areas and have had

8/ Planned average operating norms for Soviet tractors used in agriculture before first major overhaul are: tractor transmissions -- 6,000 hours; engines and undercarriages of wheeled tractors -- 5,000 hours; undercarriages of tracklaying tractors -- 4,000 hours. These averages apply only if prescribed operating and maintenance producers are strictly followed.

9/ Officials of Soyuzsel'khoztekhnika (All-Union Agricultural Equipment Association), an organization that acts as intermediary between the producer and agriculture for tractors and agricultural machinery, as well as for fuel, mineral fertilizers, and other items. Soyuzsel'khoztekhnika also controls the major repair facilities not owned by collective and state farms.

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to be set right by the producers; thousands more have become quickly inoperative shortly after delivery.

Power

28. Soviet tractors, on the average, are less powerful than US tractors (see Table 4). In 1975, tractors produced in the USSR averaged about 76 horsepower, compared with about 103 horsepower in the United States. The disparity was even greater for tracklaying tractors -- about 87 horsepower in the USSR compared with about 145 horsepower in the United States. 10/

29. In general, Soviet tractors are underpowered relative to weight. However, weight to power ratios are vastly improved over those common in the 1950s, and the newest tractors have weight to power ratios that are as good as many US models. The average wheeled tractor produced in the USSR in 1974 (weighted by output) weighed an estimated 56 kilograms per horsepower, compared with an estimated 46 kilograms per horsepower for US wheeled tractors. 11/ For more powerful tractors used in construction, weight to power ratios tend to be higher in both countries. For example, the most powerful tracklaying tractor currently in production in the USSR (the 300-horsepower DET-250M)

10/ Data on tracklaying tractors are for 1974.

11/ These data are not entirely comparable. Because weight-to-horsepower ratios for tractors produced in the US in 1974 are not available, the above figure is based on power take-off (PTO) data for a sample of 80 diesel wheeled tractors tested at the University of Nebraska test center during 1971-75. PTO horsepower in the tests was estimated to be 95 percent of engine horsepower. Since Soviet data are given in terms of engine horsepower. PTO in the US was divided by .95 to get engine horsepower.

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weighs about 98 kilograms per horsepower, based on service weight, compared with about 93 kilograms per horsepower for the most powerful US model (524 horsepower). In some construction applications, high weight is advantageous.

30. Soviet tractors weigh relatively more than US tractors, and, by comparison, are underpowered, mainly because more metal is used in the fabrication of engines, components, and parts than is the case in the United States. ^{12/} More metal is used to compensate for its relatively poor quality; metal used in Soviet tractors lacks the high strength characteristics of US alloys. Soviet tractors also tend to be underpowered because engines are adjusted to run at lower speeds to reduce wear and extend operating life. Although newer Soviet tractors are being operated at 2,000 to 2,200 rpm, typical of many US tractors of the late 1960s, engine rpm's of 2,400 to 2,800 now are quite common in the United States.

31. Soviet tractors also lose more horsepower than do US tractors between the engine and the drawbar where the power counts; that is, relatively more of the power of the average Soviet tractor goes into moving the tractor itself. The average US tractor is able to translate a greater share of engine horsepower into usable power at the drawbar, because it

^{12/} For example, the new Soviet MTZ-80 tractor tested at Nebraska weighs more in relation to its power than a similar US model tested earlier with the same maximum PTO and drawbar horsepower. The MTZ-80 weighed (without ballast) 47.5 kilograms per maximum PTO horsepower compared with 40.9 kilograms for the US model.

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has less weight relative to engine horsepower, and better gear ratios. However, the margin of US superiority in this respect seems to be diminishing. Only a few years ago, the drawbar horsepower of the average Soviet diesel wheeled tractor was about 70 percent of engine horsepower compared with nearly 90 percent for US models. Current Soviet models, according to tests apparently carried out on a Soviet track in much the same way as tests at the University of Nebraska test center, are claimed to have approximately the same drawbar horsepower in relation to engine horsepower as similar US tractors.

Uses

Agriculture

32. Agriculture absorbs by far the greater share of production of tractors in the USSR, as in the United States, and currently accounts for about $2.\overset{4}{7}$ million tractors, or about two-thirds of the total tractor park, compared with about $4.\overset{2}{7}$ million in US agriculture, or about three-fourths of the total. ^{13/} However, because tractor attrition rates are high, the number of tractors in use in agriculture in the USSR falls far short of what is optimally desired. Also, shortages of spare parts frequently keep tractors out of service for extended periods, further reducing the number

^{harvested}
^{13/} The ~~area~~^{harvested} acreage of the USSR in 197⁴ was about 216,500 hectares, or about ~~58~~⁵⁶ percent more than that of the United States while the estimated value of Soviet net farm output ^{in the early 1970s} was only about four-fifths that of the US. In 197⁴, there were about ~~96~~⁹⁶ hectares of ~~area~~^{harvested} acreage per tractor in the USSR compared with about ~~30~~³⁰ hectares in the United States.

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available for use. As an illustration of the seriousness of this problem, in the late 1960s, 30 percent to 40 percent of the entire tractor park was in a standdown condition from time to time awaiting parts.

33. According to a recent Soviet estimate, about 3.2 million tractors are needed in the USSR for optimal farm exploitation. That quantity of tractors in use would have been reached by about 1971 if the rate of tractor retirements from the park had been kept at about 4 percent to 5 percent during the past two decades, a rate that has characterized US practice for many years.

34. In fact, more than 12 percent of the existing park of tractors in Soviet agriculture has been retired annually during the past decade, a sharp rise over the 9 percent average of the 1961-65 period (see Table 5). In recent years the number of tractors retired has been equal to about 78 percent of the number of new tractors being delivered to agriculture, resulting in only relatively small additions to the existing stock. For example, during 1970-75, about 2 million new tractors were delivered, and about 1.5 million units were retired, resulting in a relatively modest increase in the total park of tractors over a six-year period of about 450,000 units. By comparison, in the United States, the annual retirement of tractors since the mid-1960s has been considerably in excess of the number of new tractors delivered, in some years by as much as 75 percent to 80 percent. Such retirements have been

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possible because the US park has long been near the saturation point, and new tractors have been purchased primarily for replacement. Also, the sharp increase in the use of higher horsepower tractors has permitted fewer tractors to do the same or an even greater amount of work. The US park reached the current Soviet level in 1945.

35. The relatively high rate of retirement of Soviet tractors is a reflection of deficiencies in machine quality and durability, and, perhaps, to a lesser extent, to poor maintenance and high usage rates. In addition, the fact that output norms are set the same for both old and new tractors within a power class encourages collective and state farm managers to replace older and less productive tractors as soon as they can justify retirement to higher authorities. Since there is no used-tractor market in the USSR, tractors that are retired, in effect, are scrapped.

36. The number of tractors in use in agriculture in the USSR will not reach optimum levels even by 1980 if the 12 percent retirement rate of the past decade continues, as seems likely. During 1976-80, 1.9 million new tractors are scheduled for delivery to agriculture, and an estimated 1.4 million units will be retired, a net increase in the park of about 500,000 tractors. By the end of 1980, Soviet agriculture is scheduled to have a park of 2.87 million tractors, or about 330,000 short of the optimum. Rising allocations of tractors to non-agricultural consumers, especially construction and roadbuilding, has prevented

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Soviet planners from allocating a larger share of production to agriculture. Agriculture is to get about 66 percent of new output during 1976-80, the same share as in 1971-75.

37. Tractors in use in Soviet agriculture, particularly the higher powered new models, are often grossly underutilized because of low inventories of complementary farm machinery. For example, thousands of the new K-700/700A and T-150K heavy-duty wheeled tractors in agriculture cannot be fully utilized because of a serious shortage of farm trailers, plows, harrows, and other machinery. Soviet experts estimate that purchases of new agricultural machinery other than tractors should amount to about 2.5 rubles per ruble expended on new tractors. That desired ratio, which is met by only a few leading farms, compares with an actual coefficient in 1970 of about 1.4 rubles throughout agriculture. Although this coefficient probably rose during the 1971-75 Plan period, the imbalance between the number of tractors in use and available agricultural machinery 14/ probably will persist for some time.

38. By upgrading the quality and durability of tractors, modifying tractor and engine designs to increase engine horsepower and overall pulling power, and increasing the volume of spare parts, Soviet planners hope to reduce attrition rates

14/ The value of output of agricultural machinery increased by 79 percent in 1975 over 1970 (compared with a 20 percent increase in unit output of tractors).

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(increasing indirectly the park of tractors) and improve the utilization and efficiency of tractors in use.

Industry

39. The USSR has made slow progress in satisfying the highly specialized needs of industrial users. Although about 28 percent of all tractors produced annually in the USSR 15/ are allocated to industrial consumers, most are tractors that have been designed primarily for use in agriculture. 16/ In 1974, the USSR produced only about 20,000 tractors specially designed for industrial applications, and 19,000 of these were logging tractors. Special-purpose tractors and tractors modified for use under differing climatic and geographic conditions are urgently needed. For example, one of the basic bulldozers in use in construction and roadbuilding is a general-purpose tracklaying tractor designed for agriculture with a blade mounted on the front. Only about one-fourth of the tractors in industrial use are said to be adapted especially for conditions under which they are operated. Tractors in use in northern climates frequently are not built for sustained operations under conditions of extreme cold. 17/ and tractors with inadequately ventilated cabs that are used in permafrost regions are sent to desert regions in the south as well.

15/ An average for 1970-74.

16/ In 1970, of the tractors allocated in the non-agricultural sector, construction and roadbuilding received an estimate 70 percent, forestry 15 percent, and mining and miscellaneous 15 percent

17/ Insufficient use is made of special low-alloy metals, special rubber, and special lubricants designed for cold climates.

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Beginning in 1974 or 1975, air-conditioning was installed for the first time on some tractors going to hotter climates.

Export

40. The USSR exports a relatively small share of tractor output -- about 6 percent to 7 percent for the past 15 years -- because of a large domestic need. Nevertheless, the USSR has become one of the world's largest exporters of tractors. In 1974, exports totaled about 40,100 units, about 88 percent that of the United States, 18/ and about one-third that of the United Kingdom, 19/ the world leader. About three-fourths of all Soviet tractor exports go to ~~the~~ Communist countries, ^{primarily} Eastern Europe and Cuba (see Table 6). These countries have been dependent on the USSR for tracklaying models, since only Bulgaria, Poland, and Romania produce tracklaying types and, until recently, only in models of up to about 65 horsepower. However, Poland now produces more powerful tracklaying tractors in the 140 to 285 horsepower range through an agreement with a US company, and Romania is producing models of domestic design of 150 and 180 horsepower. Thus, historic East European dependence on Soviet models is diminishing.

18/ Exports from the United States averaged about 37,000 units annually in the decade 1965-74, with a peak of 72,000 units in 1953.

19/ Data for the United Kingdom are for 1973. Exports for the period 1970-73 fell within a very narrow range around the annual average of 116,400 units.

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41. For many years the USSR shipped to non-Communist countries roughly a fourth of all the tractors that were exported. During 1963-72, an overwhelming proportion of these -- about 80 percent -- were shipped to the developing nations; in turn, about one-half of these went to India alone. During this period, relatively few tractors went to industrialized countries -- 2,000 or less annually -- and most of these to France. In 1973 and 1974, however, sales to industrialized countries were more than double the 1972 level, owing to sudden large purchases by the UK, Canada, and the US. Soviet officials are hoping for future sales in the US alone of 5,000 to 8,000 units annually.

42. To attract Western buyers, the USSR has made some minor modifications in tractor design in an effort to meet the special requirements of foreign customers and has set up some modern servicing facilities and spare parts depots in the West. Export tractors are beginning to match up fairly well with the performance standards of US and other Western-built tractors. More importantly, the USSR has priced tractors below competitive Western models. For example, according to industry sources, Soviet four-wheel drive tractors are being offered in the United Kingdom at about two-thirds of the price of UK-manufactured

20/ The largest are located in France, Canada and the United States (New Orleans and Milwaukee).

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models; tractors are being offered in the US at roughly four-fifths the price of comparable US models. 21/ To carry out sales in Canadian and US markets, the USSR has formed a Canadian-Soviet joint-stock company.

43. These Soviet initiatives have helped to overcome the traditional reluctance of farmers in the West, and especially in the United States, to purchase Soviet tractors. Moreover, they came at a time when a heavy domestic demand in the United States was delaying deliveries for certain US models and were aided also by a changed political climate which seems to have lessened the stigma of purchasing Soviet products. Although some US customers seem actually to prefer Soviet tractors because of their greater simplicity and lack of frills, it is still too early to judge whether Soviet tractors will prove to be sufficiently sturdy, reliable, and efficient to gain widespread acceptance in the United States.

44. The USSR has shown little interest in large purchases of Western-made tractors for use on Soviet farms (buying only small quantities for testing purposes) but has shown a growing interest in procuring large, high-powered, specialized models for industrial applications. The USSR has already purchased

21/ Selling prices of Soviet tractors in the United States bear no relation to the dollar prices obtained by converting domestic Soviet ruble prices at the official exchange rate. For example, the converted price of the MTZ-50 (one of five models being offered in the US) would be about \$3,200 (2,400 rubles x 1.33), or about one-third the price of a comparable US tractor.

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between four and five thousand large (up to 524 horsepower) tracklaying tractors from the United States and Japan. Those in the upper horsepower range are used in laying gas pipelines and ripping ground in mining operations in the permafrost regions. Included in the purchases from Japan are tracklaying models for use in forest-clearing and mining projects in the Soviet Far East.

Goals for the Seventies

1971-75

45. During 1971-75, the Soviets planned for major improvements across-the-board -- in engines, components, tractor design, and spare parts. Major technical goals included increased engine rpm's, improved fuel consumption, wider applications of turbocharging, increased average horsepower, and better weight to horsepower ratios. Though reasonable, and technically feasible, these goals were realized only partially, or not at all.

46. The Soviets had planned to increase the engine speed of the average Soviet tractor by 20 to 40 percent by raising average rpm's from 1600-1800 rpm's in 1970 to 1900-2500 rpm's in 1975. In fact, nearly all tractor engines in production in 1975 had the same rpm rating as in 1970. Planned speeds were achieved in only three of the new models: the T-150 tracklaying (2,000 rpm), the T-150K wheeled (2,100 rpm), and the MTZ-80 wheeled (2,200 rpm).

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47. Fuel consumption on some Soviet tractors is as good or better than on some US tractors, but the plan to have typical consumption rates of about 170 to 180 grams per horsepower hour by 1975 was not realized. Indeed, only four tractors in production in 1975 had consumption rates within this range (the MTZ-80 and K-700/700A wheeled and the T-100M and T-130 tracked); consumption of 185 to 195 grams per horsepower hour seemed to be typical.

48. Currently, engines of the heavy-duty K-700/700A wheeled and the new T-130 tracklaying tractors are turbocharged for increased power. The Soviets had planned to add turbocharging to three or four more engines for tractors in mass production, but this does not appear to have happened.

49. The power of the average Soviet tractor (weighted by output) was to have increased to 93 horsepower by 1975, that is, by ⁵4₁ percent above the average for 1970. The actual average in 1975 was only 76 horsepower or ⁸1₁ percent higher than 1970.

50. A significant reduction in weight-to-horsepower ratios was planned -- down to 35 to 50 kilograms per horsepower for wheeled tractors (similar to the US ratio), and to 40 to 70 kilograms per horsepower for tracklaying tractors (somewhat better than the US ratio). 22/ The Soviets made

22/ It is not clear whether these Soviet weight-to-horsepower ratios have been calculated on the basis of the designed weight of the tractor or the service weight (fueled and ready to go), but probably it is the former. The difference can be significant. For example, the average weight per horsepower of all Soviet wheeled tractors produced in 1974, weighted by estimated output, was 51 kilograms based on designed weight and 56 kilograms based on service weight. For tracklaying tractors, the figures were 81 and 86 kilograms, respectively.

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substantial progress toward these goals. All four of the major new models of wheeled tractors that were in mass production by the end of 1975 (the MTZ-80, YuMZ-6, T-150K, and K-701) had weight-to-horsepower ratios within the planned range, based on designed weight. The new T-150 tracklaying tractor also has a low weight-to-horsepower ratio of 44 kilograms based on designed weight, but it had not gone into mass production by the end of 1975. All other major models of Soviet tracklaying tractors weigh considerably in excess of 70 kilograms per horsepower, with the exception of the mass-produced T-4A and DT-75M (which average about 70 kilograms per horsepower).

51. Finally, an unprecedented feature of the Ninth Five-Year Plan was an objective to satisfy completely all requirements for spare parts by 1975. This was to be accomplished, in part, through increased consolidation of enterprises producing spare parts. Consolidation was expected also to reduce wide differences in production costs through increased economies of scale in production programs. For the five years as a whole, the Soviets had planned to increase output of parts and components for tractors and farm machinery in specialized enterprises by 2.5 billion rubles; by 1975, output of spares was scheduled to amount to one-fourth of the gross value of output of tractors and agricultural machinery combined. The Soviet press has since been silent about these

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goals or their implementation. However, there is evidence that the spare parts supply problem persists, and that the existing patterns of spare parts distribution and consumption that contribute so importantly to the problem have remained fundamentally unchanged.

1976-80

52. In the current Five-Year Plan period, the Soviets will try again to reach many of the same technical objectives that they failed to reach during 1971-75. If, as seems likely, most of the 1980 technical goals are met, the Soviets will have taken a major step toward upgrading their tractors to world standards. However, they probably will not achieve comparability with the US. The thrust in the US tractor industry for improvements in tractor performance seems to be even more intense than in the USSR.

53. One area that may prove difficult is raising average tractor horsepower to 93 horsepower by 1980 as planned. To a large extent, that goal will depend upon successful full-scale production of new tractor models at Chelyabinsk and Pavlodar. Additional capacity is under construction at Chelyabinsk but is moving slowly. Pavlodar plans to put into production the 300-horsepower K-701 wheeled tractor but has had experience producing only a single 90-horsepower tracklaying model.

General Conclusions

54. In general, Soviet tractors in 1975 were better made and more powerful than those produced in 1970, although, on

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the average, not as well-made or as powerful as those produced in the United States; the average Soviet tractor still cannot be said to be the technological equivalent of the average US counterpart. During the past five years, the technology gap with the United States has been narrowed sufficiently in Soviet export models to make them acceptable to at least some US farmers, but acceptability in the US market is not a sure indicator of technical equivalence as long as the Soviet price is substantially lower than the US counterpart. Moreover, export models are manufactured with special care and cannot be said to be characteristic of Soviet production, generally.

55. The Soviet drive to raise average tractor horsepower is well directed and should help to improve productivity in agriculture, and perhaps also to reduce agricultural manpower requirements. Even so, new, higher horsepower models are likely to be underutilized for many years because of shortages of complementary farm machinery. In addition, shortages of spare parts will continue to keep many tractors out of service for extended periods.

56. A critical shortage of special-purpose heavy-duty industrial-type tractors, including pipelayers and tractors for construction work as bulldozers, is likely to persist throughout the remainder of the 1970s. This shortage, coupled with an anticipated growth in demand generated by projects such as the Baikal-Amur Railroad (BAM), makes it likely that the USSR will continue purchase of large tractors in the United

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States and other Western countries. The USSR may also acquire US production technology under a recently signed scientific and technical cooperation agreement with a large US company.

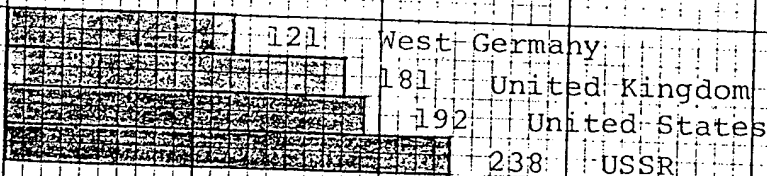
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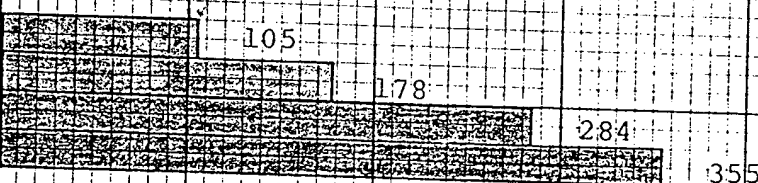
Major World Producers of Tractors*
Thousand Units

Figure 1

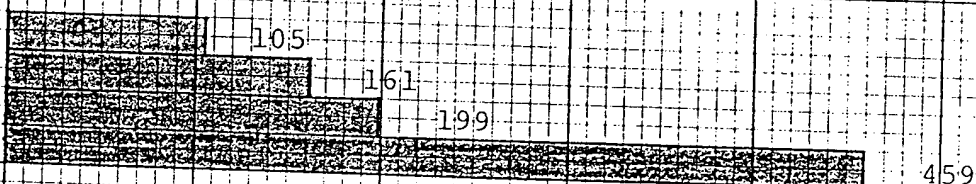
1960



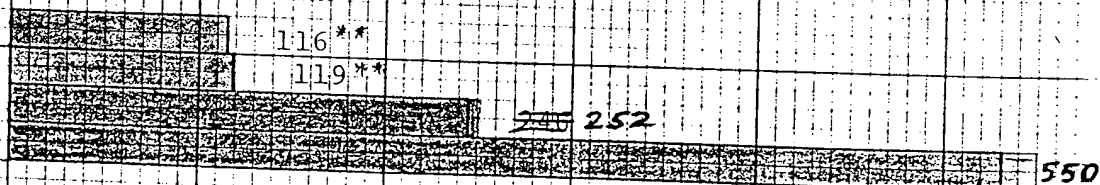
1965



1970



1975¹



* Data for West Germany exclude tracklaying tractors.
** DATA are for 1974; data for 1975 are not available.

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Table 1

US and USSR: Production of Tractors, by Major Type

	Total a/ US/		Thousand Units Wheeled		Tracklaying US		USSR		Percent of Total Wheeled		Tracklaying US		
	US/	USSR	US	USSR	US	USSR	US	USSR	US	USSR	US	USSR	
1950	542.4 c/	108.8	498.8	23.8	43.7 c/	85.1	91.9	21.8	8.1	78.2			
1955	377.1 c/	163.4	330.1	62.9	47.0 c/	100.5	87.5	38.5	12.5	61.5			
1960	192.1	238.5	152.2	116.5	39.9	122.0	79.2	48.8	20.8	51.2			
1961	199.5	263.6	171.4	127.0	28.1	136.6	85.9	48.2	14.1	51.8			
1962	216.2	287.0	188.1	149.3	28.1	137.7	87.0	52.0	13.0	48.0			
1963	235.5	325.3	203.4	176.1	32.0	149.2	86.4	54.1	13.6	45.9			
1964	253.3	329.0	213.2	186.3	40.1	142.7	84.2	56.6	15.8	43.4			
1965	284.4	354.5 d/	244.0	197.5	40.4	157.0	85.8	55.7	14.2	44.3			
1966	311.0	382.5	270.7	209.8	40.3	172.7	87.0	54.8	13.0	45.2			
1967	270.1	405.1	242.2	220.0	27.9	185.1	89.7	54.3	10.3	45.7			
1968	245.5	423.4	213.2	229.4	32.3	194.0	86.9	54.2	13.1	45.8			
1969	227.9	441.7	195.7	233.9	32.2	207.8	85.9	53.0	14.1	47.0			
1970	199.0	458.5 e/	171.6	240.8	27.4	217.7	86.2	52.45	13.8	47.5			
1971	194.1	472.0	167.5	246.5	26.6	225.5	86.3	52.2	13.7	47.8			
1972	229.2	477.8	197.2	248.3	32.0	229.5	86.0	52.0	14.0	48.0			
1973	247.4	499.6	211.5	269.5	35.9	230.1	85.5	53.9	14.5	46.1			
1974	243.5	531.1	209.4	291.6	34.1	239.5	86.0	54.9	14.0	45.1			
1975	251.5 f/	550.4 g/	226.0 f/	N.A.	25.6 f/	N.A.	89.8	N.A.	10.2	N.A.			

a. Because of rounding, components may not add to the totals shown.

b. Peak production in the United States was 617,100 units in 1951, of which 567,400 (92%) were wheeled.

c. Excluding tracklaying tractors produced as shovel loaders.

d. The plan called for 450,000 units.

e. The plan called for 600,000 to 625,000 units.

f. Shipments.

g. The plan called for 575,000 units.

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Table 2

USSR: Major New Tractor Models
Introduced During 1971-75

<u>New Models</u>	<u>Horsepower Rating</u>	<u>Models Being Replaced</u>	<u>Horsepower Rating</u>	<u>Percentage Increase in Horsepower of New Models</u>
<u>Wheeled</u>				
YuMZ-6M/6L	60/65	MTZ-5MS/LS	48	25/35
MTZ-80/82	75/80	MTZ-50/52	50/55	50/45
T-50/50A	50	T-40/40A	40	25
K-701	300	K-700	200	50
T-150K	165
<u>Tracklaying</u>				
T-150	150	T-74	75	100
T-130	140/160	T-100M	108	30/50

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Table 3

Unit

USSR: Production of Tractors, by Model, 1974 a/

Thousand Units

Model	Horsepower	Total	Light-Less than 50 Hp	Medium 50 to 89 Hp	Heavy 90 Hp & Above	Producing Plant
All Models		531.1	73.7	282.1	175.3	
Tracklaying		239.5	0.9	98.4	140.2	
DET-250M	300	0.5			0.5	Chelyabinsk Tractor Plant
T-180, T-180G	175	0.4			0.4	Bryansk Motor Vehicle Plant
D-804M	175	0.1			0.1	Bryansk Motor Vehicle Plant
T-150	150	0.5			0.5	Khar'kov Tractor Plant
T-130	140/160	Negl.			Negl.	Chelyabinsk Tractor Plant
T-4A	110	22.1			22.1	Altay Tractor Plant (Rubtsovsk)
TT-4	110	5.0			5.0	Altay Tractor Plant (Rubtsovsk)
T-100M, T-100MB	108	27.5			27.5	Chelyabinsk Tractor Plant
DT-75M	90	84.1			84.1	Volgograd Tractor Plant; Pavlodar Tractor Plant
DT-75, DT-75A	75	8.0		8.0		Volgograd Tractor Plant
DT-75B	75	10.0		10.0		Volgograd Tractor Plant
T-74	75	47.7		47.7		Khar'kov Tractor Plant
TDT-75	75	2.0		2.0		Altay Tractor Plant (Rubtsovsk)
TDT-55, LKhT-55	62	7.0		7.0		Omega Tractor Plant (Petrozavodsk)
T-54V, T-54L, T-54S	55	8.6		8.6		Kishinev Tractor Plant
DT-54A	54	10.0		10.0		Altay Tractor Plant (Rubtsovsk)
TDT-40M	50	5.1		5.1		Omega Tractor Plant (Petrozavodsk)
T-38M	48	0.9	0.9			Lipetsk Tractor Plant
Wheeled		291.6	72.8	183.7	35.1	
K-700, K-700A	215	19.6				Plant imeni Kirov (Leningrad)
T-150K	165	15.5				Khar'kov Tractor Plant
MTZ-80/82	80	1.0		1.0		Minsk Tractor Plant
YuMZ-6M/6L	60	53.0		53.0		Southern Machine Building Plant (Dnepropetrovsk)
MTZ-50M/50L	55	61.6		61.6		Minsk Tractor Plant

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Table 3

USSR: Production of Tractors, by Model, 1974 a/
(continued)

Thousand Units

Model	Horsepower	Total	Light-Less than 50 Hp	Medium 50 to 89 Hp	Heavy 90 Hp & Above	Producing Plant
Wheeled						
MTZ-52M/52L	55	19.0		19.0		Minsk Tractor Plant
MTZ-50Kh	55	2.5		2.5		Minsk Tractor Plant
T-28Kh4	50	21.6		21.6		Tashkent Tractor Plant
T-40/40M	50	8.2		8.2		Lipetsk Tractor Plant
	40	8.2	8.2			Lipetsk Tractor Plant
T-40A/40AM/40AN	50	16.8		16.8		Lipetsk Tractor Plant
	40	16.8	16.8			Lipetsk Tractor Plant
T-25A	25	28.0	28.0			Lipetsk Tractor Plant
T-16M	20	19.8	19.8			Vladimir Tractor Plant
						Kharkov Tractor Assembly Plant

a. For the most part, output data for basic models also include output of modifications of the basic model.

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Table 4

US and USSR: Estimated Average Horsepower of Tractors Produced

	1965		1970		1974		1975	
	US	USSR	US	USSR	US	USSR	US	USSR
Average horsepower per tractor								
Total	70	59	78	64	93	75	103	76
Wheeled	63	47	70	50	86	65	95	n.a.
Tracklaying	116	75	131	79	145	87	166	n.a.
Average horsepower of Soviet tractors as a percent of US								
Total	100	84	100	82	100	81	100	74
Wheeled	100	75	100	71	100	76	100	n.a.
Tracklaying	100	65	100	61	100	60	100	n.a.
Index of average horsepower (1965 = 100)								
Total	100	100	111	108	133	127	147	129
Wheeled	100	100	111	106	137	138	151	n.a.
Tracklaying	100	100	113	105	125	116	143	n.a.

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Table 5

US and USSR: Deliveries, Inventory, and Retirements of Tractors in Agriculture

Year	Deliveries			Inventory			Retirements		
	Thousand Units		Percent of Product	Thousand Units		Percent of Inventory	Thousand Units		Percent of Del
	US	USSR		US	USSR		US	USSR	
1955	269.6	123.3	71.5	4,480	840.0	134.6	78.3	3.1	49.9
1956	176.8	140.4	69.9	4,570	892.0	86.8	88.4	1.9	63
1957	185.0	148.3	69.6	4,620	924.0	135.0	116.3	3.0	63
1958	192.1	157.5	72.4	4,673	1,001.4	139.1	80.1	3.0	78
1959	204.1	144.3	68.7	4,688	1,054.0	189.1	91.7	4.0	50
1960	118.5	157.0	61.7	4,743	1,122.3	63.5	88.7	1.4	63
1961	133.5	185.3	66.9	4,763	1,212.0	113.5	95.6	2.4	56
1962	148.4	206.0	68.2	4,778	1,328.9	133.4	89.1	2.8	51
1963	150.4	239.3	63.9	4,786	1,442.0	142.4	126.2	3.0	43
1964	144.2	222.5	56.9	4,787	1,539.0	143.2	125.5	3.0	52
1965	177.2	239.5	62.3	4,783	1,613.2	181.2	165.3	3.8	56
1966	197.2	276.0	63.4	4,786	1,660.4	194.2	228.8	4.1	69
1967	180.3	287.4	66.8	4,766	1,738.8	200.3	209.0	4.2	82
1968	151.9	290.3	61.9	4,712	1,821.3	205.9	207.8	4.3	72
1969	131.5	304.3	57.7	4,619	1,908.2	224.5	217.4	4.8	71
1970	121.1	309.3	60.9	4,562	1,977.5	178.1	240.0	3.9	71
1971	118.0	313.2	60.8	4,469	2,045.7	211.0	245.0	4.6	77
1972	138.8	312.8	60.6	4,387	2,111.9	220.8	246.6	4.9	78
1973	176.8	323.0	71.5	4,376	2,188.5	187.8	246.4	4.3	78
1974	145.3	348.0	59.7	4,263	2,266.5	258.3	270.0	5.9	76
1975	140.0	370.0	55.7	4,190	2,362.3	213.0	274.2	5.0	77

a. As of 31 December.

b. Shipments for farm use. For 1966-74, data are based on retail sales of agricultural wheeled tractors (excluding imports) do not include deliveries of agricultural tracklaying tractors. About 1,600 of the latter went to agriculture in 1965 and probably smaller quantities in subsequent years.

c. US data estimated. USSR delivery data given; other USSR data estimated.

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Table 6

USSR: Exports of Tractors

Year	Communist Countries			Non-Communist Countries			Units
	Total	Eastern	Cuba other	Total	Less		
		Europe a/			Industrial	Developed	
1960	18,887	12,149	601 3,074	3,063	522	2,539	2
1961	16,136	10,141	1,468 1,148	3,379	350	3,006	23
1962	12,351	8,296	1,025 1,248	1,782	66	1,716	0
1963	23,109	13,787	2,996 1,322	5,004	331	4,655	18
1964	21,010	11,807	3,168 856	5,179	156	5,005	18
1965	21,867	9,814	5,475 1,528	5,050	569	4,442	39
1966	21,435	11,161	2,770 1,575	4,931	1,058	3,809	64
1967	23,378	10,370	4,444 2,024	6,540	1,854	4,611	75
1968	27,275	13,077	4,619 2,013	7,566	1,920	5,613	33
1969	30,709	12,925	4,862 1,262	11,659	2,234	9,372	53
1970	21,163	15,225	4,171 1,767	7,106	1,545 34	5,518	54
1971	27,520	14,784	3,893 2,349	6,494	1,396 1,408	5,047	39
1972	27,750	14,981	3,454 2,456	6,859	1,923	4,872	64
1973	33,820	17,507	4,002 3,586	8,725	4,100	4,570	55
1974	40,100	23,590	3,686 4,526	8,318	4,932	3,256	130

a. Excluding Yugoslavia, which imported 15,358 Soviet tractors during 1960-74.

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