Mechanisation and Dualism in Russian Agriculture

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Writing in 1907 a respected Russian expert on agricultural engineering noted that Russia had the greatest range and most advanced types of agricultural machines in use of any country in the world.[1] One year earlier, however, an American report had noted the following: ' insufficiency of proper agricultural machinery is the most observable feature of Russian agriculture '.[2] Both observations were true, if not the whole truth. The common picture of tillage by the wooden *sokha*, threshing by flail, harvesting by sickle remained. As late as 1910 there were more *sokhas* in use in the country than iron ploughs.[3] Yet within the vastness of Russia were areas of significant technical advancement. And there was undoubtedly a great range of imported equipment from many parts of the world, including combined harvesters from California, and an unusual giant harvesting machine made by James Martin in South Australia.[4]

Imports of agricultural machinery had developed even before the end of the eighteenth century when threshers made by Andrews Meikle came in

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[1] D.D. ARTSYBASHEV, " Ocherk rasprostraneniya sel'skokhozyaistvennykh mashin i orudii v Rossii ", *Ezhegodnik Glavnogo Upravleniya Zemledeliya i Zemleustroistva* 1907, St. Petersburg, p. 131.

[2] I.M. RUBINOW, *Russia's Wheat Surplus. Conditions under which it is Produced*, U.S. Dept. of Agriculture, Bureau of Statistics, Bulletin no. 42. Washington 1906, p. 55. Quoted in S. POLLARD and C. HOLMES, *Documents of European History*, vol. 2, London, 1972, p. 25.

[3] YA. YA. POL'FEROV, *Sel'skokhozyaistvennye mashiny i orudiya*, Petrograd, 1914, p. 15.

[4] ARTSYBASHEV, *op. cit.*, pp. 157-8.

through Riga.[5] But it was not until the middle of the nineteenth century that imports began to grow significantly. Walter Wood's American harvesting machine was first imported through Odessa in the 1850's.[6] Numerous British and American companies began exporting to Russia in the same decade.[7] The growth of imports was stimulated in part by the removal of agricultural import duties in 1868. Some years later the depression in grain farming in western Europe led manufacturers of agricultural machinery to look elsewhere for markets. Russia became an important outlet for British and other European manufacturers. The revival of trade in western Europe and the re-introduction of tariffs in Russia later in the century did not restrict the western producers in their activities. In 1885 a duty of 50 kopeks per pud weight was introduced on agricultural machinery; it was increased to 70 kopeks in 1887.[8] These duties, however, were lower than those on other machinery. Despite a short-term set back to imports agricultural machinery remained second only to textile machinery in import value. In 1891 agricultural locomotives and machinery were exempt from the great increases applied to other imports. The government were at pains to allow capital investment in agriculture and yet, at the same time, provide some protection for manufacturers in Russia. There was some, albeit ineffectual, pressure to reduce tariffs. The Congress of Agriculturalists meeting in 1890 called for duty-free admission of agricultural implements and machines to aid Russian agriculture.[9] There was something of a compromise in 1898. All agricultural machinery was divided into two groups, the first being of machines and implements which were made in Russia — these were subject to a duty of 75 kopeks per pud. The second group was of 'complex' machinery which was not made in Russia in any significant number — these were admitted duty free.[10] These complex machines included combined harvesters, steam ploughs, special machines for harvesting potatoes, cutting clover and spreading artificial fertilizers, and milk separators.[11]

There was a continued increase in the total value of imported agricultural machinery after 1898 as before. Ironically the Swedish company of Nobel

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[5] G.P. Strod, "Nachalo primeneniya sel'skokhozyaistvennykh mashin v Latvii", *Ezhegodnik po agrarnoi istorii vostochnoi Evropy 1961 g.* Riga, 1963, p. 296.

[6] V.V. Chernyaev, "Zemledel'cheskie mashiny i orudiya ikh raspredelenie i izgotovlenie", in *Sel'skoe khozyaistvo i lesovodstvo*, St. P. 1893, p. 353.

[7] See R. Munting, "Ransomes in Russia: An English Agricultural Engineering Company's Trade with Russia to 1917" *Ec.H.R.* (31, May 1978).

[8] I. Pokrovskii, *Sbornik svedenii po istorii i statistike vneshnei torgovli Rossii*, St. P. 1902, p. 268 (pud = 16.4 kg.).

[9] *Consular Report on the Agriculture of Odessa for 1890* (Parliamentary Papers 1891-2, C. 6205-32), p. 9.

[10] Pol'ferov, *Sel'skokhozyaistvennye mashiny*, pp. 38-39.

[11] Artsybashev, "Ocherk...", p. 150.

had mixed fortunes as a result. In 1888 Carl Ludwig Nobel had bought the Russian patent for the Swedish Alfa-Laval milk separator and began manufacture in St. Petersburg. When the tariff was removed it was no longer profitable to make these separators in Russia and they were imported from the parent company AB Separators, of Stockholm.[12] Imports of "simple" equipment were not evidently greatly affected. Indeed the import of German ploughs increased rapidly. So common was the German 'Sack' plough that it gave its name to a plough type, the 'Sakka" in Russia. As well as British, German, Swedish and American exporters there were Austrian and French suppliers in significant number — and even ploughs from Bulgaria. Estimates of total imports are shown on Table 1.

TABLE 1

TOTAL RUSSIAN IMPORTS OF AGRICULTURAL MACHINERY 1867-1910
(annual averages in thousand rubles of current prices)

1867-9	1,647
1874-5	4,272
1876-80 (ex 1879)	5,642
1888-90	2,719
1891-95	5,226
1896-1900	9,667
1901-1905	19,564
1906-1910	28,285

Sources:

Ezhegodnik Ministerstra Finansov za 1877g (St. P. 1878) p. 498
za 1879g (1880) p. 612
za 1881g (1882) p. 474
za 1883g (1884) p. 612

Statistical Abstract for the Principle and other Foreign Countries
for 1888-1897/8 pp. 72-3
1892-1901/2 pp. 74-5
1896-1905/6 pp. 90-1
1912 pp. 112-3

Imports did not evidently impede the development of home manufacture, rather the two increased in parallel. As early as 1774 the Free Economic Society began making a form of mechanical harvester on an experimental rather than commercial basis. The first factory proper was ironically (or perhaps typically) established by an Englishman, Wilson, in Moscow in 1802,

[12] J. KUUSE, *Interaction between Agriculture and Industry*, Goteborg, 1974, pp. 167-9.

making threshers.[13] In the 1830's and 1840's threshing machines were made in Riga from western models or (stolen?) plans.[14] The expansion of imports after 1850 was matched by a growth in home manufacture. Imported goods provided a demonstration effect. Even imported ploughs were copied until late in the century,[15] and foreign entrepreneurs set up manufacturing plants. As well as the examples of Wilson and Nobel mentioned above, James Greaves of Ekaterinoslav was probably the best known.

More important were the skills acquired through the maintenance and servicing of imported machinery. Helferich-Sade, a German who was an agent for Ransomes and Claytons as well as German manufactures in Kharkov, began manufacture on a small scale in 1870. In 1885 he developed an elevator for use with the threshers he was selling.[16] The Elvort brothers of Elizavetgrad, Kherson province, made seed drills and harvesters (*zhneiki*), building on their experience and technical knowledge gained as agents for importers. By 1904 they were employing 850 workers.[17] The Aktsai company in Rostov-on-Don, established a factory in 1890, which quickly became one of the largest plough makers in Russia.[18] Some estate owners began manufacture themselves for similar reasons — as a 'spin-off' from a servicing facility or simply because the right equipment was not otherwise available. Count A.A. Bobrinsky, on his Smelo estate, in Kiev province, was apparently dissatisfied with available equipment and set up a workshop to make his own.[19] In 1872 his workshop produced 115 ploughs, 40 harrows, 122 seed drills, 77 horse-powered threshers, 61 winnowing machines, 48 'sorters' (*sortirovki*) as well as other equipment.[20] By 1879 the works were employing 118 workers and producing 61,800 rubles worth of goods per annum.[21] The counts Branitsky, in Kiev province, employed 34 workers in two plants in 1879, and produced over 90,000 rubles worth of equipment.[22] Klein-Mikhel, in Tula province, Meklenburg-Strelitsky,

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[13] V.V. Chernyaev, "Sel'skokhozyaistvennoe mashinostroenie", in *Istoriko-statisticheskii obzor promyshlennosti v Rossii*, vol. 1, St. P. 1883, p. 142.

[14] Strod, *op. cit.*, p. 297.

[15] *Sel'skokhozyaistvennye i statisticheskie svedeniya po materialam poluchennym ot khozyaev*, vyp xi, 1903, p. 33.

[16] D.D. Artsybashev, "Iz poedki po zavodam sel'skokhozyaistvennykh mashin" *Zemledel'cheskaya Gazeta*, 1904, no. 12, p. 288.

[17] *Ibid.*, no. 9, p. 415.

[18] *Ibid.*, no. 14, p. 528.

[19] F.N. Vovchenko, "Sel'skoe khozyaistvo Smelyanskoi grafov Bobrinskikh ekonomii", *Russkoe Sel'skoe Khozyaistvo*, 1876, vol. 14, pp. 2-3.

[20] *Doklad vysochaishe uchrezhdennoi kommissii dlya issledovaniya nyneshego polozheniya sel'skogo khozyaistva i sel'skoi proizvoditel'nosti v Rossii*, St. Petersburg, 1873, prilozhenie iv.

[21] P.A. Orlov, *Ukazatel'fabrik i zavodov Evropeiskoi Rossii*, St. P. 1881, p. 373.

[22] *Ibid.*

in Poltava province, Orlov-Davidov, in Simbirsk and others developed manufacturing centres on estates.[23] Sometimes they developed a specialism or high reputation — the Bobrinsky make of cultivator was well known before the end of the century.[24]

The absence of authoritative data makes it difficult to judge the growth of home production of agricultural machinery and implements with accuracy. However, estimates have been made which suggest a marked, if unsteady growth in factory numbers and output, (see Table 2).

TABLE 2

ESTIMATES OF FACTORIES MAKING AGRICULTURAL EQUIPMENT, AND OUTPUT

Year	European Russia Including Poland *	Excluding Poland	Output ** (1,000 Rubles)	
1864	64			
1871	203			
1875/6	340		2,375	
1876				2,329 (Lenin)
1879	340		3,981	3,830 (Lenin)
1885	435			
1887		158	5,170	
1890				5,046 (Lenin)
1892	400			
1894		193	8,067	9,445 (Lenin)
1897		280	9,158	(9,537) ***
1900		235	10,445	
1906			20,000	(including kuster)
1909			35,000	(including kustar)
1911	775	665	45,693	

* Where known. Figures given excluding Poland only where definitely known to do so.

** It is not always known whether these figures include or exclude Poland, except in specified cases.

*** Including Polish production.

Sources:

The Industries of Russia, vol. III, St. P. 1893, p. 268 (figures from Balatin).

YA. YA. POL'FEROV, *Sel'skokhozyaistvennye mashiny i orudiya*, Petrograd 1914, pp. 1-4.

P.I. ORLOV, *Ukazatel' zavodov i fabrik*, 1881, pp. 357, 620.

Zemledel'cheskaya Gazeta 1913g, No. 12, p. 368.

Materialy dlya torgovo-promyshlennoi statisticheskoi svedenii dannykh o fabrichno-zavodskoi promyshlennosti v Rossii za 1897g, St. P. 1900, p. 251.

V.I. LENIN, *The Development of Capitalism in Russia*, M. 1967, p. 223.

[23] L. MINARIK, "O svyazakh krupneishikh zemel'nykh sobstvennikov Rossii s promyshlennostyu", *Ezhegodnik po agrarnoi istorii za 1971 g.*, Vil'no 1974, p. 316.

[24] *Sel'sko. i stat. svedeniya*, vyp. xi, p. 39.

There is some considerable discrepancy between different estimates for factory numbers and output before authoritative official data for 1911 were available. It is not always clear whether estimates include or exclude Poland; the definition of "factory" obviously varied — Balatin's figures for agricultural engineering factories being in excess of Orlov's figures for all engineering factories for example; factories often made non-agricultural as well as agricultural items which might have made definitions difficult.[25]

Notwithstanding these difficulties it is evident that output increased faster than factory numbers which suggests an increase in the scale of production. Overall factory numbers probably fluctuated with a tendency towards greater capital intensity in the later years of the nineteenth century.

Most Russian manufacture was of the relatively simple type of equipment (Table 3) horse powered threshers greatly exceeding steam threshers in output,

TABLE 3

MACHINE AND IMPLEMENT NUMBERS IN 50 PROVINCES 1910-1911

	Number in use	Output by value (rubles)
Sokha's	6,454,119	
simple plough (*Kosul'ya*)	800,773	
ploughs: wood	2,320,673	7,209.957
iron	4,607,010	
steam	304	
Other improved ploughs	400,853	
wood Harrows	5,032,244	
wood with iron tips	12,068,071	1,189,959
iron	396,545	
Other 'improved'	575,693	
Seed drills	292,132	7,511,202
Harvesting machines	603,334	11,556,277
Threshing machines:		6,163,883
hand	54,666	143,818
horse	392,182	5,466,719
steam	20,180	470,535
Winnowing machines	1,708,089	
Hay cutters	103,988	145,113
Horse rakes	135,259	7,200

Sources:

Sel'skokhozyaistvennye mashiny i orudiya Aziatskoi i Evropeiskoi Rossii v 1910 g.

Sbornik statisticheskikh ekonomicheskikh svedenii po sel'skomu khozyaistvu Rossii i inostrannykh gosudarstv, St. P. 1914, pp. 614-615.

(The categorization for equipment in use and production varies. There are items of output — including simple implements such as sickles and scythes — omitted).

[25] V.I. LENIN, in *Razvitie kapitalizma v Rossii*, Moscow 1952, p. 179, noted the same difficulties.

'simple' harvesting machines accounting for nearly all output, single share ploughs being more numerous than multi-shared ploughs.[26] Production of this 'simple' equipment was protected by the selective tariff of 1898. It was evident that there remained a significant technological lag behind the west. The lack of effective protection for complex machinery hindered its production because Russian productivity could not match that of European and North American producers. Nonetheless Russian manufacturers did make substantial progress in the technical level and scale of production in the years before the war and revolution.

In addition to this factory production the peasant *kustar* and artisan industries continued to make implements, mostly from wood, for peasant use. Ryazan, for-instance was a well-known plough-making centre.

It is evident that the total of domestic manufacture was not able to keep pace with the growth of demand. Both imports and home manufacture increased at a rapid rate and in parallel.

In the third quarter of the nineteenth century most demand for imported machinery came from the relatively large estates. Imported equipment tended to be relatively sophisticated, often steam powered, and unsuitable for peasant farms. It was reckoned, for instance, that a minimum holding of 50 desyatinas arable was needed to justify a horse-powered threshing machine,[27] and 400 desyatinas for a steam-powered machine.[28] Landowners did not think in such precise terms, but nonetheless the purchase of expensive equipment required a rational basis. However, peasant farms increasingly came to employ various types of machinery and 'improved' implements, though these were more likely to have been, for example, hand-or horse-powered threshers than steam (see below).

The earliest penetration into the Russian market of 'improved' equipment both by imports and home products, was the iron plough. The plough cut a deeper furrow than the *sokha* or simple wooden plough (*kosul'ya*) but saved no labour, indeed it required greater tractive effort than the *sokha*. Ploughs were bought by private estates in the early post-emancipation years, though increasingly from the mid-1880's, by peasants.[29] The German firms of Sack and Eckert had great success selling to peasants, directly or through the *Zemstva*. Ransomes, of England, designed a light plough especially for the peasant market with real, if unspectacular, success.[30] Ploughs made by Bulgarian,

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[26] *Sbornik statisticheskо-ekonomicheskikh svedenii po sel'skomu khozyaistvu Rossi i inostrannykh gosudarstv.*, St. Petersburg, 1914, pp. 612-615.

[27] BAUER, *Krest'yanskoe khozyaistvo*, M. 1925, p. 24.

[28] A.V. CHAYANOV, *Theory of Peasant Economy*. Illinois 1966, p. 189.

[29] *Sel'skoe khozyaistvo i lesovodstvo*, 1893, p. 357.

[30] MUNTING, "Ransomes...", *op. cit.*

Swedish and Russian manufacturers also made increasing sales. It was not until the twentieth century that peasants became major buyers of ploughs. In 1900 a survey found that the iron plough was in common use only in the black-soil provinces, the Baltic and Poland. Outside these areas it was found predominantly in gentry-owned estates. In 1910 there was one "improved tillage implement" (i.e. plough) for every 2.8 peasant farms in European Russia; 32.1% of peasant tillage implements were ploughs. The figure for all farms was 34.3%,[31] the private holdings weighting up the average a little. Private estates were the more likely to own ploughs proper but peasant farms provided the bulk of the market.

Of machines proper, threshing and winnowing machines were the first to find a ready market in Russia, as they were in other parts of Europe.[32] Mechanised threshing and winnowing had great and evident advantages in saving labour time. These tasks were essentially winter occupations. In much of Russia the harsh climate precluded other farm work in winter. However, where there was alternative non-agricultural employment in winter the labour saving of mechanical threshing was worthwhile. It was for this reason that mechanical threshing even became commonplace amongst peasant farms. Reports from Tula province in Central Russia around the turn of the century show that although few peasants owned threshers many hired them[33] thus enabling family members to go away for seasonal urban employment. In 1910 there was one machine for every 32 farms in peasant ownership and one winnowing machine for every eight farms.[34] These machines were very rarely steam-powered, however.

Estate owners bought threshing machines for similar reasons. Labour was often hired for the summer season or just for the harvest, so that after the harvest there was a real need to save labour. In the southern provinces much of the agricultural labour was migratory, from the central provinces. These labourers then returned home immediately after the harvest in time for the harvest in their own districts, which was somewhat later.[35] This migratory pattern was greatly aided by the advent of railways from the 1870's.

Horse-powered threshing machines became generally available in Russia in the 1850's. Steam-powered machines, and portable engines, were imported

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[31] *Sel'skokhozyaistvennye mashiny i orudiya Evropeiskoi i Aziatskoi Rossii v 1910 g.* St. P. 1913, p. 30.

[32] E.J.T. COLLINS, "Labour supply and Demand in European Agriculture 1800-1880", in E.L. JONES and S.J. WOOLF (eds.), *Agrarian Change and Economic Development*, London, 1969, p. 9.

[33] S. YU. SOTTIRI, *Ocherk rasprostraneniya u krest'yan Tul'skoi gubernii uluchshenikh zemledel'cheskikh orudii i mashin*, Tula, 1900, p. 9.

[34] *Sel'skokhozyaistvennye mashiny*, p. 30.

[35] *Sel'sko. i stat. svedeniya*, vyp. xi, St. P. 1903, pp. 3-6.

some years later. However, in 1910 most machines in use were horse-powered and only a very small share of Russian output was of steam-powered machines (see Table 3). Reaping machines were imported also from the mid-nineteenth century, but came into more general use only late in the century — again on a pattern closely comparable with other European countries.[36]

The more sophisticated machinery was largely, if not exclusively, confined to estates. It was reported in the late 1890's for instance that seed drills were rarely found in peasant farms, and only usually in estates in the Baltic and black soil areas. Cultivators (*skoropashki*) were largely confined to estates in the central agricultural region, the south-west, Ukraine and Poland.[37] Steam ploughs were used only in sugar-beet growing estates [38] which were principally in the Ukraine and Poland.

By the end of the nineteenth century some harvesters (*zhneiki*) were being made in different parts of Russia — the Elvort brothers in Elizavetgrad being amongst the best known.[39] The John Greaves factory in Berdyansk was the largest producer — in 1900 making over 1,000.[40] Most machines in use were American, however — Osbornes, Massey-Harris, McCormicks, Johnstones. Home manufacture was more important in seed drills, again the Elvort brothers being particularly well known. Some were even exported.[41] In 1907 a heavy demand for seed drills which could be used both for sowing and for applying fertilizer was reported.[42] Barely a decade earlier only a very limited demand had been evident.[43]

Demand for agricultural machinery was very uneven, geographically, being much heavier in the southern provinces and the Baltic, than in central Russia. The major importing companies had their agencies or warehouses (*skladki*) here, as well as in the major centres of Moscow and Petersburg. Ransomes had a branch in Odessa and agents in Kharkov, Samara, Taganrog, Saratov, Riga, Moscow and Petersburg.[44] Other British, German and American companies, like McCormicks,[45] had agencies in the same areas. George Hume, who sold Marshalls' machines, confined himself to the Ukraine.[46] In 1880

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[36] COLLINS, *op. cit.*, p. 74.

[37] These returns are largely based on survey data for c. 1900. *Sel'sko. i stat. svedeniya*, vyp. xi, 1903, pp. 33, 39, 67, 120.

[38] ARTSYBASHEV, "Ocherk..." *Ezhegodnik*, 1907, p. 138.

[39] ARTSYBASHEV, "Iz poedki...", *Zem. Gaz.* 1904, no. 9, p. 417.

[40] ARTSYBASHEV, "Ocherk...", 1907, p. 142.

[41] *Ibid.*, p. 140.

[42] *Ibid.*, p. 139.

[43] *Sel'sko. i stat. svedeniya, vyp. xi*, p. 67.

[44] MUNTING, *op. cit.*

[45] G.S. QUEEN, "The McCormick Harvesting Machine Company in Russia", *Russian Review*, 23, 1964, pp. 164-181.

[46] G. HUME, *Thirty five Years in Russia*, London 1915, *passim*.

warehouses handling imported equipment numbered 10 in Odessa, five each in Kharkov, and Kiev, four in Rostov, two in Saratov, 12 in Moscow, nine in Warsaw and four each in Petersburg and Riga.[47] Russian manufacturers were concentrated in the same areas. In 1911 there were 57 factories in Taurida province, 38 in Kherson, 39 in Ekaterinoslav, 24 in Kharkov, 17 in the Don Oblast, 20 in Lifland and 8 in Moscow. There were also 110 in Poland, principally in Lublin and Warsaw.[48] In 1911-13 84½ of all agricultural engineering production was in factories in Taurida, Kherson, Ekaterinoslav, Kharkov, Kiev, Don Oblast, Moscow and Warsaw.[49]

The growth in total demand and the regional disparity of demand reflected structural and technical changes in farming, over time and space. Most demand for agricultural machinery was in the peripheral areas — in particular the south and south-east and the Baltic. Demand was relatively slack in the central provinces, notwithstanding the important manufacturing centre of Moscow. The growth in demand over time coincided with a severe net decline in gentry landholding and extension of peasant landholding.

Emancipation had initiated a period of consolidation of peasant landholding in Russia. In Boserup's terminology it had begun a transition from an "Eastern type" agrarian structure — with a seigneurial élite living on the cultivator — to a 'French type' structure, with peasant owner-cultivators,[50] though in Russia ownership was circumscribed by the institutionalisation of the commune. From the 1870's worsening terms of trade and increasing land prices, as well as the simple inability to manage farms, led many gentry to sell part or even all of their holding. As a consequence there was a severe net decline in gentry landholding, which had already been reduced by the terms of emancipation. Gentry landholding fell from 75,076,800 desyatinas in 1877 to 52,163,600 in 1905, in 49 provinces of European Russia.[51] In parallel, there was a net shift of land to the peasantry, though a minor shift also to merchants (*Kuptsy*) and other social groups. In 1905 the peasants owned 151,981,612 desyatinas of land including allotment and privately-owned land.[52] This was second only to state-owned land, most of which was non-agricultural. In addition there were substantial, if unrecorded, leasings of land to the peasantry. Thus the peasantry were becomming more dominant in land-

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[47] V.V. Chernyaev, "Sel'skoknozyaistvennoe mashinostroenie" in *Istoriko-statisticheskii obzor promyshlennosti Rossii*, vol. 1, St. P., 1883, p. 157.

[48] N. Nikitin, "Proizvodstvo v Rossii sel'skokhozyaistvennykh mashin i orudii v 1911 g.", *Zemledel'chekaya Gazeta*, 1913, no. 12, p. 367.

[49] Ya. Ya. Pol'ferov, *op. cit.*, p. 7.

[50] M. Boserup, "Agrarian Structure and Take-off", in W.W. Rostow (ed.), *The Economics of Take Off into Self-sustained Growth*, London, 1964, p. 209.

[51] *Statistika zemlevladeniya 1905 g. Svod dannykh po 50 guberniyam Evropeiskoi Rossii*, St. P. 1907, vol. 50, pp. 12-13.

[52] *Ibid.*

holding, a process which continued after 1905. Peasant farming was smaller-scale than estate farming, more labour intensive and, in the opinion of many, less likely to be technically progressive.[53]

At the same time, however, there is substantial evidence of a growing commercialism in agriculture, the rapid increase in capital investment in agriculture, as has been shown, and, according to Lenin's testimony, the development of capitalist modes of production.[54] More recently I. D. Kovalchenko has suggested that Russian agriculture had bourgeois-pomeshchik characteristics by virtue of the qualitative superiority of estate farms.[55] He adduces empirical evidence to demonstrate how gentry farming was considerably more important in production and marketing (*tovarnost'*) than in landholding as such.[56] There is here an apparent paradox but one that may be readily resolved.

The net decline in gentry landholding does not indicate a decline in or weakening of gentry farming as such, for under serfdon, gentry farming hardly existed. Nearly all farming was done by enserfed peasants using their own equipment. Indeed the loss of serf labour acted as a stimulus to the development of gentry farming, mechanisation being one aspect of that development. Further, the figures of gentry landholding conceal two developments. First, the gentry were very large buyers of land so that, before 1905, most land sold by the gentry was bought by other members of the gentry. There was thus a volatile land market and probably increasing differentiation amongst the gentry. It is clear also that there was substantial investment in land by gentry as well as disinvestment. Second, there were great regional and provincial variations in the rate of net decline of gentry landholding. It was most severe in the central provinces of European Russia and the Lake region (and far north). It was least of all in the Baltic provinces (Lifland, Kurland and Estland) and only moderate in the north-west, Belorussia and Ukraine.[57]

Gentry landowership then was more resilient than at first apparent, if only in certain regions. Russian agriculture, in the years between 1861 and 1905 had an evident and growing dual structure — on the one hand an increasingly quantitatively predominant peasant small-holding sector, and on the other a 'residual' but in many ways qualitatively superior gentry estate sector, which displayed some characteristics of capitalist farming.[58] The existence of this

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[53] BOSERUP, *op. cit.*

[54] V.I. LENIN, *Razvitie kapitalizma v Rossii*, pp. 151-206.

[55] I.D. KOVAL'CHENKO, "Sootnoshenie krest'yanskogo i pomeshchego khozyaistva v zemledel'cheskoi proizvodstve kapitalisticheskoi Rossii", in *Problemy sotsial'no-ekonomicheskoi istorii Rossii, sbornik statei*, M. 1971, p. 173.

[56] *Ibid.*, p. 191.

[57] SVYATLOVSKII, *Mobilizatsiya zemlevladeniya...*, pp. 109-119.

[58] This concept of dualism is developed by G. GRANTHAM, "Scale and Organiza-

dual structure modified, and even determined investment in machinery in Russia, and helps explain the anomaly of increasing investment of scarce capital alongside growing landhunger, " surplus population ", and rapid population growth. It should be seen in terms of regional variations and a distinction between the gentry estate sector and the peasant sector.

In general the regions with the greatest demand for modern agricultural technology were those where gentry landownership was most resilient. But these regions had diverse economic characteristics. In the northern and eastern extremes a ' long forest fallow ' system persisted even into the twentieth century. Under this system forest areas were cleared, cultivated for some years, and then allowed to grow to forest again. Included in this area were Arkhangel, Olonets, Vologod, part of Novgorod, Kostroma, Vyatka and Perm provinces. In these areas agriculture was thus at a restricted commercial level and the forest provided as rich a source of income as the land. In the far north gentry landownership was insignificant, even in 1861 (most forest being state property). In Vyatka and Perm, on the other hand, gentry estates were vast, but concentrated on mining and metallurgical industry rather than agriculture.

Another ' long-fallow ' region, in the south, had quite different characteristics. Taking in Ufa, Orenburg, Samara, Astrakhan, Kuban, Don Oblast, and parts of Taurida, Kherson, Ekaterinoslav, the system employed long grass fallow between cropping periods. This was one of the richer productive areas of European Russia, where gentry estates were strong and where mechanisation developed well for extensive grain cultivation.

At the other extreme, the Baltic and parts of Belorussia were ones of well developed mixed farming, including dairying and other branches of livestock farming. From the 1890's Belorussia became one of the major dairy centres of Russia.[59] Fodder crops, such as clover, potatoes and grass like timothy, were grown.[60] This system involved a generally high level of labour and capital intensity and often ' specialised ' equipment — for dairying and grass and clover cutting. Livestock farming was well developed, though on a less commercial scale, into Central Russia including, St. Petersburg, Moscow, Kaluga, Tver, Yaroslavl, Kostroma, Vladimir, Kazan, Tula as well as western provinces.

In most of central Russia, to the northern limit of black soil belt, from Tula and Ryazan in the north to Podolya in the west, Kharkov in the south, and part or Saratov in the east, the three-course system, was predominant.

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tion in French Farming 1840-1889 ", in W. Parker and E.L. Jones (eds.), *European Peasants and their Markets*. Princeton, 1976.

[59] Kh. Ya. Beil'kin, " Padenie tsen i sostoyanie khlebnoi torgovli Belorussii v gody agrarnogo krizisa kontsa xix v. " *Ezhegodnik po agrarnoi istorii vostochnoi Evropy* 1968 g.

[60] V.N. Tyurin, " Sel'skokhozyaistvennaya spetsializatsiya Litvi v k. xix v. – n. xx v ". *Materialy po istorii sel'skogo khozyaistva i krest'yanstva SSSR vol.* 4, pp. 246-291.

Sales of machinery were less well developed here than elsewhere. Further south — Saratov, Samara, Kherson, Poltava, Ekaterinoslav and parts of Kharkov and Voronezh — was more evidence of improvement with multi-course systems employing sown leys and less fallow land. This was an area of export grain production. Machine sales seemed to be well developed by the close of the nineteenth century.

There were also two specialised crop 'areas' for sugar and flax, which had their own particular demands for machinery. Steam ploughs were used in sugar beet areas but not elsewhere. The principal sugar growing areas were in Kursk, Kiev, Kaluga, Chernigov, Volyn and Podolya; flax in Pskov, Vitebsk, Novgorod, Smolensk and parts of provinces to the east.[61]

These regions are only general areas – merging into and overlapping with one another. By no means all farming in the prescribed regions employed the system referred to here, and such crops as sugar were grown beyond the main 'sugar growing' area. But such regions have some general validity. In general demand for agricultural machinery was higher where there was most evident commercial development – and this tended to be in areas where estate farming was strongest.

Estates were not the only buyers of machinery and "improved" equipment.

TABLE 4

DATA FOR 1910 REVEALS THE FOLLOWING DISTRIBUTION

	Density of certain machines in European Russia	
	Peasant Farms only	All farms
Average arable area per:	(desyatinas)	
Seed drill	432	381
Harvesting machine	160	185
Threshing machine	203	238
Winnowing machine	51	65
Meadow area per hay cutter	24	225

Sources:
Sel'skokhozyaistvennye mashiny i orudiya v 1910 g, pp. 30-34.

In some cases machines were more intensively used in peasant farms than the average for all farms. Peasant farms are included in the 'all farms' category so direct comparison with gentry farms is impossible. There is, however, a clear indication that machinery was widely used on peasant farms, if

[61] This regionalisation is based largely on *Istoriko-statiticheskii obzor promyshlennosti v Rossii*, vol. 1, St. P. 1888, pp. 5-15.

much of that machinery was relatively simple. However, it is difficult to draw hard and fast conclusions from these figures because they reveal little. Evidently hay cutters (*senokosil'ki*) were intensively used in peasant farms. It seem more likely, however, that they were inefficiently used -- their " density " being a result of a relatively small meadow area. On average there was one hay cutter for every 183 peasant farms.

What is perhaps more striking is that regional disparities in the distribution of machinery and implements were extreme (see Table 5).

TABLE 5

REGIONAL DISTRIBUTION OF AGRICULTURAL EQUIPMENT IN PEASANT FARMS IN 1910 (sample provinces)

		Peasant Farms per: Iron plough	Iron harrow	Threshing machine	Seed drill
Far N:	Arkhangel'	458	409.1	454	5,205
Central:	Moscow	20.4	167.2	128	1,483
	Tver'	11.7	65.5	47	6,010
Baltic:	Kurland	0.7	1.3	5	12
	Lifland	1.0	1.5	7	95
West:	Mogilev	2.4	121.2	79	182,226
East:	Vyatka	116.6	56.1	37	9,920
South:	Don oblast	1.1	10.7	17	10
	Ekaterineslav	1.0	5.7	17	6
	Taurida	1.1	9.3	25	9

(*Sel'skokhozyaistrennye mashiny i orudiya*, pp. 30-31).

The use of machinery and ' improved ' implements in peasant farms was far more developed in the southern provinces and the Baltic than elsewhere, just as for non-peasant farms and estates. This suggests that commercialisation or agrarian capitalism was strongly developed regionally, irrespective of type of farm, and that there was some " demonstration effect " from the commercial estate to peasant farms in the vicinity. At the same time other evidence confirms that most peasant demand was for the relatively simple type of machinery, with the exception of iron ploughs. Foreign exporters to Russia and their agents found their chief markets for sophisticated and ' complex ' machinery amongst the estate sector.

By no means all the equipment referred to may be described as ' labour-saving ', an iron plough for example saved no labour but did a better job than a wooden one. Threshing machines, harvesters and seed drills and the like, on the other hand, were substantially labour-saving.

Estate owners were prepared to invest relatively large sums on labour saving equipment, and in some cases set up workshops to make this equipment themselves. A labour shortage really dates from emancipation for, by definition, it denied the gentry of its supply of free labour. The need to pay wages automatically made capital relatively cheaper, and the provision of allotments made peasants less dependent on work on the estate land. The dual structure of landholding in Russia can explain, therefore, the growing capital intensity in some areas and some farms while at the same time there was a growing small-scale labour-intensive sector with low levels or productivity. The crucial difference between the 'peasant' sector and the commercial estate sector is the manner of employment of labour. The latter employed labour as a factor of production, the peasant farm was nearer to the position of having a given supply of family labour for which work had to be found.[62]

For the 'commercial' farm there was a relatively high elasticity of substitution of labour and capital at the margin so that where labour became relatively scarce there was some substitution. Very obviously, the relatively high cost of labour encourages the use of labour-saving technology.[63]

The dual structure of Russian land ownership and farming meant that most potential agricultural labourers on estates were peasants who were themselves landowners. Peasants sought outside employment in estates where hunger or poverty demanded it. But this employment was an alternative to work in the home farm or other employment in crafts and trades (*promysly*). As the timetable for agricultural work was essentially the same in peasant farms and estates alike — in any one locality — a good harvest naturally meant more work to be done on the home farm and less available (local) labour for estate work. Contemporary reports bear testimony to this. It was reported from south Russia, in different years in the last quarter of the nineteenth century, that a good harvest resulted in large sales of machinery to landowners on estates, and high labour costs — for the local peasants had sufficient work of their own to occupy them fully. Conversely poor harvests meant easily available local labour and unsold machines in merchants' hands.[64]

In addition to these short-term fluctuations, mechanisation was more developed in those provinces of relatively long-term high labour costs. Data collected in the 1880's show that the provinces with the highest annual labour costs were Taurida, Kurland, Don Oblast, Astrakhan, Bessarabia, Ekaterinoslav, Kherson and Lifland — each with average payments to male workers employed

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[62] S.H. FRANKLIN, *The European Peasantry*, London, 1969, p. 19.

[63] B.H. SLICHER VAN BATH, "The Influence of Economic Conditions on the Development of Agricultural Tools and Machines in History", in J.L. MEIJ (ed.), *Mechanisation in Agriculture*, Amsterdam, 1960, p. 23.

[64] *Report on the Agriculture of South Russia for 1875* (Parliamentary Papers, 1875, C. 1355) lxxiv, pp. 61-71; and *Ditto* for 1888 (P.P. 1889 C. 5618 - 34) lxx, p. 2.

for the year of over 80 rubles.[65] This same survey reported an absolute labour shortage in the provinces of Bessarabia, Kherson, Ekaterinoslav, Taurida, Don oblast, Saratov, Samara and Orenburg. The basis for this calculation was only hypothetical yet it provides a reasonable assessment of the comparative labour supply in various regions of Russia.[66] At the other end of the scale were 21 central and western provinces, where there was a surplus of labour.[67] These included areas of lowest wage rates and the greatest penetration of peasant landholding.

The remaining 21 provinces fell into a strange category of a theoretical shortage of labour, according to the working norm, but an actual excess of 4,556,195 workers — excess for the needs of agriculture, that is.

In the first group, the deduced labour shortage was aggravated in real terms by the labour-intensive nature of the farming in some areas — tobacco and fruit growing for example. There was also some movement to factory work. The shortfall was in part made up by migratory labour but more particularly by capital substitution. As wage rates were pushed up to attract labour so capital substitution became more attractive — even though the purchase of machines was a major expense and required raising credit. The gentry never bought other than on credit.

For the second group there was no general labour shortage. Demand was likely to be in excess only at harvest time — a direct cause of imports of harvesting machines (*zhatvennye mashiny*) in the 1880's.[68] There was, however, considerable alternative employment in migratory (factory) work in the region, especially in the Moscow and Petersburg area.

There is some irony in the third group for this includes the Baltic provinces where mechanisation was well developed, and yet there was no net labour deficit. Further in the Baltic provinces there was some landless labour providing permanent agricultural labour.[69] Year-long employment was common.[70] However, even as early as 1867 landowners in Kovna were expressing concern

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[65] *Sel'sko i stat, svedeniya*, p. 110.

[66] The survey took a hypothetical norm of 15 desyatinas land per peasant household, of which seven were sown; a family of six people of which three were working age. This showed that in these eight provinces there was a surplus of land and a hypothetical labour shortage of 6, 524, 306 workers, or 1, 435, 193 for the land already cultivated.

[67] Kovna, Vil'no, Volyn, Grodno, Podolya, Kiev, Poltava, Kharkov, Voronezh, Kursk, Chernigov, Orel, Tula, Ryazan, Tambov, Penza, Simbirsk, Kazan, Moscow, Kaluga, Nizhegorod, Arkhangel.

[68] *Sel'sko. i. stat. svedeniya, op. cit.*, p. 84.

[69] *Ibid.*

[70] In the Baltic provinces emancipation, early in the nineteenth century, had left many peasants as landless labourers, unlike the remainder of European and Russia where the provision of land allotments was a basic measure of emancipation.

at a labour shortage — attributing it to alternative employment opportunities in railway construction and smuggling! [71]

There was no simple deterministic pattern and much depended on local rather than regional or provincial characteristics. In western and north-western areas — including parts of Belorussia, Lithuanian and Baltic provinces — the diversification which followed the fall in grain prices in the 1880's was both labour and capital intensive. Potatoes, grown for feed and as raw material for distilling, demanded more labour than simple arable farming. So too did dairying and other livestock production. Yet they also demanded capital investment. A similar picture may be seen in flax and sugar beet production — both relatively labour intensive, and with a longer agricultural working year than grain crops, and both demanding specialised capital equipment. A relative abundance of labour, therefore, did not imply a low rate of capital investment in these areas for capital investment was governed by technical demands as well as labour substitution. However, in the early twentieth century labour shortage — reportedly resulting from migration — were noted and hence further capital substitution was required.[72]

Mechanisation in Russian agriculture developed very little differently from other European countries, in form. Threshing was the first process to be mechanised on any significant scale. Sowing and harvesting were also mechanised to some degree. Russian agriculture remained relatively under-mechanised compared with western Europe, before 1914, and therefore 'backward' in this respect. However, even in the most advanced regions — Britain and Holland for example — the age of agricultural mechanisation came after rather than before the first world war.

The most advanced agricultural technology was available and in use in Russia before 1914, and indeed before the end of the nineteenth century. This technology was made available through imports from all parts of the world and Russia was an important market for agricultural engineering firms in Europe and north America. But the impact of this technology was limited. It was limited geographically — to the peripheral regions — and it was limited in the type of farm involved. Although peasant farms were increasingly coming to use certain types of machinery — threshing and winnowing machines — in the early twentieth century, their 'improved technology' was for the most part confined to iron ploughs and harrows. A greater range of agricultural technology was employed in the large estates.

There were two major economic bases for using machinery — themselves inseparable at the margin. Certain specialised branches of farming, such as sugar beet, flax growing, livestock farming, demanded specialised equipment as part of a generally high level of intensity. These tended to be concentrated

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[71] *Doklad vysochaishe...*, *op. cit.*, p. prilozhenie 2, p. 8.

[72] TYURIN, *op. cit.*, p. 255.

in certain broad areas in the western borders – from the Ukraine to the Baltic. Mechanisation in the extensive arable farming areas in the southern districts was associated more with labour substitution.

Despite the apparent abundance of labour in the economy – rapid population growth and rural 'overpopulation' – there were seasonal and regional bottlenecks to labour supply, most notable at harvest time and especially in the southern sparsely populated provinces. The growth of employment opportunities outside agriculture accentuated these labour shortages – a phenomenon by no means peculiar to Russia. But in Russia the dual structure of landholding and the consolidation of peasant farming exacerbated short-term or localised labour shortages. Work on the peasant's own farm came first and agricultural wage work was sought where the peasant harvest was poor, where the prospective income from wage work was greater than the home farm, or where there was sufficient family labour to release. Further, the continued, and in some cases growing, importance to peasant family income of earnings from crafts and trades (*promysly*), many of which were winter occupations, meant that there was often a shortage of agricultural labour after the harvest. This was one major reason why threshing was one of the first and most important tasks to be mechanised, not only on estates but also on peasant farms.

Russian agriculture remained 'backward', but mechanisation grew quickly to 1914. However, this growth is less well explained by the 'backwardness' of Russian agriculture than by the dualism of its structure. This dualism was evident both between peasant farms and the 'large estates' and between the more advanced regions and the poorer 'consuming' regions of Russia.