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Agricultural Development and Machinery Usage in Uzbekistan

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ABSTRACT. Since the change in leadership, Uzbekistan is gradually transforming from an inward-looking, command-oriented economy to an outward-looking, market-oriented economy. This paper briefly presents the agricultural development and machinery usage situation in Uzbekistan. The development of agriculture has been identified as a critical component of the economic reform. The historical focus of the sector on the production of cotton and wheat has continued to dominate production. With the introduction of critical liberalization measures for the production of cotton and wheat in the beginning of 2020, the transition to higher value horticulture crops production has accelerated. Many farms are around 50 ha, and the associated farmers lack sufficient technical knowledge, farm business management capacities, business planning and/or marketing knowledge which significantly constrains their ability to attract or effectively use investment capital to develop their businesses. Moreover, very limited private advisory capacities and/or consultancies exist in rural areas. There is also growing evidence of larger private farms and agri-business companies establishing and developing their own advisory capacities to support the development of more integrated supply chains. In addition, cluster models are being promoted by the government.

Modern agriculture requires a wide range of technology, knowledge and skills used by farmers and agri-businesses, from operating modern machinery and equipment in open fields and in greenhouses, to maintain minimum safety, hygiene and quality standards in all stages of production, harvesting, post-harvesting, processing and marketing. The paper discusses challenges faced in the machinery sector, technology infrastructure including technical training, machinery dealer support, repair and maintenance, and suggestions to the future.

Keywords. *Agricultural development, machinery usage, challenges, Uzbekistan.*

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Overview

Since the change in leadership in 2016 Uzbekistan has been going through major reforms aimed at building a more open and market-oriented economy. In February 2017, a development strategy for the years 2017-2021 was released, which focused on five main areas for the development of Uzbekistan, namely economic liberalization, the development of social and environmental spheres, a constructive foreign policy, strengthening of the Rule of Law and Good Governance. In September 2017, the exchange rate was unified, and the foreign exchange market began price and trade liberalization, and made significant cuts to tax rates for both firms and individuals starting in January 2019. The country's opening to the world included elimination of entry visas to promote tourism and business and a renewed commitment to join the World Trade Organization. The government has expanded social safety net coverage and substantially improved the availability of economic statistics. Uzbekistan's progress has been impressive and as a late reformer, it can also benefit from the lessons learned by other transition economies [1].

With per capita GDP of US\$1,687 in 2020, Uzbekistan ranks as a low middle income country. GDP growth slowed sharply from 5.8% in 2019 to 1.6% in 2020 due to COVID-19 related lockdowns and trade disruptions. However, positive growth was supported by a robust agriculture output and substantial anti-crisis measures that boosted health spending and supported households and firms [2].

Uzbekistan's agriculture is one of the main sectors of economy, and it has the advantages of a warm climate, a long growing season and water for irrigation. Today 50% of the Uzbekistan population lives in rural areas and 28.2% of GDP were derived from agriculture, forestry, and fisheries [3]. Annual rainfall is less than 300 mm in most locations, and farming is nearly impossible in places with no irrigation systems. The temperature falls below 8°C in the winter throughout most of the country, which makes it difficult to grow anything except winter wheat. In the summer, the temperature exceeds 25°C in most places, which makes them well suited for growing crops. The main sources of water for Uzbekistan are the Amudarya and the Syrdarya, which are both international rivers. The Amudarya supplies 63% of surface water in Uzbekistan, while the Syrdarya contributes 37%. Roughly 80% of the country's main water source, surface water, originates in neighbor countries. Exports of agricultural products contributed approximately 9.8% to Uzbekistan's external earnings in 2019.

In the past, the Soviet agricultural policy leveraged Uzbekistan's favorable conditions mainly for cotton cultivation. Big state and collective farms mainly were specialized for cotton cultivation. After independence, state and collective farms were reorganized into comparatively small individual farms, and cotton production was reduced while wheat production increased. Access to agriculture land and land ownership has a particular meaning in the Uzbekistan context because all land is state property. Individuals are granted land use rights under long-term leases.

Agricultural producers

There are two main types of agricultural production in Uzbekistan: (1) farms and (2) dehkan farms.

Farms are an independent economic entity, managing commodity agricultural production on leased land plots. To conduct farming, land plots are leased on the basis of an open tender for a period of up to fifty years, but not less than thirty years. For farms specializing in crop production, the minimum size of land provided for cotton growing and grain production is 30 hectares; for grain production and vegetable growing the minimum is 10 hectares; for horticulture, viticulture, and cultivation of other crops – up to 5 hectares. Farms specializing in the production of livestock products, are formed under the condition that there are at least 30 equivalent livestock units. The minimum size of land leased to a farmer is at least 0.3 - 0.45 hectares per livestock unit in the irrigated lands, and on non-irrigated lands - no less than 2 hectares per livestock unit. The following coefficients are used for converting physical livestock into equivalent livestock units: cattle (cows, breeding bulls, fattening bulls) and horses-1.0, young cattle-0.6, sheep and goats-0.1, pigs-0.3 and poultry-0.025.

Dehkan farms are family small-scale farms that produce and sell agricultural products on the basis of the personal labor of family members on a personal plot of land. The land area of a dehkan farm will be in range of the 0.06 to 1 hectare. This land will be given to the head of the family for a lifetime of inheritable possession.

Uzbekistan has gone through several waves of farm restructuring and agriculture land reallocations since independence. In the past, farm restructuring has been an integral part of the strict policy to increase production of two strategic crops, namely cotton and wheat. Farmers who requested to produce these crops received land, intermediate inputs, capital and market outlets. However, outputs were procured at prices which could rarely cover production costs. In many cases, farmers experienced losses, especially in the areas with poor soils and insufficient water [4].

At the beginning of 2020, there were 92,600 farms, 5,000,000 dehkan (small-scale) farms and 27,600 organizations engaged in agricultural activities in Uzbekistan. Of the total number of farms, 40,000 are engaged in cotton and grain growing, 31,000 in horticulture and viticulture, 14,800 in livestock, 5,000 in vegetable and melon growing, and 1,800 in other areas of production [5].

The country is taking consistent measures to reform the agricultural sector and introduce market mechanisms and modern technologies. In October 2019, the Strategy for the Development of Agriculture of Uzbekistan for 2020-2030 was adopted. In accordance with this plan, for production of high added value products, agricultural clusters are organized. In

the current year and in the long term, the government is planning on canceling the state order and phasing out the mandatory placement of crops by 2023.

In the modern economic literature, a cluster is defined as an industrial complex formed on the basis of a territorial concentration of networks of specialized suppliers, main producers and consumers connected by a technological chain, and acting as an alternative to the sectoral approach. At the same time, a cluster has properties of mutual competition of its participants, cooperation of its participants, the formation of unique competencies of the region, the formation of a concentration of enterprises and organizations on a certain territory [6].

For smallholder producers, the key benefits of cluster marketing arrangements include: greater access to markets, technical information, inputs and micro-finance; improved bargaining power; higher prices and lower costs. Cluster farming is an alternative farming strategy for smallholder vegetable farmers in Mindanao, Philippines. However, 91% of the respondents (smallholder producers) believed that they were financially better off after joining the cluster [7].

Currently, there are more than five hundred clusters in Uzbekistan: 97 specializing in cotton-textile (average size 9500 hectare), 149 in fruit and vegetable, 65 in cereal production, 35 in rice production and 7 in medicinal plants, as well as 11 cotton-textile cooperatives. Production is organized on the basis of the cluster method, in 34 livestock, 10 poultry, 36 fish, and 15 bee farms. In addition, over the past two years, 62 clusters in the field of sericulture have been organized [8].

Agricultural land and crops

In 2019, 20,236,300 hectares of land were used for agriculture in Uzbekistan, including 3,988,500 hectares of arable land, 383,100 hectares of perennial plantings, 11,028,300 hectares of hay and pastures, and 4,836,400 hectares of other land. Major yield in agriculture received from arable irrigated land. Pastures low productive and mainly used for feeding small animals, sheep and goats.

In 2019, crops were sown on an area of 3,309,400 ha, of which 1,578,300 ha was used for the production cereals (1,316,100 ha wheat), 1,099,500 ha industrial crops (1,050,600 ha cotton), 89,600 ha potatoes, 220,000 ha vegetables, 53,400 ha melons and 267,600 ha forage crops. In 2019, the area of fruit plantations was 336,600 hectares, grapes on 120,200 hectares [3]. Wheat and cotton are still major crops, but the area allocated for those crops is declining with some increase of fields for vegetables and higher value horticulture crops production (Figure 1, 2).

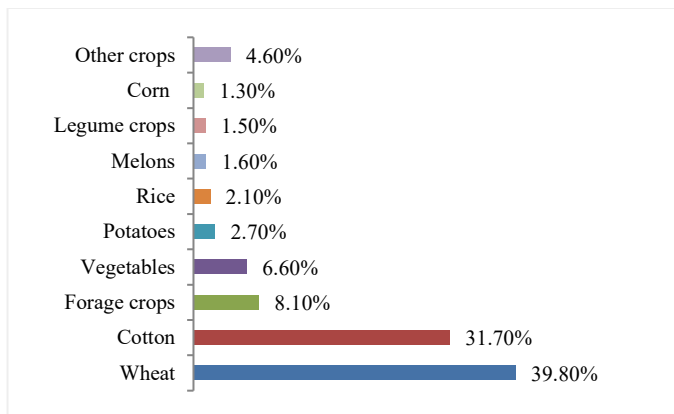


Figure 1. Crops in sown area in 2019

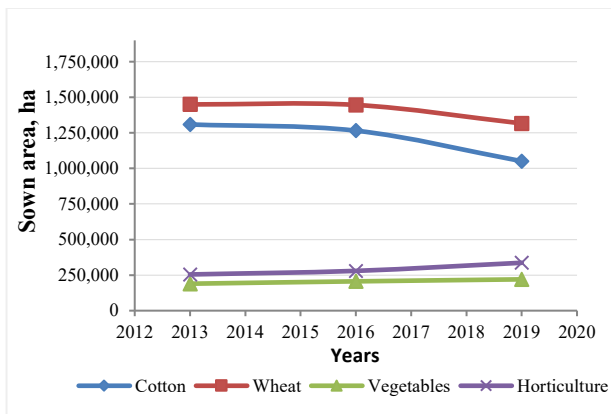


Figure 2. Land allocation

Source: Based data from The State Committee of the Republic of Uzbekistan on Statistics

The analysis by categories of farms showed that 70.1 % of the total agricultural output is accounted for by dehqan farms, 26.9 % - by farms, 3.0 % - by other organizations engaged in agricultural activities.

Uzbekistan has a strong potential comparative advantage in the production of certain high value horticulture products. Export of horticulture products increased by over 50% in 2019, mostly exported as low to medium quality primary products to Russia and Kazakhstan. This export growth has already allowed the country to become the second largest global exporter of dried apricots, the third largest exporter of persimmon, the fourth largest exporter of raisin and apricot, and the fifth/sixth largest exporter of dried prune, fresh cherries and plums.

Many of Uzbekistan's horticulture products have a good reputation and are appreciated by consumers in the neighboring Commonwealth of Independent States. They are, however, less known in the fast-growing markets of Asia and the EU. Meeting the quality and food safety requirements of these more stringent markets remains a challenge.

Agricultural mechanization and machinery

According to FAO [9], mechanization covers all levels of farming and processing technologies, from simple and basic hand tools to more sophisticated and motorized equipment. It eases and reduces hard labor, relieves labor shortages, improves productivity and timeliness of agricultural operations, improves the efficient use of resources, enhances market access and contributes to mitigating climate related hazards. Sustainable mechanization considers technological,

economic, social, environmental and cultural aspects when contributing to the sustainable development of the food and agricultural sector. Agricultural mechanization is recognized as one of the greatest engineering achievements of the 20th century, but its application still differs hugely across the globe and it is often associated solely with tractors and agricultural machinery.

In the past, the tractors and agricultural machines used in the agricultural fields of Uzbekistan were made in Russia, Ukraine and Byelorussia. Additionally, specialized cotton tractors were manufactured at the Tashkent tractor plant of Uzbekistan. After the disintegration of the Soviet Union, not all factories could reorient and organize competitive manufacturing under the conditions of transitioning to a market economy. In addition, the relationships with Russia, Byelorussia and Ukraine diminished and the delivery of agriculture equipment from those countries was sharply reduced. At that time, newly organized farms did not have resources to purchase tractors and other agricultural machines. In the mid-1990s the government established machine-tractor parks to carry out land preparation, seeding and cultivation of agricultural crops and harvesting on the basis of contracts with farms [10]. Later in 1997, tractors (Magnum-7240 and 8940) and grain harvesters (Case-2366) from the US Case IH Company were purchased for machine-tractor parks. Also several joint ventures were organized: UzCaseMash, UzCaseTractor, UzCaseService and UzCaseAgroLeasing for production machines and after sale service. Since 2000, farmers started using Germany company CLAAS grain harvesters (Dominator-130) and tractors (Arion-630). Now CLAAS is producing machines in Uzbekistan through UzClaasAgro LLC and providing after sale service through UzClaasService LLC.

Recently, several newly-organized clusters purchased modern cotton harvesters and tractors from John Deere. Those tractors were equipped with automatic guidance systems and telematics to remotely navigate and monitor machines. The JDLink telematic system establishes a continuous connection between machines working in the field. This solution empowers farmers to remotely control their fleet of equipment, monitor the execution of work and manage logistics online. Highly qualified service specialists of the company monitor machine condition, from the delivery of equipment to maintenance, as well as analyze the operation and performance. If the tractor malfunctions, it sends an alert and operators quickly analyze the notification, inform and instruct the client for further action. The JDLink system helps predict which parts will soon fail, and notify in advance.

In the Uzbekistan, the Tashkent plant of agricultural machinery (the former Tashkent tractor plant) produces three and four wheeled specialized cotton tractors and cotton harvesters with power range from 60, 80 and 100 hp. In recent years, the plant is cooperating with South Korean LS Mtron Company in producing tractors. Wheeled tractors in the 80 and 100 hp range are produced in Byelorussia by Belarus. These tractors are widely used by farmers in Uzbekistan.

In the table below provided info about machines produced by western companies and used in Uzbekistan in 2020. The majority of these tractors are 150 hp or more and used in tillage.

Table 1. Number of machines produced by western companies and used in Uzbekistan in 2020

Name of Company	Tractors	Grain and forage harvesters	Cotton harvesters
John Deere	672	19	111
CNH Industrial	4888	1433	653
CLAAS	2548	3136	-

As of July 1, 2018, the agricultural machinery fleet in the Republic of Uzbekistan consisted of 57,822 tractors, 3,608 combine harvesters, 1,224 cotton harvesters, and 1,738 forage harvesters. Of the above-mentioned number of available agricultural machinery, many are obsolete with a service life of 11 years or more, including 30,412 tractors, 1,131 combine harvesters, 175 cotton harvesters, 919 forage harvesting equipment, which creates a shortage of equipment during the peak season of agricultural work [11].

At the end of 2019, 16,794 tractors were available in farms, and 11,212 tractors were available in organizations engaged in agricultural activities. In 2019, the share of foreign investments and loans in the financing of agriculture, forestry and fisheries was 41.4% [3]. The majority of farms hire tillage tractors and harvesters, and machinery rent cost is one of highest costs and might be around 40% of total production costs if machines are not available in a farm [12]. In cotton fields, two operations; weeding and picking still requires some hand labor [13]. Almost all cotton in Uzbekistan is harvested by hand until 2016, even though mechanization existed during the Soviet period [14]. Not long ago, the government adopted a policy to mechanize the cotton harvest as part of its drive to modernize the agricultural sector. On other hand, wages for hand labor are increasing each year, and farmers are now using more machinery in weeding and picking. Hand labor is still intensively used during harvesting in horticulture and vegetable farms.

Agricultural educational institutions

Tashkent Institute of Irrigation and Agricultural Mechanization Engineers (TIAME), the main agricultural engineering institution, future engineers are trained in hydro melioration, hydro technical construction, land management, agricultural mechanization and electrification and also agricultural economics and accounting. Tashkent State Agrarian University (TSAU), the main institution for agronomy, the following majors are offered: plant protection, horticulture, forestry, agro

chemistry, agro-logistics, farm management, and animal science. There also branch campuses of those institutions in the regions at Bukhara, Qarshi, Samarqand, and Termiz and two Agricultural institutions are located in Andijan, Nukus.

At TIIAME, 88% of Agricultural Mechanization major students grew up in rural area and have some connection to the farm machinery and management. The majority of those students will go back to their hometowns after graduation and work in the farms, dealer and service companies and other engineering related jobs. Unfortunately, there are cases when outdated materials are used which are not well aligned with agricultural sector or labor market needs. Identifying new skills and needs and developing new qualifications will require a coordinated action at the sector with the direct engagement and active participation of sector stakeholders. In the last 2-3 years, TIIAME enhanced collaboration with industrial companies and now at TIIAME located Training center of JV UzCaseService; the John Deere Company equipped classroom, and a classroom opened at the local tractor production plant of CLAAS Company (Figure 3).

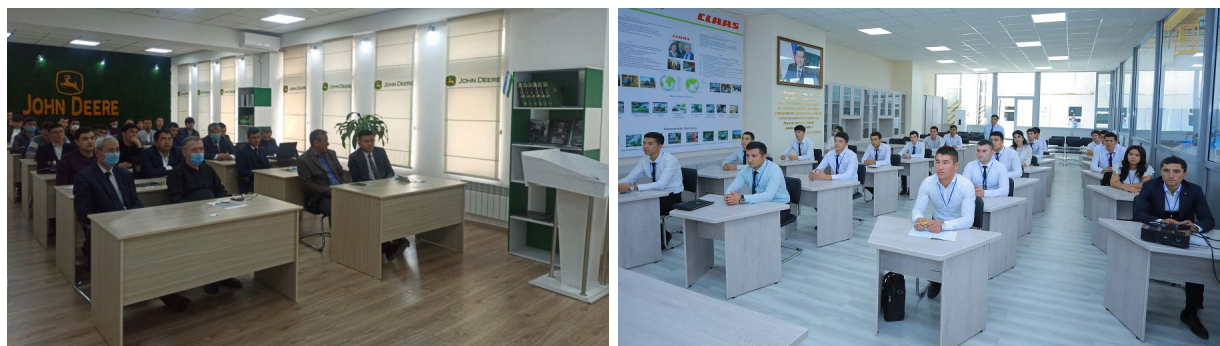


Figure 3. Classrooms equipped by John Deere and CLAAS

Challenges in farming and using machinery

Modern agriculture requires a wide range of technology, knowledge and skills to be used by farmers and agribusinesses, from operating modern machinery and equipment in open fields and in greenhouses, to maintain minimum safety, hygiene and quality standards in all stages of production, harvesting, post-harvesting, processing and marketing.

During the last decade, the digital revolution is transforming agriculture by using modern machinery, computerized tools, and information and communication technologies to improve decision making and productivity. The spread of several cutting-edge technologies, from GPS and remote sensing to big data, artificial intelligence and machine learning, robotics, and unmanned aerial vehicles, is leading to increased yields, lower costs, and reduced environmental impact.

The absence of a well-functioning agricultural knowledge and information system that can effectively link research, education and the provision of advisory and extension services remains one of the most significant constraints to agricultural sector development in Uzbekistan.

Many farmers lack sufficient technical knowledge, farm business management capacities, business planning and/or marketing knowledge which significantly constrains their ability to attract or effectively use investment capital to develop their businesses. Moreover, very limited private advisory capacities and/or consultancies exist in rural areas and those that do exist tend to cluster around higher value vertically integrated value chains where their services are most in demand. Supply of agricultural inputs (seed, fertilizer, agrochemicals) also remains mainly state-led and controlled.

In Uzbekistan now available to use modern tractors and agricultural machinery but properly use all advantages of those machines is problematic. To solve these issues close communication industry, dealers, educational institutions and farmers needed.

Conclusion

Uzbekistan's agriculture is one of the main sectors of economy, 50% of the Uzbekistan population lives in rural areas and 28.2% of GDP were derived from agriculture, forestry, and fisheries. Exports of agricultural products contributed approximately 9.8% to Uzbekistan's external earnings in 2019.

At the beginning of 2020, there were 92,600 farms, 5,000,000 dehkan (small-scale) farms and 27,600 organizations engaged in agricultural activities in Uzbekistan. Of the total number of farms, 40,000 are engaged in cotton and grain growing, 31,000 in horticulture and viticulture, 14,800 in livestock, 5,000 in vegetable and melon growing, and 1,800 in other areas of production.

The absence of a well-functioning agricultural knowledge and information system that can effectively link research, education and the provision of advisory and extension services remains one of the most significant constraints to agricultural sector development in Uzbekistan.

In Uzbekistan, number of modern tractors and agricultural machinery increasing, but less attention given in organization special training courses in proper use all advantages of those machines. To solve these issues, close

communication between industry, dealers, educational institutions and farmers needed. It is very important to organize and teach special advanced training courses for machinery users, farmers and students. Here it is also important to foster close communication between industry, foreign and local educational institutions in updating teaching materials for the courses.

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