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AGRICULTURE IN CENTRAL ASIA: CURRENT STATE AND DEVELOPMENT PERSPECTIVES

This paper aims to analyze the current state and development perspectives of the agricultural sector of the Central Asian countries. It shows that the sector, despite the decreasing trends in many indicators, plays an important role in terms of production, employment, and trade. The paper also considers trade indicators of the region with a focus on the pandemic period. It finds that the countries of Central Asia depend on agricultural imports. However, the Central Asian countries play an important role in the global agricultural market in terms of wheat and cotton production. The paper identifies major disadvantages and challenges for regional agriculture, including rising food prices, climate change, quality of institutions, and productivity. It provides recommendations for the regional policymakers, including escaping trade wars, export bans and other restrictions, and liberalization of trade in agricultural products. In terms of improving the competitiveness of the regional agriculture, the policymakers should focus on climate change adaptation strategies, stimulate capital investment, and improve institutional quality. These policies will require both individual and regional efforts of the governments, businesses, and universities of Central Asia. The findings and recommendations of the paper can be beneficial for policymakers and scholars of Central Asia.

Key words: Central Asia, agriculture, trade, Kazakhstan.

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Орталық Азиядағы ауыл шаруашылығы: қазіргі жағдайы және даму перспективалары

Мақаланың мақсаты – Орталық Азия елдерінің аграрлық секторының ағымдағы жағдайы мен даму перспективаларын талдау. Мақалада көптеген көрсеткіштердің төмендеу үрдісіне қарамастан, сектор өндіріс, жұмыспен қамту және сауда тұрғысынан маңызды рөл атқаратындығы көрсетілген. Зерттеуде пандемия кезеңіне баса назар аудара отырып, аймақтың сауда көрсеткіштері қарастырылған. Орталық Азия елдері ауыл шаруашылығы өнімдерінің импортына тәуелді екені анықталды. Алайда, Орталық Азия елдері бидай мен мақта өндірісі тұрғысынан әлемдік ауылшаруашылық нарығында маңызды рөл атқарады. Жұмыста азық-түлік бағасының өсуін, климаттың өзгеруін, институттардың сапасы мен өнімділігін қоса алғанда, өңірлік ауыл шаруашылығы үшін негізгі кемшіліктер мен сын-қатерлер айқындалған. Мақалада аймақтық саясаткерлерге арналған ұсыныстар келтірілген, оның ішінде сауда соғыстарының, экспортқа тыйым салулардың және басқа да шектеулердің, сондай-ақ ауылшаруашылық саудасын ырықтандыру. Өңірлік ауыл шаруашылығының бәсекеге қабілеттілігін арттыру тұрғысынан саясаткерлер климаттың өзгеруіне бейімделу стратегиясына назар аударуы, инвестицияларды ынталандыруы және институттардың сапасын жақсартуы керек. Бұл саясат Орталық Азия үкіметтерінің, бизнесі мен университеттерінің жеке де, өңірлік те күш-жігерін талап етеді. Мақаланың тұжырымдары мен ұсыныстары Орталық Азияның саясаткерлері мен ғалымдары үшін пайдалы болуы мүмкін.

Түйін сөздер: Орталық Азия, ауыл шаруашылығы, сауда, Қазақстан.

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Сельское хозяйство в Центральной Азии: текущее положение и перспективы развития

Целью данной статьи является анализ текущего состояния и перспектив развития аграрного сектора стран Центральной Азии. Статья показывает, что сектор, несмотря на тенденцию к снижению многих показателей, играет важную роль с точки зрения производства, занятости и торговли. В статье также рассматриваются торговые показатели региона с акцентом на период пандемии. Установлено, что страны Центральной Азии зависят от импорта сельскохозяйственной продукции. Однако страны Центральной Азии играют важную роль на мировом сельскохозяйственном рынке с точки зрения производства пшеницы и хлопка. В работе определены основные недостатки и вызовы для регионального сельского хозяйства, включая рост цен на продукты питания, изменение климата, качество институтов и производительность. В статье содержатся рекомендации для региональных политиков, включая нежелательность торговых войн, запретов на экспорт и других ограничений, а также либерализации торговли сельскохозяйственной продукцией. С точки зрения повышения конкурентоспособности регионального сельского хозяйства, политикам следует сосредоточить внимание на стратегиях адаптации к изменению климата, стимулировать инвестиции и улучшить качество институтов. Эта политика потребует как индивидуальных, так и региональных усилий правительств, бизнеса и университетов Центральной Азии. Выводы и рекомендации статьи могут быть полезны для политиков и ученых Центральной Азии.

Ключевые слова: Центральная Азия, сельское хозяйство, торговля, Казахстан.

Introduction

Agriculture plays an important role in the global economy. Its functions are broad and include the provision of food security, triggering of economic and industrial growth, poverty reduction, narrowing of income disparities, delivery of environmental services, and structural transformations (Byerlee et al., 2009). In the period of economic and political shocks, food security remains a major goal of any government. The recent pandemic shows the importance of trade in agricultural products for global food security, which increases the role and responsibility of food-exporting countries.

Agriculture in Central Asia plays a crucial role in regional development. The region historically specializes in agricultural production and has high shares of the rural population. During the Soviet Union, the agricultural south, where Central Asia belonged, provided the center with the bulk of agricultural raw materials. Uzbekistan is still one of the world leaders in terms of cotton production while Kazakhstan is one of the largest wheat producers. Central Asia is a resource-abundant region, which significantly affects its production and trade specialization. The countries of the region specialize in exports of oil, natural gas, and metals. The end of the energy super-cycle in 2014 and a substantial drop in oil prices showed the vulnerability of such kind of a development model. The regional governments make the case for industrialization and support of the agricultural sector by implementing various programs for producers and exporters. Therefore, the paper aims to analyze the current state and development perspectives of the agricultural sector of the Central Asian countries. By doing so, it identifies a list of challenges, which should be addressed by regional governments.

Literature review

The post-Soviet transition of Central Asian agriculture was difficult. Before the transition, the agricultural sector of many planned economies had similar characteristics. In particular, they had large inefficient farms with high costs of production, high levels of food consumption, subsidized food prices, macroeconomic imbalance, including budget deficit and foreign debt, and pervasive monopoly in food processing and distribution (Brooks et al., 1991). According to Lerman et al. (2003), the Soviet Union was spending 10% of its national income (20% of the government budget) on food subsidies. For Baltic Republics and Russia, the producer subsidy equivalent in the late 1980s was between 70% and 80%. However, in 1992 this indicator for those countries became negative and increased in 1998 (10%-19%). The average share of unprofitable

farms in Kazakhstan increased from less than 5% in 1990–93 to more than 60% in 1998. Moreover, Kazakhstan reduced input use by more than 40%. The Organization of Economic Cooperation and Development (OECD, 2013) distinguishes three phases of agricultural development in Kazakhstan. The first one (1992-1997) is characterized by neglected agricultural policy, during the second one (1998-2002) the government started a stabilization policy. The third phase started in 2003 is associated with the oil boom and the increasing support from the state level. Favorable resource prices led to the rise of services and affected output and employment in agriculture. Indeed, there is plenty of evidence, showing that the booming sector can lead to de-industrialization, which is widely known as Dutch disease (Corden, 1984). Dutch disease is associated with production and export boom, capital inflows and as a result, exchange rate appreciation, which hits non-booming sectors, in particular, manufacturing and agriculture. Apergis et al. (2014), based on the analysis of the Middle East and North African countries, found that a boom in oil rents is associated with a contraction of the agriculture sector, which serves as evidence of a Dutch disease effect. Moreover, the authors also found that agriculture adjusts slowly back to equilibrium after a boom in oil rents. This means that the restoration of agriculture will require more resources in terms of physical and human capital and technology.

Mogilevskii and Akramov (2014) show that imports of agricultural and food products increased its importance for all economies of Central Asia. According to the findings of the authors, trade policies with regards to agricultural products vary greatly in the region from liberal to protectionist, but no correlation was observed between the type of trade regime and performance of agricultural production and trade. Pomfret (2016) shows that in the Soviet era emphasis on achieving output growth by increasing inputs was reflected in the focus on labor, capital, water, and fertilizers in Central Asian agriculture and in the poor record on productivity. The author recommends overcoming these problems by transferring technical knowledge and technology. A list of his recommendations includes shifting from controlling agriculture to an environment that facilitates farmers' access to knowledge, funding agricultural research, and provision of information to farmers. Lerman and Sedik (2018) show that one of the features of the agricultural transition in Central Asia is the dramatic shift, since 1992, from the predominance of large corporate farms to small farms. The authors add that small family farms outperform large enterprises. According to Khitakhunov (2020), members of the Eurasian Economic Union consider their agricultural sectors as the source of economic diversification. However, due to different factors, including difficult transition, reduction of state support, development of other sectors, the role of the agricultural sector decreased substantially. Many countries even did not achieve their pre-independence level of production. The EAEU countries pursue different strategies. All of them prefer supporting large agricultural enterprises, ignoring smallholders.

Methodology

Key agricultural indicators in Central Asia

Central Asia's agriculture follows global trends. It also has a decreasing share in the economies of the region. According to the World Bank (2021a) data, in 1992, Kyrgyzstan had the highest (37.3%) and Turkmenistan had the lowest (10.9%) shares of agriculture in gross domestic products (GDP). The sector's shares in the GDPs of Kazakhstan, Tajikistan, and Uzbekistan equaled 23.3%, 29.5%, and 35.1%, respectively. In 2020, the share of agriculture in the GDP of Kazakhstan dropped to 5.3%. Tajikistan and Uzbekistan still have higher shares, which equaled 23.8% and 26.1%, respectively. Kyrgyzstan and Turkmenistan witness a declining trend. In 2020, the indicator of Kyrgyzstan amounted to 13.5%, while the value for Turkmenistan equaled 10.8% in 2019.

Due to different external and internal factors including a boom in the resource sector, the rise of the services sector (in particular wholesale and retail trade, construction, finance, etc.), the breakdown of regional production chains, border and water disputes, the agricultural sector transformed substantially in terms of production and employment. For instance, between 2003 and 2013, Kazakhstan added about 1.5 million jobs as employment grew by about 22% but agriculture was the only sector where employment declined by 14% in absolute terms (World Bank, 2015). It should be noted that an accelerated reduction of employment in agriculture has started since 2003 following the resource boom that caused the rise of service-related industries. Despite these changes, Kazakhstan still has a high share of the rural population, which equaled 42.3% in 2020. At the same time, the share of agricultural employment achieved almost 15% in 2019 (37% in 1991) which is the lowest level in Central Asia.

The shares of the rural population in Tajikistan and Kyrgyzstan are the highest in the region. In

2020, this indicator for the two countries equaled 72.5% and 63.1%, respectively. At the same time, shares of Turkmenistan and Uzbekistan vary between 47-50%. As of 2019, employment in agriculture achieved the level of 45% in Tajikistan, 26% in Uzbekistan, 19% in Kyrgyzstan, and 21% in Turkmenistan.

Countries of Central Asia, in particular Kazakhstan, play an important role in the global wheat market. In 1961 production and export of wheat amounted to 222 and 40 million tons, respectively. In 2019, production reached 766 million tons, increasing by 3.5 times. In the same year, the export of wheat equaled 180 million tons growing by 4.5 times. Global trade in wheat increased substantially in value terms. While in 1961 global exports amounted to $2.5 billion, in 2019 it increased to $39.6 billion.

Wheat prices experienced significant changes. In December 1990, prices for a metric ton of wheat were $113.2. In December 2000, they increased to $128. Since the early 2000-s, the prices started to rise and peaked in March 2008, reaching almost $440. The global financial crisis and significant reduction of oil prices negatively affected wheat prices. In September 2020, they equaled $198.4 (IndexMundi, 2021).

Figure 1 shows major exporters of wheat. Russia ranks first in the list of main wheat exporting countries. In 2019, its export equaled 32 million tons. The wheat supply of the United States amounted to 27 million tons, while Canada's export reached 23 million tons. Ukraine ranked fifth and in 2019 and exported 13 million tons. Kazakhstan, in turn, supplied 5 million tons of wheat. In 2019, the revenues of Russia from wheat export amounted to $6.4 billion. The United States and Canada exported wheat worth $6.3 and $5.4 billion, respectively. Ukraine and Kazakhstan, in turn, correspondingly earned $3.1 and $1 billion. This means that wheat export accounts for a significant share of Kazakhstan's non-mineral exports.

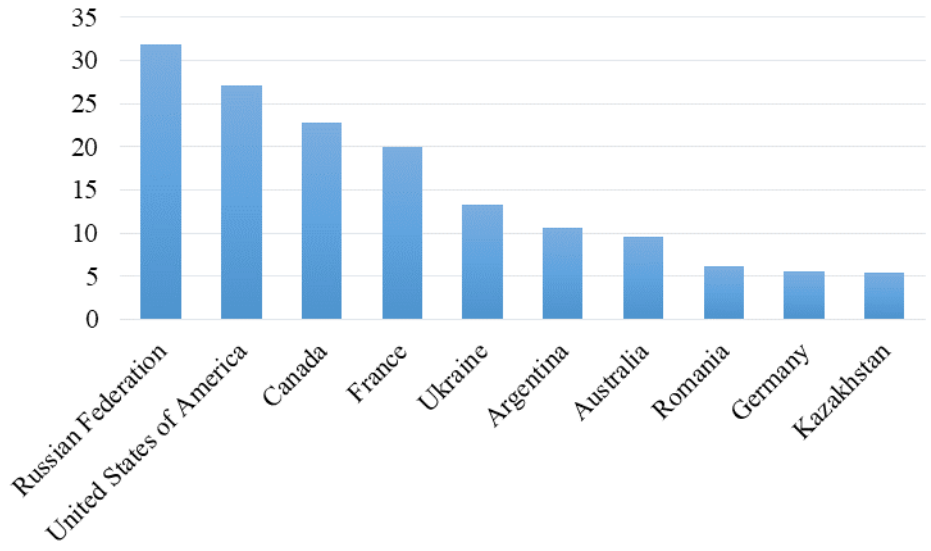

Figure 1 – Major exporters of wheat, million tons
Note – compiled by the author based on the FAOSTAT (2021)

Following Figure 2 shows wheat production in Central Asia. In the early 1990s, Central Asia produced 20.5 million tons of wheat of which the share of Kazakhstan was 89%. Then production in Kazakhstan decreased. At the same time, Uzbekistan increased both wheat production and the area harvested. In 2017, the share of Kazakhstan in Central Asian wheat production decreased to 63%, while the share of Uzbekistan increased to 26% from the low 5.1% in 1992.

Various studies show the importance of Russia, Ukraine, and Kazakhstan for the international grain markets and global food security. In particular, harvest in these countries or their policy towards the regulation of grain markets has a significant impact on global markets. For instance, lower harvest or

export restrictions or bans cause higher world prices. Higher prices are harmful for consumers but at the same time can be beneficial for producers. Increasing prices generally do not affect food security in high-income countries. However, economic costs for net grain importing lower-income countries are high despite their farmers may benefit from higher prices (Fellmann et al., 2014).

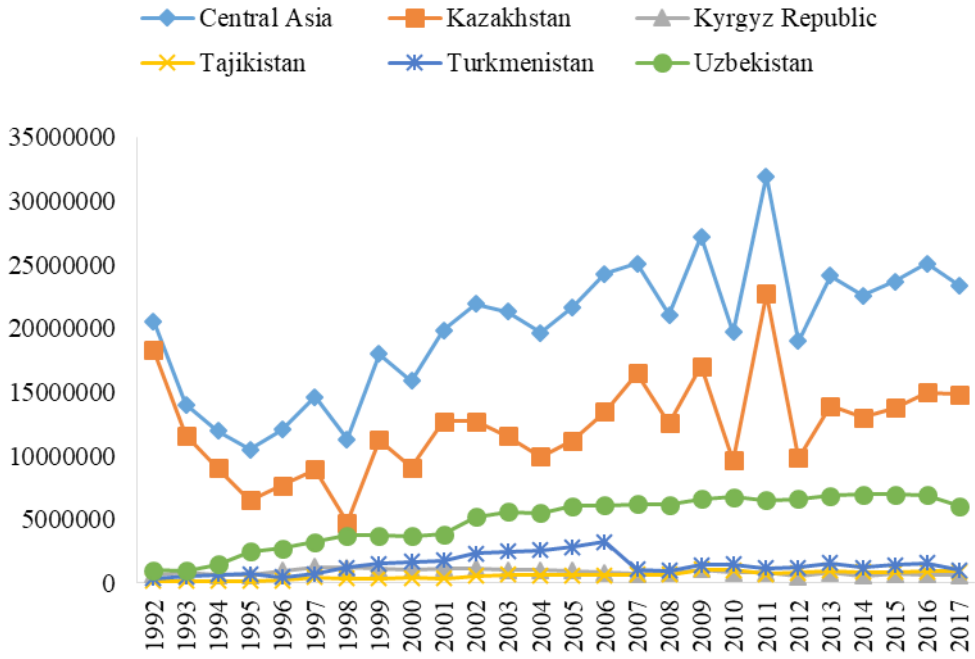

Figure 2 – Wheat production in Central Asia, tons
Note – compiled by the author based on the FAOSTAT (2019)

At the same time, wheat dependence may well be a significant source of food insecurity, when combined with other variables, in particular income levels. Therefore, high wheat import dependency may be considered as a matter of food security in low-income countries, as wheat-based products account for a relatively high percentage of their total cereal consumption (González-Esteban, 2018). For instance, countries of Central Asia spend high shares of their income on food consumption. In Tajikistan, this portion amounts to 63%, and wheat, mainly in the form of bread, accounts for 40% to 60% of total daily food calories. As a result, growth in food prices leads to social and political unrest. For example, higher prices caused public protests in Uzbekistan in September 2007, in Tajikistan in February 2008, and in Kyrgyzstan in April 2010. Therefore, wheat self-sufficiency is crucial for the local governments. Local production in the majority of countries does not satisfy their internal demand. Consequently, on average, imports account for 41% of wheat consumption in Central Asia and Kazakhstan remains an exclusive supplier. Costs of wheat trade in the region are high due to high transportation costs and unofficial payments (Svanidze et al., 2019).

It is important to note that Uzbekistan remains one of the largest cotton producers and ranks seventh in the world production (IndexMundi, 2019). It is noteworthy that cotton production and favorable cotton prices allowed Uzbekistan to keep Central Asian economic leadership up to 1996, without reverting to large-scale reforms. Nowadays, Uzbekistan plans to reduce cotton exports and focus on cotton processing and textile exports. Cotton production is also important for Turkmenistan (ranks 14th) and Tajikistan (ranks 21st) (IndexMundi, 2019).

However, besides their traditional specialization, the Central Asian countries were able to develop new products. This is a case of kidney beans production in Kyrgyzstan. Bean as an export crop was initiated in northern Kyrgyzstan (Talas region) in 1995 on an area of 230 hectares. Currently, the bean is

cultivated on an area of 53000 hectares. In 2009, beans accounted for 16% of agricultural exports. By 2015, the share of beans increased to 26% against the general decline in exports of agricultural products (Tilekeyev et al., 2018).

Trade in agricultural products in Central Asia

In terms of trade, the agricultural sector is an important source of export revenues. At the same time, the import of agricultural products provides regional food security. The provided below calculations are based on data from the International Trade Centre (ITC, 2021). Agricultural products include goods from the 1-24 chapters of the Harmonized System.

The pandemic led to significant changes in the agricultural sector of the region. The Central Asian countries closed the borders and imposed export restrictions. Moreover, the regional countries had to address regional issues such as disruption of internal value chains and migration. The negative shocks led to a surge in prices. All these factors affected the pattern of trade in food products.

Total exports of the region decreased from $86.1 billion in 2019 to $71.1 billion in 2020. Agricultural exports, in turn, experienced an insignificant reduction. During the reported period, the region's indicator declined from $5.2 to $5.1 billion. At the same time, the share of agricultural exports in total exports increased from 6% in 2019 to 7.2% in 2020. Total imports of the region decreased from $71.5 billion in 2019 to $67.9 billion in 2020. Despite the reduction in total imports, agricultural and food products imports in the region increased from $7.8 billion in 2019 to $8.1 billion in 2020. As a result, the share of imports of agricultural products in total imports of the region increased from 10.9% to almost 12%. Therefore, trade in agricultural products in the region changed from $13 billion in 2019 to $13.2 billion in 2020. Moreover, the share of trade in agricultural exports experienced growth. These changes show a critical role of agricultural products in regional trade.

Kazakhstan remains a key supplier of agricultural products for the rest of the Central Asian countries. The country's agricultural exports during the reported period experienced almost no changes. In 2019, its exports amounted to $3.28 billion, while in 2020 it equaled $3.27 billion. For the reported period, the share of agricultural exports in total exports increased from 5.7% to 7%. The country's total agricultural imports increased from $3.9 billion in 2019 to more than $4 billion in 2020. Consequently, the share of agricultural imports increased from 10.2% to 10.7%. It is important to note that the trade balance in agricultural products for Kazakhstan widened. While in 2019 its trade deficit was equal to $620 million, in 2020 it increased to $730 million.

Kyrgyzstan's exports of agricultural and food products experienced almost no changes. It changed from $251.1 million in 2019 to $250.5 million in 2020. During the reported period, the share of agricultural exports in total exports remained the same and amounted to 12.8%. At the same time, agricultural imports of the country decreased from $655 million in 2019 to $594 million in 2020. Despite this reduction, the share of agricultural imports in total imports increased from 13.4% to 16.1%. Moreover, the trade deficit narrowed from $403.9 million to $343.5.

Agricultural exports of Tajikistan remain the lowest in the Central Asian region. In 2019, the country exported products worth $33 million. In 2020, its exports of agricultural products exceeded $35 million. However, despite this insignificant growth in the volume of exports, the share of agricultural exports in total exports decreased from 3% in 2019 to 2.7% in 2020. Tajikistan's imports of agricultural products remain substantial. In 2019, the country's agricultural imports amounted to $757 million, while in 2020 it exceeded $818 million. The share of agricultural and food imports in the country's total imports is significant. The indicator was equal to 22.7% in 2019 and increased to 26.1% in 2020. The trade deficit in agricultural products in Tajikistan remains substantial. In 2019, it amounted to $724 million, while in 2020 it increased to $783 million.

Data unavailability complicates the analysis of Turkmenistan's trade flows. For instance, the ITC data do not include information on live animals, meat, or dairy product exports. Therefore, the presented calculations on Turkmenistan's indicators may be biased due to a lack of reliable data. However, the existing data shows that in 2019 Turkmenistan exported agricultural and food products worth $59.5 million. In 2020, the country's exports decreased to $53.5 million. The share of agricultural exports in total exports was insignificant and correspondingly equaled 0.5% and 0.7% in 2019 and 2020. Turkmenistan's agricultural import in 2019 was equal to $386.3 million, while in 2020 it decreased to $356.4 million. It is important to note that while agricultural exports in Turkmenistan's total exports remained negligible, the share of imports in the country's total imports is significant. For instance, in 2019 the indicator amounted to 12.5%, while in 2020 it decreased to 11.7%. The country's trade

deficit in agricultural products is also substantial. In 2019, the indicator amounted to $326.8 million, while in 2020 it decreased to $302.9 million.

Agricultural exports are one of the key sources of export revenues for Uzbekistan. In 2019, the country exported agricultural products worth $1.6 billion, while in 2020 the indicator decreased to $1.5 billion. The share of agricultural exports in the country's total exports amounted to 11% in 2019 and increased to 11.6% in 2020. At the same time, agricultural imports increased for the reported period. While in 2019 the country imported products worth $2.1 billion, in 2020 its purchases increased to $2.3 billion. The share of agricultural imports in total imports of the country increased from 9.5% in 2019 to 11.5% in 2020. The trade deficit of the country widened from $500 million to $800 million.

Interdependence in trade in agricultural products is high in the region. For instance, Uzbekistan is one of the main consumers of Kazakhstan's wheat and flour. According to data from the ITC (2020), in 2001, the shares of cereals and products of the milling industry in agricultural exports of Kazakhstan equaled 83.5% and 15.2%, respectively. In 2003, this trend changed substantially. The share of cereals decreased to 3.4% and the share of the milling industry products increased to 87.3%. This meant that Uzbekistan decided to rely on Kazakhstan's flour supply instead of developing its own milling industry. However, it revised its policy in 2011, when it started to increase the import of cereals to produce its own flour. As a result, Kazakhstan's export of wheat flour decreased from $311 million in 2011 to $77 million in 2019. For the same period, the export of wheat increased from $80 million to $373 million. However, there are some contradictions. Uzbekistan not only started to satisfy its internal flour needs but also became one of the competitors of Kazakhstan's flour producers on the market of Afghanistan. Higher competition led to significant losses for Kazakhstan's producers, and the number of mills in the country significantly declined. For instance, about 70% of flour mills were idle in South Kazakhstan in 2019. Experts note, however, that the problem stems not from flour producers, but from the shortages of Kazakhstan's trade policy (Kopzhasarova, 2019). According to Kazakhstan's flour producers, grain can be imported to Uzbekistan without value-added taxes, while imported flour is taxed at a rate of 20%. Moreover, the transit of a ton of flour through Uzbekistan to Afghanistan costs $47 for producers from Kazakhstan, and the transport costs for local producers in the same direction amount to $22. It is important to note that the government of Uzbekistan exempted flour-milling enterprises from many types of taxes for 5 years. The producers also claim that differences in loan rates, electricity, and labor costs make producers of Uzbekistan more competitive. As a result, several large flour milling companies from the Turkistan region and two companies from the Karaganda region constructed flour mills in Uzbekistan and shifted their production due to a better business environment and a higher level of state support in Uzbekistan (Buyanov, 2019). In recent years, Kazakhstan significantly increased the export of live animals to Uzbekistan. In 2017, it equaled $619000, and then the number increased to $23 million and $93 million in 2018 and 2019, respectively. Responding to this situation, the government of Kazakhstan banned the export of live animals explaining its decisions by the need to diversify the livestock breeding industry to meet the demand at the internal market.

It is important to note that all Central Asian economies have a negative trade balance in agricultural products. During the pandemic, food demand increased substantially and the countries of the region experienced growth in agricultural trade flows while export of other products such as fuels dropped. This fact shows the importance of the development of the agricultural sector. Moreover, higher trade flows show high interdependence of the regional economies in terms of food trade. Therefore, the regional policymakers should consider the following recommendations. Firstly, the trade policy of individual countries should consider the interests of neighboring states to escape trade wars. Export restrictions or bans can cause a similar reaction and decrease total supply, which will cause an increase in prices. The surge in prices will hurt the well-being of all countries of the region. Secondly, regional policymakers should liberalize trade in agricultural products. This policy change may result in higher supply and lower prices. Therefore, trade in agricultural products remains an important source of export revenues. Moreover, it stabilizes regional prices and significantly contributes to the improvement of food security.

Results and Discussion

Challenges and development perspectives for Central Asian agriculture

The countries of Central Asia consider the agricultural sector as one of the promising directions for development. However, to provide the growth of the sector, the governments of Central Asia should address challenges, which include the pandemic,

rising rates of global poverty and inequality, the escalating climate and biodiversity crises, increasing hunger, as well as growing food and nutrition insecurity (Dixson-Declève et. al., 2021).

Increasing food prices remain an important challenge for global food security. Food prices are one of the most important indicators, which play an important role in economic and political stability. Food prices depend on a variety of factors, including growth in demand, financial market speculations, export restrictions, weather shocks, productivity slowdown, currency depreciation, rising oil prices, biofuels demand, and decline of stocks (Headey and Fan, 2008). The recent pandemic became one of the most challenging factors for the global food market and substantially affected food prices. The Food and Agriculture Organization (FAO) of the United Nations indicated that the food prices reached the highest level in the last decade. According to data from the FAO (2021a), the Food Price Index averaged 127.4 points in August 2021, up 3.9 points (3.1%) from July and 31.5 points (32.9%) from the same period last year. Local supply chain breaks, lockdowns, and quarantine measures affected the informal sector, including sellers, traders, and shop owners. According to estimates, the prices of food increased by more than 10% in 15 developing countries in the first quarter of 2020. At the same time, due to climate shocks, many countries expect a significant reduction in output and crop yields, which will result in a decrease in supply pushing food prices up (Sova and Man, 2021).

Central Asian agriculture has several important features. Countries of the region significantly depend on food imports. This situation is associated with higher macroeconomic risks. For instance, following the depreciation of national currencies the prices of imported agricultural and food products can increase. The situation in Kazakhstan creates challenges and risks for the remaining Central Asian countries, as it remains a key supplier of wheat products. For instance, changes in Kazakhstan's trade policy, in particular, export duties or restrictions can lead to food shortage and higher inflation in other Central Asian countries. Central Asian countries may respond with their restrictive measures. For instance, Kyrgyzstan imposed livestock export restrictions. These counterproductive policies may further accelerate an increase in prices. It is important to note that the economies of Central Asian countries are experiencing one of the downturns, which have social implications. According to the recent data, around 1.7 million people (25.3% of the total population) in Kyrgyzstan lived below the poverty line in 2020, having increased by 5.2 percentage points compared to the previous year (Kabar, 2021). Higher food prices may worsen the existing situation and cause social instability.

Climate change and agriculture have bi-directional effects. Agriculture remains one of the most affected sectors, which will be significantly changed due to higher emissions and temperature. At the same time, agricultural development also contributes to greenhouse gas (GHG) emissions. According to estimates, global warming of 2°C, as in the most optimistic forecast, could reduce agricultural output by up to 25%. Results of many country-based studies demonstrate that climate change may lead to considerable losses in the agricultural sector (Aragon et al., 2019). Thus, direct consequences of climate change on the agricultural sector include increasing temperatures, weather variability, shifting agroecosystem boundaries, invasive crops and pests, and more frequent extreme weather events. It reduces crop yields, the nutritional quality of major cereals, and livestock productivity (World Bank, 2021b). Climate change contributes to an increase in food prices, which is of great concern for low-income and food import-dependent countries.

At the same time, agricultural activities, in particular crop and livestock production for food, remain important contributors to climate change. Various management practices on agricultural soils, including the application of synthetic and organic fertilizers, the growth of nitrogen-fixing crops, the drainage of organic soils, and irrigation increase the availability of nitrogen in the soil and result in emissions of nitrous oxide (N2O). Livestock, in particular cattle, produce methane (CH4) as part of their normal digestive processes. Moreover, livestock manure management practices also contribute to CH4 and N2O emissions. Various sources show different contributions of agriculture to global greenhouse gas emissions. According to the United States Environmental Protection Agency (2021) data, the share of the agricultural sector in the global GHG emissions was equal to 24% in 2010. This share was a direct effect of the cultivation of crops and livestock and deforestation. The OECD (2016) mentions that agriculture contributes a significant share of the GHG emissions that are causing climate change – 17% directly through agricultural activities and an additional

7-14% through changes in land use. The World Bank (2021b) indicates that agriculture currently generates 19–29% of total GHG emissions. It notes that without action, that percentage could rise substantially as other sectors reduce their emissions. Therefore, the share of agriculture in global GHG emissions equals around 30%. To mitigate the negative consequences of climate change, the Food and Agriculture Organization of the United Nations proposes to implement the climate-smart agriculture approach. The approach has three main objectives. Firstly, it aims to increase agricultural productivity and income. Secondly, it intends to adapt and build resilience to climate change. Finally, it aims to reduce and/or remove GHG emissions (FAO, 2021b).

Despite the climate risks remain one of the most important threats, the reaction from the regional governments is insufficient. Central Asia lacks climate adaptation and management strategies even ignoring ongoing climate-related changes in regional agriculture. For instance, in 2021, almost all regions of Kazakhstan experienced drought. This weather shock led to a decrease in the yield of major crops in both food and forage segments. Instead of the projected 15 centners per hectare, agrarians collect 5-7 centners per hectare (Qazaq Zerno, 2021). Higher input prices also contributed to the growth in food prices. In Kazakhstan, fuel, lubricants, fertilizers, plant protection products, spare parts, agricultural machinery, and other necessary materials have risen by 20-30% compared to the last year. The current situation, as well as similar dry conditions in the Central Asian countries – the main consumers of Kazakh wheat and flour – have led to an increased demand for grain products. By the end of July 2021, the price of importers for wheat of the 3rd class increased by $15-20 per 1 ton and now stands at $260-265 per ton. Similarly, the domestic price of wheat increased – from 93-95 thousand tenge/ton (219-223$) to 103-105 thousand tenge/ton (242-247$) (APK Inform, 2021).

Thus, climate change and the agricultural sector have bi-directional impacts. To mitigate mutual negative consequences, there is a high need for a multilateral cooperation, as individual countries cannot solve these problems. Central Asian countries in turn need to work on raising the awareness of the problem, which will allow the responsible private sector to change their management practices. Agricultural companies together with governments should invest in new climate-friendly agricultural technologies and change food management systems. These policies can contribute to the sustainable development of the agricultural sector of Central Asia under climate change.

The low level of capital investment and quality of institutions also affect the agricultural development of Central Asia. President of Kazakhstan Kassym-Jomart Tokayev in his September 2021 Address devoted a significant part of his speech to agricultural and food issues. The President proposed special measures to develop the country's agriculture and stabilize the food market. In particular, the Head of State mentioned the importance of creating a network of wholesale distribution centers and unified control over prices along the chain from producer to consumer. According to the President, it is necessary to expand the area of cultivation of fodder crops and to strengthen control over the observance of crop rotation, and improve the sphere of veterinary medicine. He noted that about 90% of the technologies used in the agro-industrial complex are completely outdated and in need of modernization. The President instructed the government to revise and stabilize the mechanism of subsidies. The President mentioned that more than 2 trillion tenge ($4.71 billion) had been allocated for subsidies. At the same time, more than half of the criminal cases in the agro-industrial complex are related to the theft of subsidies (Akorda, 2021).

One of the main disadvantages of the Central Asian agricultural sector is its low productivity. According to the World Bank (2019) data, Kazakhstan's output per worker in 2018 equaled $6900 (constant 2010 US$). Kyrgyzstan and Tajikistan have approximately the same levels of productivity ($1500). Uzbekistan has a comparatively higher level of output per worker ($2130). The dynamics and level of this indicator show that agriculture in Central Asia is labor-intensive. This makes regional production less competitive with high-income economies and rising economies of Asia. For instance, output per agricultural worker in Australia in 2018 equaled $80408 which is 11.7 times higher than in Kazakhstan and 37.7 times higher than in Uzbekistan. Capital intensive agriculture provides more opportunities for growth, development of new products and markets, productivity, and competitiveness.

To achieve higher productivity and competitiveness, the countries of the region should take into consideration trends and challenges for the future of food and agriculture, in particular, population

growth (up to 10 billion by 2050), urbanization and aging population, structural transformation of the global economy, climate change, political conflicts and wars (including for natural resources) and degradation of land and biodiversity (FAO, 2017). It is important to use the geographical proximity of large markets such as China and Russia. The reduction of global poverty with a simultaneous increase of incomes of rising Asian countries, in particular China and India, will boost demand for agricultural products. It should be noted that higher incomes and rising wages affect the diets of people and will require diversity of their nutrition. High-income countries are a good destination for Central Asian agricultural exports, so production standards should be improved significantly.

There are large cross-country productivity differences in agriculture due to farmland misallocation, insufficient fertilizer use, and labor intensiveness of agriculture in poor countries (Gollin et al., 2014). Thus, for the regional governments, it is necessary to stimulate the private sector to be involved in the agricultural development process. By doing so, the governments can increase labor productivity by attracting capital investment. The roles of agricultural universities and research institutes should be strengthened. Moreover, research in agriculture should become a priority, and fundamental and applied research should be financed by the governments.

Economic and political factors which affect the agricultural development of the region should be taken into consideration. In particular, there is a need for coordination while implementing regional infrastructural projects and collective action towards water issues. Governments should also support the infrastructural connection of urban-rural areas which will stimulate bilateral trade flows and reduce trade costs. These measures can lead to substantial positive changes.

Conclusion

Agriculture historically plays an important role in Central Asian economies. Despite decreasing trends, the share of rural population and employment in agriculture in Central Asia remain high. The countries of the region produce a significant share of the global wheat and cotton. Moreover, besides their traditional specialization, they were able to develop new products.

Trade in agricultural products remains an important source of revenues for the regional countries. Kazakhstan plays a key role in Central Asia as it provides the region with wheat and flour. At the same time, other Central Asian countries export fruits and vegetables to Kazakhstan. Trade in agricultural products improves the food security of the region and directly impacts food prices. Therefore, for Central Asian countries it is important to coordinate their trade and agricultural policies to escape counterproductive trade wars. Other policies, including export bans and restrictions, should also take into consideration interests of the all countries of the region. Trade liberalization for agricultural products may bring substantial gains for the region.

To successfully diversify Central Asian economies through agriculture, the regional governments need to address a list of important issues, including increasing food prices, climate change, low levels of capital investment and productivity, and corruption. Addressing these issues will require a climate change strategy, cooperation of governments, businesses, and universities, and institutional improvements. Moreover, there is a need for policy coordination in Central Asia, as many issues including borders and water remain unresolved. Regional policy coordination and individual efforts of the countries can transform agricultural sectors of the region, improve its food security and provide higher competitiveness.

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