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MAIN DIRECTIONS OF STRENGTHENING FOOD SECURITY AND SUSTAINABLE DEVELOPMENT OF AGRICULTURE IN UZBEKISTAN

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Abstract: *The article focuses on strengthening of food security through sustainable development of agriculture in Uzbekistan. In particular, aspects for assessing food security, the factors influencing the food security and sustainable agricultural development in the country were assessed. Attention is also paid to attracting investments in the agricultural sector, increasing the efficiency of land and water resources use through the introduction of modern technologies.*

Key words: *global pandemic, Sustainable Development Goals; food security; food supply chain; eliminate hunger; production potential of agriculture; productivity; investment; modern water-saving technologies; favorable agribusiness environment; state support; public procurement; minimum and maximum prices.*

Introduction

The United Nations General Assembly in 2015 has identified food security and sustainable agriculture as one of the 17 global objectives of the 2030 [Agenda for Sustainable Development](#) Goals: “Eliminate hunger, ensure food security, improve nutrition and promoting the sustainable development of agriculture” (United Nations, 2015). According to the data of Food and Agriculture Organization of the United Nations (FAO) “There is more than enough food produced today to feed everyone in the world, yet close to 800 million are chronically hungry” (FAO, 2015).

At a time when it is becoming clear that the coronavirus pandemic is threatening human life as well as leading to an economic crisis around the world, food shortages are on the rise and some countries are taking steps to exclude the main types of food they grow. In the context of the global crisis and pandemic, the importance of food supply and security around the world is growing. As noted in the report of the Food and Agriculture Organization of the United Nations (FAO) published on March 29, 2020, “COVID-19 and Risks in the Food

Supply Chain: How to respond?”, the measures taken worldwide in the fight against coronavirus cause disruptions in the food supply chain, causing instability in the system and, consequently, great harm to the poor, destitute population. This poses a particular risk, especially to countries that do not have alternative sources of food supply (FAO, 2020).

Therefore, agriculture and food production are becoming the most important issues today. According to the World Bank “agriculture is the largest sector of and the largest employer in Uzbekistan’s economy, and has a large role to play in reducing poverty and inequality through job creation” (World Bank, 2020).

The “Strategy of the Development of Agriculture of the Republic of Uzbekistan for 2020-2030”, approved by the Decree of the President of the Republic of Uzbekistan dated October 23, 2019 No PF-5853, provides the following tasks for the implementation: development of state policy on food security; development of food safety and improvement of consumer rations; improvement of mechanisms for production required amount

of food; monitoring of food safety assessment system based on internationally recognized methodologies and best practices; creation of a favorable agribusiness environment and value chain involving the production of high value-added agricultural and food products.

The article analyzes the issues of strengthening the food supply through sustainable development of the agricultural sector.

Literature review

Theoretical and methodological bases of sustainable development are reflected in the scientific research of a number of foreign and national scientists. As noted in the research of J. Sachs, the Millennium Development Goals (MDGs) mark a historic and effective method of global mobilization to achieve a set of important social priorities worldwide. They express widespread public concern about poverty, hunger, disease, unmet schooling, gender inequality, and environmental degradation (Sachs J. D., (2012).

Research, conducted by Griggs D. and scientists group shows, that “further human pressure risks causing widespread, abrupt and possibly irreversible changes to basic Earth-system processes. Water shortages, extreme weather, deteriorating conditions for food production, ecosystem loss, ocean acidification and sea-level rise are real dangers that could threaten development and trigger humanitarian crises across the globe. Growing affluence and the right to development among the world’s poor demand that people of all nations make the transition to sustainable lifestyles (Griggs D. et al., (2013).

In the context of the global crisis and pandemic, the importance of food supply and security around the world is growing. As noted in the report of the Food and Agriculture Organization of the United Nations (FAO) published on March 29, 2020, “COVID-19 and Risks in the Food Supply Chain: How to respond?”, the measures taken worldwide in the fight against coronavirus cause disruptions in the food supply chain, causing instability in the system and, consequently, great harm to the poor, destitute population. This poses a particular risk, especially to countries that do not have alternative sources of food supply (FAO, 2020). At a time when it is becoming clear that the coronavirus pandemic is threatening human life as well as leading to an economic crisis around the world,

food shortages are on the rise and some countries are taking steps to exclude the main types of food they grow.

According to Robert K., Parris T. and Leiserowitz A. “a minimal sustainability transition would be one in which the world provides the energy, materials, and information to feed, nurture, house, educate, and employ the many more people of 2050 – while reducing hunger and poverty and preserving the basic life support systems of the planet” (Robert K., et al., 2005).

According to a group of Russian scientists led by Ushachev I., “food security” is a complex concept that includes food independence and access to food, physically and economically. “Food independence” is a concept determined by the country’s self-sufficiency in food products, based on the level of normative and actual consumption, that is, the ratio of production in the country to total domestic consumption of all types (Ushachev I. et al., 2015).

As noted in the research of Russian scientists A.Tatarkin and S.Polbitsyn, the doctrine of food security of the countries reflects the level of quality and minimum provision of the population with the food they can buy. Thus, food security can be considered as the physical, economic and social provision of food products that meet the needs and preferences of consumers (Ushachev I. et al., 2015).

In the national literature of Uzbekistan we can highlight the researches of a number of scientists (Saidova D.N., Rustamova I.B., Tursunov Sh.A., 2016; Abulkosimov Kh.P., Rasulov T.S., 2015; Ilyina D.N., 2020; Sotvoldiev N.Yu., 2017; Isadjanov A.A., Kendjaboeva R.M., 2015).

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The article analyzes the issues of strengthening the food supply through sustainable development of the agricultural sector.

Data and Methods

In preparing this article, materials and statistical data of the United Nations Organization (UN), Food and Agricultural Organization of the United Nations (FAO), the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan were widely used.

The results of scientific research of national and foreign scientists engaged in the analysis of global food security and supply problems served

as a theoretical and methodological basis for this research. In the preparation of the article used abstract and analytical observation, analysis and synthesis, normative and positive analysis, comparative and factor analysis, multivariate correlation analysis, economic-statistical and other methods.

Discussions

A review of the scientific literature and other sources shows that “food security” concept was first introduced into consumption in the 1970s. Later, this concept expanded in meaning. According to the definition proposed by the World Bank at the 1996 World Summit on Food Security, “the ability of all people, both physically and economically, to obtain adequate, safe and nutritious food at all times to lead an active and healthy lifestyle – represents food safety” (World bank, 1986). Subsequently, the 2009 World Summit on Food Security identified the following 4 aspects of food security assessment (Table 1).

Table 1. Food safety indicators, developed by the Food and Agriculture Organization of the United Nations (FAO)

Aspects	Explanation of concepts
Food availability	Physically, the availability of food depends on the volume of production, stocks and the balance of food exports / imports
Opportunity to obtain food	Physical and economic access to food. Economically – at the disposal of the population, with food prices and the level of social protection; Physically – it is determined by the availability of infrastructure to support the functioning of markets
Food consumption	Absorption of various nutrients present in food by the human body. Adequate consumption of nutrients and energy is ensured through the use of food preparation, diet and care methods, distribution of food within the household
Sustainability of food supply	The stability of the other three factors mentioned above over time. If a person from time to time is at risk of not getting enough food and quality (under the influence of unemployment, inflation and other factors), he is considered vulnerable in terms of food security

Source: www.fao.org

Producing enough food does not mean that food security has been ensured. The “Concept of Food Security” adopted by the UN Rome Declaration in 1996 sets out its basic principles: food security is not just self-sufficiency in food; if the country has comparative advantages, it should

produce enough food for its own needs; if necessary, the country should be able to import the required amount of food to meet the needs of its citizens; the government must ensure that food is safe for its citizens, both physically and economically; it is necessary to take into account the growing and

changing individual needs of the population in ensuring food security; the country can ensure food independence of the country regardless of external factors; food supply must be resistant to seasonal and climatic factors (World bank, 1986).

Global food supply and security issues have always been in the focus of the world community. In particular, the historic summit of the UN General Assembly in September 2015 adopted 17 global goals and 169 tasks “Sustainable Development Goals – SDG”, which are to be implemented by 195 countries by 2030.

Sustainable development presupposes a path of development that meets the interests of present generations without compromising the needs of future generations. Such development reflects the aspirations of people around the world to work together for a sustainable, inclusive and bright future.

SDG’s first goal is the “end all forms of poverty” worldwide by 2030. It is estimated that more than 780 million people on the planet still live in extreme poverty, and more than 70% of them earn less than \$ 1.9 a day. In the richest countries of the world, more than 30% of children are forced to live in poverty. Almost 80 percent of the world’s extreme poor live in rural areas where most are dependent on agriculture (United Nations, 2015).

The second goal of the SDG is the “eliminate hunger, ensure food security, improve nutrition and promoting the sustainable development of agriculture”. According to FAO’s research: malnutrition exacts high economic and social costs on society; two billion people do not consume enough vitamins and minerals; one in three of the world’s population cannot eat on a complete ration; 45% of all under-five deaths worldwide are due to malnutrition, and 3.1 million children die each year as a result (FAO, 2015). Sustainable development of agriculture will provide an opportunity to end hunger in rural areas, feed families and live a decent life in exchange for adequate food production and job creation.

According to UN forecasts, the world’s population could reach 10 billion by 2050, complicating the task of providing adequate and quality food to the world’s population in the face of increasing degradation of agricultural land and declining water resources. At a time when 2.6 billion, or more than 33% of the world’s population live in rural areas, 52% of agricultural land has been severely degraded, resulting in a significant decline in soil fertility. As a result of drought and desertification, 12 million hectares of land (23 hectares per minute) are out of use every year.

However, these areas could produce up to 20 million tons of grain per year. Land degradation is negatively affecting the living standards of 74% of the world’s poor population. At the same time, such drastic changes in the planet’s climate, “global warming” and environmental pollution will have an impact on agricultural productivity. Due to defects in the systems of harvesting, transporting, storing, and delivering agricultural products to consumers more than 1.3 billion tons of food products with \$ 1 billion value are lost annually (United Nations, (2015).

Hunger and malnutrition continue to hinder the sustainable development of the world economy, leading to a decline in people’s ability to work and an increase in susceptibility to disease, and ultimately a deterioration in their quality of life. Eliminating hunger can also have a positive impact on the economy, health and education, and make a significant contribution to equality and social development. This is an important condition for building a better future for humanity. It is estimated that an additional \$ 267 billion will be needed each year to eradicate hunger by 2030 (FAO, 2015).

In order to consistently implement the UN “Sustainable Development Goals” in Uzbekistan by the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated October 20, 2018 No-841 “On measures to implement national goals and objectives within the framework of Sustainable Development until 2030” was approved “National goals and objectives and a roadmap for their implementation”. In this roadmap until the period up to 2030 are set a number of tasks for implementation, such as: the elimination of extreme poverty and the halving of all forms of poverty; strengthening the targeting and effectiveness of the social protection system; ensuring high quality and balance of nutrition in the required amount and eliminating all forms of malnutrition; ensuring the sustainability and efficiency of food production; development rural infrastructure, agricultural research, and innovative technologies.

As noted by the President of the Republic of Uzbekistan Shavkat Mirziyoyev “in conditions of glob-

al crises and pandemic agriculture and food production are becoming the most pressing issue today” (Mirziyoyev Sh.M., 2020). But the absence of a long-term strategy for agricultural development in the country negatively affected to efficient use of land and water resources, limited investment attraction to the sector and decreased competitiveness of agricultural products. The adoption of the “Strategy of the development of agriculture of the Republic of Uzbekistan for 2020-2030” by the Decree of the President of the Republic of Uzbekistan dated October 23, 2019 No-5853 was an important step in this direction. The main goal of this Strategy is to radically improve public policy to further deepen reforms aimed at increasing the competitiveness of the agricultural and food sectors of Uzbekistan, and includes the following priorities: ensuring food security of the country; creating a favorable agribusiness environment and value added chain; reduction of state participation in the management of agrarian sector and increase of investment attractiveness; rational use of natural resources and protection of the environment; development of modern public administration systems; gradual diversification of public expenditure to support the agricultural sector; development of scientific, educational, information and consulting services in agriculture; development of rural areas; development of transparent system of network statistics.

As defined in this Strategy, food security depends on a wide range of socio-economic, demographic and environmental factors. Population growth, increasing demand for land, water and energy resources, and drastic climate change are the main factors influencing food security. State food safety policy is developed and implemented on the four components of food security (availability of food, its purchasing power, its use and sustainability).

To achieve food security strengthening goal, the following tasks are identified in above mentioned Strategy: improvement of mechanisms for providing enough amount of food, as well as the integration of agricultural producers with social facilities; introduction of the system of state intervention procurement in grain production, the gradual abandonment of the mechanism of state regulation of prices for agricultural and food products and the introduction of a mechanism for the purchase of grain for state needs at market prices on a quota basis; development of a long-term program to promote a culture of healthy consumption; introduction and continuous monitoring of food safety assessment systems based on internationally recognized methodologies and best practices; development of sectoral programs to intensify the production of socially important products; conducting research aimed at increasing productivity in animal husbandry, sustainable intensification of fish and poultry production, as well as milk production.

Analysis and Results

Food supply and security rely primarily on the potential of the agricultural sector. Although the share of gross agricultural output in the country’s GDP fell from 34.4 to 27.1%, and the share of agriculture in the population employed in all sectors of the economy from 34.4 to 26.9% in 2000-2020, the agricultural sector still remains one of the largest sectors of economy of Uzbekistan (Table 2).

Table 2. Dynamics of key macroeconomic indicators of agricultural sector’s development in Uzbekistan¹

Indicators	2000	2005	2010	2015	2020
The share of agriculture in GDP, in %	34.4	29.5	32.9	34.1	27.1
Annual growth rates of gross agricultural output, in % compared to the previous year	103.1	105.4	106.3	106.1	102.7
The share of agriculture in fixed capital investments, in %	5.7	4.4	3.5	3.3	7.0
The share of agriculture in the population employed in all sectors of the economy, in %	34.4	29.1	26.8	27.6	26.9

¹including forest and fishing branches

Source: State Statistics Committee of the Republic of Uzbekistan. www.stat.uz

Certain results have been achieved in strengthening the production potential of agricultural sector of the Republic of Uzbekistan. As a result, the volume of production of basic agricultural products has

increased significantly.

According to the State Statistics Committee of the Republic of Uzbekistan, despite the fact that, from 2000 to 2020 the permanent population of the country increased by 38.7% and the total area

under crops decreased by 11.8%, per capita production of wheat was increased by 38.6%, vegetables by 181.3%, potatoes by 206.4%, melons by 237.7%, fruits by 153.6%, grapes by 83.8%, meat (live weight) by 115.8%, milk by 117.6% (Table 3).

Table 3. Dynamics of per capita production of basic types of agricultural food products in Uzbekistan, in kilograms

Indicators	2000	2005	2010	2015	2020	2020 to 2000, in %
Wheat	159.4	231.5	236.1	222.5	221.0	138.6
Vegetables	107.3	134.4	222.2	320.8	301.8	281.3
Potato	29.7	35.3	59.3	85.4	91.0	306.4
Melon crops	18.3	23.5	41.4	58.7	61.8	337.7
Fruits	32.1	36.3	59.9	87.0	81.4	253.6
Grapes	25.3	24.5	34.6	50.0	46.5	183.8
Meat (live weight)	34.1	40.6	51.3	61.4	73.6	215.8
Milk	147.4	174.1	216.0	288.4	320.7	217.6
Information for comparison:						
Permanent population, in thousand people	24 908.2	26 312.7	29 123.4	31 575.3	34 558.9	138.7
Total crop area, in thousand hectares	3 778.3	3 647.5	3 708.4	3 694.2	3 371.1	89.2

Source: State Statistics Committee of the Republic of Uzbekistan. www.stat.uz

Most importantly, this increase was not due to extensive factors, but to intensive factors such as productivity of resources, using modern technologies and etc. In particular, in the years 2000-2020, cotton yield increased from 21.8 to 28.8 centners or 32.1%, wheat from 27.8 to 45.4 centners or 63.3%, potatoes from 129.3 to 213.4 centners or 65.0%, vegetables from 183.8 to 234.4 centners or 27.5%, vegetables from 132.4 to 168.3 centners or 27.1%, fruits and berries from 56.9 to 116.7 centners or 105.1%, grapes from 63.1 to 152.0 centners or 140.9% (Fig. 1).

As confirmed a scientific research conducted by the author, a number of factors affect the sustainable development of agricultural sector.

To determine the influence of various factors on the development of the agricultural sector for the period 2000-2016, the author used a multivariate econometric model. The model included the following factors: effective indicator – gross agricultural output in 2016 prices (Y) in billion sums; as factors influencing gross agricultural output – total area of agricultural crops, thousand hectares (X_1); the value of investments in fixed assets attracted to the sector, billion sums (X_2); the number of people employed in agriculture, thousand people (X_3); the value of fixed assets of agriculture, billion sums (X_4); the volume of mineral fertilizers applied to the sown area, thousand tons (X_5); volume of water consumption in agriculture, mln.m³ (X_6).

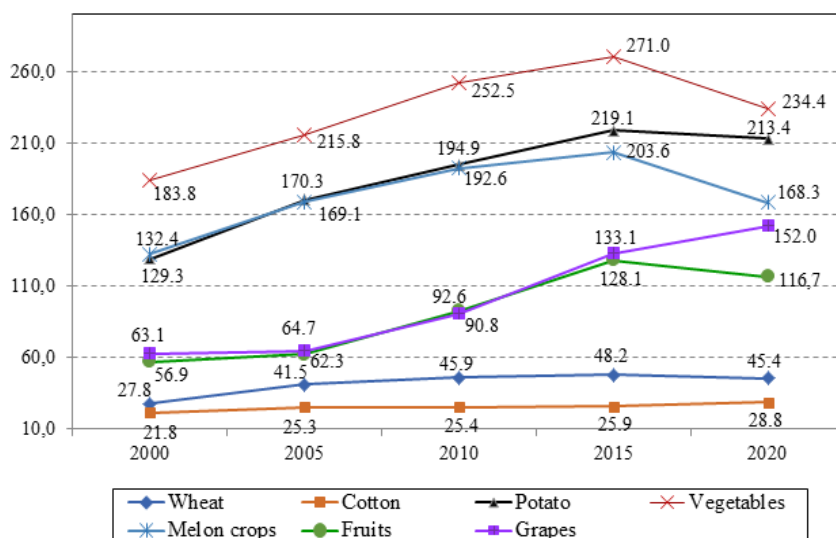


Figure 1. Dynamics of productivity of the main types of agricultural crops, centners/ha
 Source: State Statistics Committee of the Republic of Uzbekistan. www.stat.uz

Calculations showed that there were the following interdependencies between the effective indicator (Y) and the factors influencing it: with the investments in fixed assets (X_2) (0.9649) and the amount of fixed assets in agriculture (X_4) (0.9912) were dense; with the amount of population engaged in agriculture (X_3) (0.8567) was average; with the volume of agricultural crops area (X_1) (0.5451) was weak and with the volume of water consumption in agriculture was very weak (0.1559).

Based on the calculations made in the model, the average value of an increase in gross agricultural output (Y) as a result of changes in the influencing factors included in model was calculated:

According to this model (1), an increase in the value of fixed capital investment (X_2) by one billion Uzbek sum may contribute to an increase in the value of gross agricultural output (Y) by 4.1346 billion sum; an increase in total crop area (X_1) by 1,000 hectares to an increase by 2.6723 billion sum; an increase in the value of fixed assets (X_4) by one billion sum to an increase by 1.5466 billion sum.

In this case: $R^2 = 0.9945$, flattened $R^2 = 0.9911$. Hence, the effective indicator is sufficiently

closely related to the factors included in the model. That is, the change in the value of gross agricultural output depends on 99.45% of the factors included in the model, and the remaining 0.55% of factors not taken into account (Yusupov M.S., 2018).

From the above model, it is clear that one of the most influential factors in the growth of gross agricultural output is investment in fixed capital in the sector. But, the issue of attracting private investments to the agricultural sector is extremely limited due to low profitability in the sector and slow capital turnover, as well as the lack of pledge to attract loans from commercial banks and international financial institutions. In the period 2000-2020, the share of agriculture in fixed capital investment remained on average 4.6%.

In particular, from 2005 to 2015, 28.6 to 42.5% of total investments in fixed capital in agricultural sector were centralized public investments financed from the state budget, and only in 2020 this indicator decreased to 15.9%. During the 2005-2020 years the share of funds of enterprises and organizations in fixed capital investments decreased from 37.9 to 9.3%, while the share of foreign investments and loans increased from 15.1 to 41.4% (Table 4).

Table 4.

Composition of investments in fixed capital of agriculture by sources of financing

Indicators	2005	2010	2015	2020
The value of investments in fixed capital of agricultural sector, in billion sums	138.2	530.6	1375.4	12199.1
The share of agriculture in fixed capital investments of their total volume, in % to total	4.4	3.5	3.3	6.2
Distribution of investments in fixed capital of agriculture by sources of financing, in % to total				
Total, including	100	100	100	100
state budget allocations	28.6	32.9	42.5	15.9
funds of enterprises and organizations	37.9	17.3	31.8	9.3
bank loans and other borrowings	15.3	27.8	20.5	16.7
foreign investments and loans	15.1	7.1	4.7	41.4
other sources	3.1	14.9	0.5	16.7

Source: State Statistics Committee of the Republic of Uzbekistan. www.stat.uz

It is known from the data given in Table 4, the share of state budget funds in total investments in agricultural sector is still remaining of a large amount, and the attraction of private sector funds remains low. Due to the absence of private ownership of land, as well as the frequent optimization of the land areas of farms conducted by the government from 2006 to 2019 several times (although the lease term for land plots by farmers is up to 50 years), it remains very difficult to attract private investors to the agricultural sector and the farmers have lost the confidence in the efficient use of these lands.

The issue of food security of the country depends primarily on the efficient use of agricultural

arable land. Only 20.7% of the 20.2 million hectares of agricultural land are irrigated. Over the last 15 years, per capita irrigated land has decreased by 24% (from 0.23 to 0.16 hectares). This is due to population growth and the transfer of agricultural land to other land categories. Over the next 30 years, irrigated land is projected to reduce by another 20 to 25 percent (Yusupov M.S., 2020). Most of the available arable land in the country is more or less saline due to the proximity of groundwater and other reasons. As January 1, 2021, the share of saline lands relative to total irrigated lands was 45.0% (Table 5).

Table 5.

Dynamics of changes in the salinity of irrigated lands in the country in 2008-2019, in % to the total irrigated lands

Land types	2008	2010	2012	2014	2016	2018	2020	2020 to 2008, (+,-)
Unsalted lands, total	49,78	50,41	51,40	52,52	54,42	55,6	55,0	+ 5,22
Saline lands, total	50,22	49,59	48,6	47,48	45,58	45,4	45,0	- 5,22

Source: Based on data from the Ministry of Agriculture of the Republic of Uzbekistan (2008-2016) and the Ministry of Water Resources (2018-2019)

High salinity of irrigated lands and low quality indicators (with a score of 55 on a 100-point scale) have a negative impact on crop yields, leading to significant additional costs associated with leaching of soil salinity and increasing soil fertility. According to the Ministry of Agriculture of the Republic of Uzbekistan, 18.0% of total irrigated lands belong to poor and below-average category lands with class I-IV, 53.0% to average category lands with class V-VI, 29.0% to good category lands with class VII-X. It can be seen that the share of poor, below-average and average lands is 71.0% of the total agricultural arable land area (Ministry of Agriculture of the Republic of Uzbekistan, 2020).

According to the Ministry of Water Resources, to improve the reclamation of irrigated lands in the country, the total length of 142.9 thousand km, as well as 172 reclamation pumping stations, 3 897 vertical drainage wells are used. During the period from 2008 to 2017, within the framework of the State Programs on Improvement of Irrigated Land Reclamation and Rational Use of Water Resources, more than 3.2 trillion sums were allocated from the

state budget for the building and reconstruction of irrigation systems. In addition, 2.5 trillion sums were allocated for the construction and repair of land reclamation facilities during this period (Ministry of Water Resources of the Republic of Uzbekistan, 2020).

However, despite large expenditures from the state budget and the special funds, it has been possible to reduce the salinity of irrigated lands by 5.2% over the last 12 years and this problem remains relevant.

In accordance with the "Concept of Water Resources Development of the Republic of Uzbekistan for 2020-2030" 298,5 hectares of irrigated lands not used in agriculture are planned to be put into operation in 2019-2025. In the measures developed in this regard, it is planned to decrease the share of saline lands from 45.7 to 40.0% in total irrigated lands and reduce the share of irrigated land areas with high groundwater levels (0 – 2 m) from 24.0 to 18.0% in 2020-2030 (Table 6).

Table 6.
Targets for improving the reclamation of irrigated lands in the "Concept of Water Resources Development of the Republic of Uzbekistan for 2020-2030"

Indicators	Until 2019	Key target indicators			
		2020	2021	2025	2030
Decreasing the share of saline lands in total irrigated lands, in% to total	45,7	45,0	44,6	43,0	40,0
including reducing the share of strongly and moderately saline irrigated lands, in% to total	14,0	13,5	13,0	12,0	10,0
Reducing the share of irrigated land areas with high groundwater levels (0 – 2 m), in% to total	24,0	23,0	22,0	20,0	18,0
Re-use of irrigated lands that have fallen out of use in agriculture, in thousand hectares	48,0	58,2	41,5	150,8	-

Source: The Concept of Water Resources Development of the Republic of Uzbekistan for 2020-2030. <https://water.gov.uz>

More than 91% of agricultural food products in Uzbekistan are grown on irrigated lands. However, given the fact that the country is located at the bottom of transboundary watercourses, and only 20.0% of water resources are formed in the country, the remaining 80.0% in neighboring Tajikistan and Kyrgyzstan, the problem of water supply for irrigation may be complicated in the future. According to

the data of the Ministry of Water Resources of the Republic of Uzbekistan recently, the number of years of water shortage in the region has been increasing. If before 2000 the water shortage was repeated every 6-8 years, in recent years it has been observed every 3-4 years. It is obvious that the rational and efficient use of every drop of water is becoming one of the most urgent tasks not only in Uzbekistan but all over

the world. The total water deficit in Uzbekistan until 2015 amounted to more than 3 billion cubic meters, by 2030 it may reach 7 billion cubic meters, and by 2050–15 billion cubic meters.

In recent years, the average annual volume of water resources used in Uzbekistan is 51-53 cubic kilometers, which indicates a significant reduction in total water intake (20%). 90% of water resources is consumed by agriculture. At the same time, the population of the country will increase by an average of 650-700 thousand people a year and reach 39 million by 2030, and it is expected, that their demand for quality water will increase from 2.3 billion cubic meters to 2.7-3.0 billion cubic meters (18-20%) for this time. This leads to an increase in the demand for water in the utilities sector from year to year. In recent years, industrial and energy sectors are actively developing, and their demand for water is growing every year. It is estimated that the total annual water consumption of these sectors will increase from 1.9 billion cubic meters to 3.5 billion cubic meters (1.8 times) by 2030.

Over the last 40 years, the population of Uzbekistan increased from 15 to 34 million. As a result of this per capita water consumption decreased from 4403 to 1600 cubic meters in 1980-2019. Nevertheless, per capita water consumption in Uzbekistan remains high compared to developed countries, such as: Switzerland – 1000 cubic meters, Turkey – 550 cubic meters, Germany – 460 cubic meters, in Israel – 300 cubic meters, Singapore – 45 cubic meters.

As a result of the disproportionate distribution of water resources and the uneven complex relief of irrigated lands, about 60% of irrigated lands are supplied with water by 1,687 pumping aggregates, with an annual electricity consump-

tion of 8 billion kWh. In addition, a total of 155.2 thousand km of irrigation networks and more than 10,280 pumping aggregates are used by water consumers' associations, farms and clusters. The cost of water supply through the pumping aggregates is covered from the state budget of Uzbekistan and a large amount of money is spent for this direction each year. According to the Fund for State Support of Agriculture under the Ministry of Finance of the Republic of Uzbekistan in the framework of the implementation of the Decree of the President of the Republic of Uzbekistan dated February 28, 2018 No-3574 "On measures to significantly improve the financing system for the cotton and grain cultivation" 150.8 billion sums in 2019, and 344.6 billion sums in 2020 were allocated from the state budget to cover the cost of pumping aggregates, irrigation wells and electricity consumed for cultivation to support farmers (Ministry of Water Resources of the Republic of Uzbekistan, 2020).

The high demand for irrigation water due to the obsolescence of irrigation methods in the face of scarcity of surface and groundwater resources is another obstacle to strengthening food security. In recent years, drip irrigation has become important as one of the effective options to reduce soil salinity, increase soil fertility and crop yields. The advantage of the widespread introduction of drip irrigation is that this technology, on the one hand, eliminates soil salinity, on the other hand, helps to eliminate the problem of water scarcity. According to the Ministry of Agriculture of the Republic of Uzbekistan, drip irrigation of vegetables and melons in the country will reduce water consumption by 50-55, labor consumption by 50-60, mineral fertilizers by 50% and increase productivity by 55-65% (Table 7).

Table 7.

Advantages of implementing of drip irrigation systems

Crop type	Water saving rate, in %	Labor cost savings, in %	Mineral fertilizer savings, in %	Productivity increase, in %
Cotton	30-40	50-60	Depending on the type of crop	90-150 %
Gardens and vineyards	40-60	25-30		20-25 %
Vegetables and melon crops	50-55	50-60	- until 50%	55-65 %

Source: Ministry of Agriculture of the Republic of Uzbekistan

In addition: soil erosion stops, groundwater level and soil salinity decreases; soil does not harden, inter-row cultivation and tillage are reduced; fertilizer is applied with water and its absorption rate increases; water evaporates less from the soil, so that water does not flow in vain; the root layer of the crops is constantly supplied with moisture, allowing it to absorb water and nutrients. In this case, the plant directs all its energy to increase the yield.

In recent years, the government of Uzbekistan has implemented the practice of providing below listed subsidies from the state budget and extra-budgetary funds for the introduction of drip irrigation technologies in irrigated areas: in the cultivation of raw cotton – in the amount of 8 million sums per hectare; in the creation of new vineyards – in the amount of 8 million sums per hectare; in the creation of new gardens and greenhouses – in the amount of not more than 6 million sums per hectare.

In addition to these, the following subsidies are provided for digging wells, construction of pumps and purchase of irrigation equipment: for the construction of drilled wells for drainage of water in vineyards and orchards with an area of 35 hectares and more, as well as for the construction of a pumping station to draw water from rivers, canals and other water sources – in the amount of not more than 120 million sums; for the purchase of irrigation equipment – up to 10 times the basic calculation amount of wages (2461800 sums); to

cover the costs associated with drilling and commissioning of each vertical irrigation well with a depth of more than 10 meters – 100 000 sums for each meter of well depth; to cover 70 percent of the costs associated with drilling and operating vertical irrigation wells with power to irrigate at least 30 household plots (Ministry of Water Resources of the Republic of Uzbekistan, 2020).

Despite the large-scale measures taken in recent years, the introduction of drip irrigation and other modern water-saving technologies in the country remains low (in 2019 – 4 % of all irrigated crop lands). In the “Concept of Water Resources Development of the Republic of Uzbekistan for 2020-2030” it is planned to expand of modern water-saving irrigation technologies from 4,0 to 47,0%, and expansion of areas with drip irrigation technologies from 1,77 to 14,1% to total irrigated lands (Table 8).

In accordance with the Decisions of the President of the Republic of Uzbekistan No-4633 of March 6, 2020 “On measures to widely introduce market principles in the cotton sector” and No-4634 “On measures to widely introduce market principles in the cultivation, purchase and sale of grain”, the state order and the practice of setting state purchase prices in the field of raw cotton and grain production were gradually abolished, creating a favorable agribusiness environment for the widespread introduction of market principles in agrarian sector.

Table 8. Targets for the expansion of water-saving technologies in the “Concept of Water Resources Development of the Republic of Uzbekistan for 2020-2030”

Indicators	Until 2019	2020	2021	2025	2030
Expansion of water-saving irrigation technologies, in thousand hectares	175	250	532	1000	2000
in% to total irrigated lands	4,0	5,8	12,3	23,0	47,0
Including: expansion of areas with drip irrigation technologies, in thousand hectares	77,4	125	175	300	600
in% to total irrigated lands	1,77	2,9	4,05	6,9	14,1

Source: The Concept of Water Resources Development of the Republic of Uzbekistan for 2020-2030. <https://water.gov.uz>

This is a great event in the history of agriculture of Uzbekistan, which allows farmers to place crops at will and sell their products at market prices. In short, real market mechanisms based on entrepreneurial freedom and self-interest have begun to emerge in the agricultural sector.

Today, food supply and security is becoming an important issue not only in Uzbekistan but around the world. As a result of a number of measures taken in recent years to strengthen food security in the country, Uzbekistan has strengthened its position in the world and gradually improved its position in Global Hunger Index (GHI). In the 2020 Global Hunger Index, Uzbekistan ranks 30th out of the 107 countries with sufficient data to calculate 2020 GHI scores. With a score of 6.7, Uzbekistan has low level of hunger (Global Hunger Index (GHI), 2020).

At the same time, in the context of the pandemic, there was an increase and fluctuation (volatility) of prices for some agricultural products in the food markets of the country. We consider it expedient to introduce public procurement and commodity interventions using minimum and maximum prices in order to provide the population with socially important food products and prevent price fluctuations.

Conclusions

We make the following recommendations for strengthening food security and sustainable development of agriculture in Uzbekistan: development of mechanisms to increase labor productivity in the agricultural sector through strict state protection of private property rights and land use; zoning of varieties of agricultural crops and the establishment of a scientifically based crop rotation system; prevention of losses in the delivery of food products from the field to the consumer; bringing the quality of food products to the level of world standards and expanding the introduction of international quality standards; development of "smart agriculture" by accelerating the introduction of digital and innovative, resource-saving technologies; support for the development of organic

farming through providing subsidies from the state budget; accelerate the adoption of the "The Law on Food Security", "The Law on the minimum consumer basket" and "The Law on the minimum subsistence level"; introduction the practice of hearing and discussing the "National Report on the State of Food Security" at the joint session of the Oliy Majlis (The Supreme Council) of the Republic of Uzbekistan at the end of each year to monitor the food security of the country.

In our opinion, given the importance of water-saving technologies, it is necessary to implement targeted state programs aimed at the introduction of drip irrigation every 5 years until the necessary level to increase the efficiency of water use, and for this purpose regularly allocate centralized public investment from the state budget. In addition to the state budget for measures to improve the reclamation of irrigated lands, it is necessary to attract long-term (10-15 years) investment loans from commercial banks, apply a privileged payback period at least 5 years and introduce the practice of reimbursing at least 50% of loan interest payments to commercial banks from the state budget.

The high risks inherent in the agricultural sector and the lack of financial strength of farmers force commercial banks to be cautious in lending to them. One of the main problems is the lack of property or other types of funds to provide collateral in the amount of 120% of the loan value required to obtain a loan in most farms. In our opinion, given the high climatic conditions and risk-taking nature of agriculture and its high importance for the country's food security, it is expedient to comprehensively strengthen the state's participation in the system of financing and lending to the sector.

Implementation of these recommendations will lead to overcoming the growing problem of water scarcity in the agricultural sector, increase profitability through significant savings in material and labor costs for production, significantly increase crop yields and improve the reclamation of irrigated lands.

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