SECTOR ASSESSMENT (SUMMARY): AGRICULTURE AND NATURAL RESOURCES (IRRIGATION, DRAINAGE, and FLOOD PROTECTION)\(^1\)

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. From 1913 to 1990, Uzbekistan’s national irrigation service area increased by 200% from 1.4 million hectares (ha) to 4.2 million ha.\(^2\) However, the irrigation service area has peaked and may have started to decline. Uzbekistan has over-allocated its water over too large an irrigated area; and is facing increasing water scarcity and salinity, poor service delivery, and low agricultural productivity of water. These problems are interrelated, occur at the river basin level, and require new solutions and a challenging transition from infrastructure development to integrated river basin management. At the irrigation system level, infrastructure continues to deteriorate, organizational management capacity remains limited, and agriculture faces various constraints.

2. Agriculture in Uzbekistan is dependent on irrigation as mean annual rainfall is only 206 millimeters (mm). Some 96% of the total cropped land is irrigated and agriculture uses 93% of water withdrawals. Therefore, there is a large overlap between water management and agriculture. From 2000 to 2007, Uzbekistan’s agriculture sector grew at 6.8% per annum, faster than the economy as a whole. From 2008 to 2010, agricultural growth averaged 5.7%. Agriculture employs 32% of the workforce, produces 24% of gross domestic product (GDP), and accounts for almost 70% of domestic trade.

3. **Increasing water scarcity.** Uzbekistan shares the Aral Sea Basin (ASB) with six other countries. The ASB is drained by (i) the Syr Darya River, with a mean annual flow (MAF) of 37.2 cubic kilometers (km\(^3\)), which is 32% of the ASB MAF; and (ii) the Amu Darya River with an MAF of 79.3 km\(^3\), which is 68% of the ASB MAF. Most of the water originates in the upstream countries. The Kyrgyz Republic generates 72% of the Syr Darya MAF. Tajikistan generates 70% of the Amu Darya MAF and Afghanistan accounts for 18%. Uzbekistan’s present annual per capita water endowment of 1,850 m\(^3\) is adequate as it is above the 1,700 m\(^3\) threshold of water stress. However, Uzbekistan suffers from acute water scarcity as it has developed too much irrigated land and over-allocated water. In 1999, for example, the total ASB supply was 118.6 km\(^3\), withdrawal was 156.2 km\(^3\), and consumption was 118.6 km\(^3\) of which 109.6 km\(^3\) (92%) was productive. Therefore, the ASB was over-allocated as 132% of supply was withdrawn, all of it was consumed, and the ASB is “closed” (no outflow), which is why the Aral Sea is desiccated.\(^3\)

4. The present water scarcity is only likely to increase because of increased inter-sectoral demand in Uzbekistan, development of upstream storage dams, and climate change. Upstream irrigation expansion will consume more water while hydropower development will continue to change the flow regime from summer, when water is needed for downstream irrigation, to winter. Climate change projections for Uzbekistan from 2005 to 2050 indicate that (i) water demand will increase from 59 km\(^3\) to 62–63 km\(^3\), (ii) supply will decrease from 57 km\(^3\) to 52–54

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\(^1\) This summary is based on Asian Development Bank (ADB) sector knowledge and operational experience in Uzbekistan.


\(^3\) United Nations Development Program. 2007. *Central Asia--Regional and National Water Sector Review*: http://waterwiki.net/index.php/Central_Asia_%E2%80%93_Regional_and_National_Water_Sector_Review. Withdrawal greater than 100% of MAF is possible as drainage recharges groundwater and returns to rivers where it is reused.
km$^3$, and (iii) the present water deficit will increase by over 500% from about 2 km$^3$ to 11–13 km$^3$. Increased irrigation efficiency is the ubiquitous prescription to address water scarcity. However, the only real way to save water and increase its availability is to reduce consumption, primarily by reducing the irrigated area by taking (the least productive) land out of production.

5. **Salt accumulation.** Waterlogging and salinity affect 47% of irrigated land in Uzbekistan, cotton yields decline 20%–30% on slightly saline land and up to 80% on highly saline land, and 20,000 ha go out of production each year. The main source of primary (river basin level) salt is mineral salt, present in some soils, which is dissolved by rainfall and irrigation, transported by infiltration and drainage, and returns to groundwater and rivers. The main sources of secondary (irrigation system level) salt are (i) withdrawal of saline irrigation water, and (ii) waterlogging (high water table) and capillary rise that transports salt into the crop root zone.

6. **Low agricultural productivity of water.** Productivity (T m$^{-3}$) is equal to yield (T ha$^{-1}$) divided by consumption (m$^3$ ha$^{-1}$). Initial analysis indicates that productivity of water in Uzbekistan is low because water is over-allocated, covers too much land, and optimum crop water requirements (consumption) are not met. Therefore, productivity can be raised by increasing consumption, as the resulting yield increase will be proportionally more than the increase in consumption. For example, initial analysis indicates that 20% more wheat could be produced on 25% less land while maintaining present total water consumption. Over-extended irrigation areas will go out of production with increasing water scarcity. The improved agricultural productivity of water and associated land suitability considerations offer the government an opportunity to plan and manage the economic efficiency and social equity trade-offs involved. Improvement and consolidation of existing areas should receive priority over new development.

7. **Deteriorated infrastructure.** During the 1990s, the state share of agricultural investment declined from 27% to 8%, with a decline in state financing for agriculture from 2.9% to 1.8% of GDP. Recurrent system management (operation and maintenance) allocations were also sharply reduced, and the volume of canal de-silting and structural repair decreased and reconstruction stopped. The investment needs were subsequently estimated as follows: (i) 60% of reservoirs needed de-silting, (ii) 18 of 42 intakes with capabilities of 10 m$^3$/s to 300 m$^3$/s needed replacement or reconstruction; (iii) 32% of 22,300 km of main and secondary canals and collector drains required reconstruction and 24% needed repair; (iv) 42% of 149,500 km of tertiary and on-farm canals and drains required reconstruction and 17% needed repair; (v) 11,500 km of subsurface drains required reconstruction or repair; and (vi) 19,000 km of open drains needed de-silting.

8. **Pumped irrigation and drainage pose additional challenges.** Three massive pumped cascade systems irrigate over 800,000 ha of land from the Amu Darya River. ADB is financing rehabilitation of Amu Zang, while the other two systems also need urgent rehabilitation. Almost all pumps are operating beyond their design life and are starting to fail. About 80% of 76 large pumping stations, 50% of 496 medium pumping stations, and 30% of 561 small pumping stations—supplying 50% of the national irrigation area—require reconstruction or repair.

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6 International Water Management Institute. 2007. *Water for Food, Water for Life – A Comprehensive Assessment of Water Management in Agriculture*. London and Colombo (Figures 7.2 and 7.3) present winter wheat yield is 4.2 T ha$^{-1}$, potential consumption 500 mm, potential winter wheat yield, with full consumption, is 9.2 T ha$^{-1}$, and crop water stress is assumed to account for half the yield gap.
Substantial investment is needed to convert pumped systems into efficient and cost-effective operations.  

9. **Water management.** The Ministry of Agriculture and Water Resources is responsible, under the extant 1993 Water Law, for agriculture and water resources including water rights, allocation, and dispute resolution. Its Directorate for Water Management is responsible for development and management of irrigation and drainage systems. Since 2003, the directorate has administered 10 basin irrigation system administrations, each with lower-level main canal administrations and irrigation system administrations. However, organizational responsibilities remain unclear and new capital and operations and maintenance related cost recovery and financing modalities are required, including for pumping stations, to prevent further infrastructure deterioration and to sustain improvements.

10. **New water user associations (WUAs) have been established and are responsible for tertiary irrigation and drainage systems that were managed by the state prior to 1993. However, (i) WUA sizes and responsibilities vary considerably, with low women’s representation (less than 10%); (ii) there is no program to develop their capacity; and (iii) membership fees, collection efficiencies, and financial sustainability remain low. A recent study found participatory irrigation management, irrigation management transfer, and WUA capacity development programs to be more successful when (i) water is scarce, and (ii) the programs are implemented by nongovernment organizations.**

11. **Agriculture and food security.** In 2007, cotton accounted for 40% of Uzbekistan’s exports; cotton crops (grown on 41% of the irrigated area) and wheat crops (grown on 42% of the irrigated area) accounted for 60% of agricultural production. Wheat self-sufficiency became a strategic government priority after independence. From 1992 to 2008, cotton yields increased only marginally, from 2.5 tons per hectare to 2.6 tons per hectare. Wheat yields increased from 2.4 tons per hectare to 4.2 tons per hectare during this period.

12. **The government manages the production and marketing of cotton and wheat. Farmers are subject to quotas to grow large areas with subsidized credits and inputs. They are also required to sell 50% of the wheat and cotton harvest to the government. Land use contracts are often not registered or recognized, and the title of the land is not transferable to another user. This limits incentives for private productivity investments and credit availability since farms are not viable as collateral. Shirkat (cooperative) farms were poorly performing state cooperatives that have been privatized. Dehkan (peasant) farms are 0.15–0.35 ha inheritable household plots. They have secure long-term tenure. About 4 million–5 million dehkan farms produce one-fifth of the country’s grain and most of its horticulture.**

2. **Government’s Sector Strategy**

13. **The objectives of Uzbekistan’s new Welfare Improvement Strategy (WIS-II) for 2012–2015 include sustainable inclusive economic growth (including agriculture growth) and food security. The government’s 2009 Integrated Rural Development Program includes further reform of the legislative and regulatory framework of the agricultural sector, improvement of irrigation and subsurface drainage systems, and development of WUAs. The national investment program includes separate irrigation and drainage projects, often for the same system.**

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However, the government does not have an official strategy for the integrated management of land and water resources at the irrigation system level or the river basin level.

3. ADB Sector Experience and Assistance Program

14. Since 1996, ADB’s water and irrigated agriculture program in Uzbekistan has comprised (i) five projects, involving seven loans totaling $295.2 million; and (ii) 12 technical assistance (TA) projects for $8.8 million. The project completion reports rated the Grain Productivity Project *successful* and the Ak Altin Agricultural Development Project *partly successful*.\(^9\) As with the expected cotton and wheat yield outcomes of the Ak Altin Project, the Project’s infrastructure outputs were also only partly achieved.

15. Improved identification and preparation is positively associated with the success of ADB projects, including in the water sector.\(^10\) The ADB Water Operational Plan, 2011–2020 envisages a new generation of projects to address water scarcity by improving service delivery and water productivity.\(^11\)

16. The 2011 country assistance program evaluation (CAPE) of the Independent Evaluation Department recommended that ADB maintain its focus on infrastructure, including for agriculture and natural resources, and provide advisory TA to help the government develop an agriculture and natural resources sector strategy.\(^12\) A strategy and investment plan was developed as part of the Water Resources Management Sector Project, approved in November 2008, to select its core subprojects.\(^13\) The strategy identified agricultural productivity of water as the core development problem, but the design and monitoring framework of the project included productivity of water only at the impact level rather than the outcome level.

17. The country operations business plan, 2012–2014 for Uzbekistan includes assistance for the Amu Bukhara Irrigation Project. This project is part of the government’s 2009 Integrated Rural Development Program and will improve the agricultural productivity of water. The Amu Bukhara project preparatory TA\(^14\) and regional TA\(^15\) covering Uzbekistan were both approved in late 2011. The regional TA will prepare (i) strategic country water assessments, as envisaged by the Water Operational Plan, to identify and prioritize challenges at the river basin and irrigation system levels; (ii) water sector strategies with solutions to address the challenges; (iii) prioritized lists of potential investment projects to implement the strategies; and (iv) draft concept papers for priority projects in each participating country.

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\(^15\) ADB. 2011. *Technical Assistance for Knowledge and Innovation Support for ADB’s Water Financing Program (Supplementary)*. Manila.
Problem Tree for Agriculture and Natural Resources (Irrigation, Drainage, and Flood Protection)

Water limiting and consumption too low

Waterlogging and high soil and water salinity

Economic efficiency and social equity not optimized

Deteriorated infrastructure

Low farm incomes, high rural poverty

Development Problem
Low agricultural productivity of water

No integrated Syr Darya or Aru Darya River basin management strategy

Poor system management (O&M) service and low irrigation efficiency

Little diversification
Low crop yields

No water allocation strategy

No salt management strategy

Deteriorating infrastructure

Supply will decrease with climate change and development in upstream countries

No salt reduction or dilution and limited disposal with too much valuable water

New WUAs lack technical capacity and financial resources to manage (O&M) irrigation systems

Water over allocated and fully consumed

Restricted drainage

Conflict economic efficiency and social equity objectives

Limited MAWR O&M budget and capacity to manage river basins, irrigation systems, and WUA capacity development

Too much irrigation land

Little NGO presence

MAWR = Ministry of Agriculture and Water Resources, NGO = non-government organization, O&M = operation and management, WUA = water user association
### Sector Results Framework (Agriculture and Natural Resources [Water Resources], 2012–2016)

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<td>Outcomes with ADB Contribution</td>
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<td>Productivity of water increased from 1.40 kg of wheat in 2011 to 1.68 kg of wheat in 2016 per m³ of water</td>
<td>Water resources infrastructure and systems expanded and improved</td>
<td>800,000 hectares of irrigated land receive secure water supply by 2016</td>
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<td>Crop yields increased by 5% by 2016 (2008 baseline: 2.6 tons per hectare for cotton and 4.2 tons for wheat)</td>
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<td>60 water pump stations upgraded by 2016</td>
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ADB = Asian Development Bank, ha = hectare, kg = kilogram, km = kilometer, m³ = cubic meter, PPTA = project preparatory technical assistance.
Source: Asian Development Bank staff.