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Strengthening Water Resource Management in Uzbekistan through Reliable Hydrometric Measurements

UzNIM is supporting a modern, water management system aligned with the Water Sector Development Concept of Uzbekistan for 2020-2030

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The Challenge

Uzbekistan is highly dependent on irrigated agriculture to support its national food supply, which makes effective and sustainable water resource management a key national priority. Increasing water scarcity, combined with aging irrigation infrastructure and growing demand, is placing significant pressure on Uzbekistan's national water systems. A persistent limitation has been the insufficient reliability, consistency, and comparability of hydrometric data used in water management. Different measurement approaches and fragmented monitoring practices have made it difficult to obtain coherent and comparable information across irrigation systems. As a result, the ability of decision makers or other stakeholders to assess water distribution, identify inefficiencies, and support operational or planning decisions has been constrained.

A key challenge is the reliable, consistent quantification of water flow and related hydrological parameters within irrigation and water management systems. In particular, the water flow (discharge) and water levels are measured using different approaches, limiting consistency across locations. Further, the measurement results are not always directly comparable due to differences in methods and monitoring practices, and the resulting monitoring data are not always integrated across municipalities, reducing their usefulness for regional and national water management analysis. The consequences of these limitations include difficulty in identifying water losses and inefficiencies at specific locations along the irrigation system, which reduces the effectiveness of irrigation management and limits confidence in data used for operational and planning decisions.

These challenges highlight the importance of improving the quality and consistency of measurement data as a basis for better water management in Uzbekistan.

The Solution

In 2020, Uzbekistan adopted a broader national policy to improve water resource management and irrigation efficiency. This included the development of the relevant policy framework, Concept for the Development of the Water Sector of the Republic of Uzbekistan for 2020–2030 (Presidential Decree No. UP-6024, 10 July 2020),¹ with the implementation of a National Strategy for Water Resources Management and Development of the Irrigation

¹ Agency of IFAS for implementation of the Aral Sea basin. Decree of the President No. UP-6024 on Approval the Water Sector Development Concept of Uzbekistan for 2020-2030. <https://aral.uz/en/blog/2020/07/23/decreed-of-the-president-no-up-6024-on-approval-the-water-sector-development-concept-of-uzbekistan-for-2020-2030/>

Sector. These broader national initiatives focus on modernizing water management systems and hydrometeorological activities nationwide.

Building upon the national measurement infrastructure already established for liquid flow and liquid level measurements,² the Uzbek National Institute of Metrology (UzNIM) plans to progressively strengthen its contribution to Uzbekistan's water sector modernization. Existing national measurement standards already provide national capabilities for the calibration and verification of liquid flow measuring instruments using static weighing and master meter methods, while national capabilities for liquid level measurements have also been established. Building on this foundation, UzNIM will continue strengthening its technical competence in hydrometric measurements, including participation in the COOMET supplementary comparison COOMET.M.FF-S12 to demonstrate the international comparability of its measurement capabilities. In parallel, work is underway on the development and implementation of national standards harmonized with relevant recommendations of the International Organization of Legal Metrology (OIML), including OIML R 49 for water meters. Together, these activities will contribute to establishing a reliable measurement infrastructure supporting metrological traceability and modern, measurement-based water resource management in Uzbekistan.

A series of reviewed research studies^{3,4,5} from Uzbekistan and neighboring Kazakhstan has also demonstrated that a measurement-based approach can be applied to the practical development and upgrade of the water systems in Uzbekistan. This includes a structured measurement and monitoring approach in which hydrometric data are collected, integrated, and used to support water management analysis and decision-making processes. In general, this new process could involve four key steps: 1) measurement of hydrological parameters, primarily water flow (discharge) and water level, within irrigation systems and water channels; 2) collection and monitoring of measurement data through hydrometric observation practices and field monitoring systems; 3) use of GIS-based analysis and data integration approaches to support spatial visualization and assessment of irrigation conditions; and 4) use of the integrated information to support identification of inefficiencies, assessment of hydraulic infrastructure, and operational planning activities.

The results of these prior research activities have demonstrated improved reliability and consistency of hydrometric data, an enhanced ability to identify inefficiencies and water losses in irrigation systems, a more robust basis for planning and operating hydraulic infrastructure,

² Saidoripov, L., Stetsenko, A., Glova, Y., Naumenko, V., and Ukolov, O. Development of a national standard of water consumption in the Republic of Uzbekistan. DOI 10.21014/tc9-2022.088. <https://www.imeko.info/publications/tc9-2022/IMEKO-TC9-2019-088.pdf>

³ Djalilov, A., Nazarov, O., Sobirov, E., Tasheva, U., Abdunabiyev, J., and Urolov, S. 2023 "Research of water flow measuring device based on Arduino platform" International Scientific Conference "Construction Mechanics, Hydraulics and Water Resources Engineering, CONMECHYDRO – 2023. 401, 04039 <https://doi.org/10.1051/e3sconf/202340104039>

⁴ Li, M., Karlykhanov, O., Ponkratov, D., Imanaliyev, T., and Tazhiyeva, T. 2018 "Automatic water meter for gauging stations of irrigation canals" Revista ESPACIOS, vol. 39 (34) <https://www.revistaespacios.com/a18v39n34/a18v39n34p29.pdf>

⁵ Glovatskii, O., Usmanov, S., Ergashev, R., Hamdamov, B., and Gazaryan, A. (2023). Hydrometric flow measurement in water management. E3S Web of Conferences. 365. 03016. 10.1051/e3sconf/202336503016. <https://www.researchgate.net/publication/367534620>

and improved effectiveness of water management decisions supported by measurement data. The application of structured measurement practices to improve the consistency of data collection, together with monitoring systems and GIS-based tools to support data integration, analysis, and visualization, will be instrumental in enhancing the coherence and usability of measurement data and in supporting its application in water management processes. This will serve as a future model for UzNIM and other agencies within Uzbekistan to develop a robust, metrologically sound water resource management system.

A Quantifiable Impact

This case study describes UzNIM's planned contribution to Uzbekistan's water sector modernization and underscores the importance of strengthening measurement practices within water management systems, coordinating research, monitoring, and operational activities, and recognizing measurement capability as a key element of effective resource governance.

While prior research studies do not provide uniform quantitative indicators across all steps, they consistently demonstrate the importance of accurate, reliable measurements for improving water management practices and processes. These developments are supporting an ongoing transition towards more structured, data-informed, and efficient water management practices. Thus, this case study highlights the role of measurement data in supporting water management at both operational and planning levels.

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