



CLIMATE-SMART IRRIGATION

TECHNOLOGY DESCRIPTION

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The climate-smart irrigation (CSI) technology consists of several main “elements” – conventional irrigation technology combined with meteorological stations and their sensors. The irrigation system includes a complex of interconnected structures and devices, which ensures an optimal water-salt regime in the upper soil layer for high crop yields. The irrigation system consists of a water source from where, through a pumping station with a pressure pipeline, water is fed into the receiving basin, it is further distributed by inlet channels. CSI system is based on use on modern technologies, such as IoT (Internet of Things), different meters, drones, GSM, GLONASS and automated systems used to increase agricultural output productivity. The technology helps to water crops only when required (in contrast to watering based on technological maps for crops or scheduled watering). This technology is essential for the proper dosage of nutrients (part of which, in the end, reaches water bodies).

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

As of April 2019, about 2.5 thousand weather stations in Ukraine were installed within the last 10-12 years. Unfortunately, farmers were not able to benefit fully from the use of weather stations, and a majority of them became obsolete and not functional, so now they require modernization or repair that might cost as much as the brand-new station. Weather stations were not used combined with the available irrigation infrastructure. At the current stage of the technology development, the implementation of CSI in Ukraine could be mainly driven by agri holdings and medium-sized farms (those with an area of less than 3 thousand ha as in Ukraine, they process about 52% of arable land, agri holdings process 30% of arable land, whereas the remainder 18% of arable land are being processed by 15 million households), according to TNA Ukraine (2019). The market chain consists of equipment for CSI producers, importers, equipment maintenance, irrigation networks, and, finally, end-users of technology (in our case, these are future Water Users Associations). The demand from end-users is in place due to the worsening problem of droughts, especially in the South of Ukraine, and the growing inclusion of contemporary IT-based technologies by agricultural companies.

CLIMATE RATIONALE OF THE TECHNOLOGY

The climate change adaptation rationale for CSI technology deployment addresses two significant problems: 1) growing water scarcity and 2) aggravated droughts, especially in the South of Ukraine. Even though at the time of this Technology Brief preparation, the official vulnerability analysis of agriculture and water sectors has not been conducted yet, there are reasons to expect the particular problems named above in the future. The following specific needs under climate impacts will be addressed using the CSI:

- prevention of crop loss due to overwatering or underwatering;
- more reasonable and diminished use of water, that leads to the decreased amount of nutrients reaching water bodies;
- the maximal use of soil moisture;
- the indirect conservation of biodiversity through cleaner water;



- large-scale CSI as water technology is subject to integrated water resource management at the national level (and even at basin) level, contributing to enhanced management of water under the climate change balancing the availability of water supply and irrigation demand.

Major mitigation's co-benefit is the reduction of CO₂ emissions into the atmosphere as a result of lower electricity consumption, as less water is required to be transported for irrigation.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The Strategy for Irrigation and Drainage until 2030 (2019) indicates that available water infrastructure (water supply, the capacity of main and distribution canals, number and capacity of different pumping stations) are sufficient to withdraw and supply water for the irrigation of at least 1.5-1.8 million ha, envisaging the expansion of irrigation in the area of 1 million ha by 2030. Actual irrigation in 2019 reached 0.532 million ha. Agri holdings process 30% of arable land (TNA Ukraine 2019), and there are medium-size farmers; thus, the ambition for CSI spread in Ukraine is the **implementation of CSI on 0.5 million ha by 2033**. This target is very ambitious, as it is equal to the currently irrigated area, and, besides, the current annual increment of irrigated areas reaches only a maximum of 20 thousand ha. This ambition is in line with Strategy for Irrigation.

Amongst the 9 Technology Readiness Levels (TRL), CSI currently might be located at a TRL 8 - system complete and qualified. Should the ambition level of deployment be achieved, TRL 9 would be reached - actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies). However, it is essential to bear in mind that TRL does not consider the high cost of technology, while the cost factor hinders the technology deployment.

Judging of Commercial Readiness Index (CRI), CSI is currently at the CRI level 3 – commercial scale-up. Should the ambition be reached, it might get the CRI level 5 - market competition driving widespread deployment, as the growing presence of CSI on the market might induce the cost of technology down, potentially giving a chance for domestic equipment producers (which might again drive the cost down).

EXPECTED IMPACTS OF THE TECHNOLOGY

CSI is expected to have a significant impact in decreasing climate change vulnerabilities, in particular more reasonable distribution of scarce water, maximal use of soil moisture, as well as diminishing the amounts of nutrients reaching water bodies. This technology is a crucial element of climate-smart agriculture. It might have a significant impact on the environment and economy. For instance, reduced nutrient utilization minimizes soil loss to erosion. Improving farmers' knowledge of soils and plants is also essential for more accurate dosing of nutrients, the timing of their application, which will meet the more precise needs of crops. There are significant benefits for economic and social development, including increased crop yields, reduced fertilizer costs, reduced water transport costs, reduced soil degradation and erosion, growing soil organic matter, improved public health due to reduced fertilizer use and their content in water. In the study, the equipment was assumed to be mostly imported; however, the domestic market could adjust through the creation of domestic production facilities, especially given that heavy machine building is well developed in Ukraine.



The equipment requires maintenance from time to time, and Ukrainian experts can cover it. CSI requires a high level of expertise in IT, which could become a good niche for Ukrainian IT specialists.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

There are not so many policies in place related to CSI in Ukraine. There are general documents such as Water Code (1995 with subsequent revisions), Association Agreement between the European Union and Ukraine (2014) that presumes implementation of the EU Directives in water sector, namely Nitrates Directive 91/676/EEC (relevant because agricultural nutrients extensively reach water bodies), as well as Strategy for Irrigation and Drainage in Ukraine until 2030 (2019).

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

The main measures and actions that need to be taken include:

- The gender-sensitive assessment of water available for irrigation in the medium and long-run (providing extensive inclusion of women in the studies);
- The adjustment of imported equipment to local conditions (i.e. the study to develop adjustment factors for local crops and weather conditions);
- The development of special funding program, aimed at the provision of long-term soft loans, including SMEs from rural areas;
- The adoption of import tax exemption for imported equipment for CSI;
- the adoption of Draft Law On the organizations of water users and stimulation of hydraulic amelioration of lands #5202 dated 04.03.2021 (to create Water Users Associations). This would enable creation of Water Users Associations (WUAs), and WUAs would have legal basis to become fully operational and to obtain pumping stations to their balance;
- The transition of irrigation machinery and elements of CSI system from State Agency for Water Resources to Water Users Associations;
- The extension of the existing National Standard DSTU 7735:2015 “Technics of Water Supply. Terms and definitions of basic concepts” (2015);
- The spread of information about CSI;
- The enhancement of networking of CSI value chain actors, including SMEs from rural areas.

COSTS RELATED TO THE IMPLEMENTATION OF POLICY

The preliminary estimates indicate that the cost of climate-smart smart irrigation is USD 4251/ha (TNA Ukraine 2020). In order to simplify calculations, we assume USD 4200/ha, allowing the economy of scale and acknowledging partial presence of some elements of CSI, possessed by farmers and agri holdings. The purchase the equipment for CSI on the area 0.5 million ha, USD 2.1 billion is needed until 2032. To assess the water available for irrigation in the medium and long-run, USD 0.1 million is required. To adjust the imported equipment to local conditions (i.e. study to develop adjustment factors for local crops and weather conditions) would require USD 0.5 million.



USEFUL INFORMATION

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LINKS TO TNA REPORTS

TNA Adaptation (2021) Preparing a Technology Action Plan <https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2021/11/tap-report-ukraine-1.pdf>

TNA Adaptation (2020) Barriers Analysis and Enabling Frameworks <https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2020/06/baef-ukraine-adaptation.pdf>

TNA Adaptation (2019) Technology Needs Assessment <https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2019/09/final-ukraine-tna-adaptation-report.pdf>