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Sustainable Agriculture from the 'Efficient Water Use' Perspective

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The Role of Agriculture in Azerbaijan's Economy

Agriculture is one of the main contributors to the national economy of Azerbaijan: it accounts for 6 percent of the country's GDP and employs about 36.5 percent of the country's economically active population. Azerbaijan thus gives special attention to its agriculture sector to diversify economic activities and also in order to provide higher food security levels.

The main challenge concerning agriculture in Azerbaijan is low productivity, which mainly stems from fragmented landholdings, inefficient water use, and serious soil degradation. Other major challenges are related to soil erosion, salinity, reduction of soil fertility and organic matter, increased secondary salinization and water logging, degradation, and desertification. Additionally, due to the geographical conditions in Azerbaijan, irrigation is extensively used, with 90 percent of the land being irrigated. The majority of the above-mentioned challenges are related to inefficient water and land use technologies.

Sustainable Agriculture

Sustainable agriculture is an integrated system of plant and animal production practices that ensures the supply of food while focusing on environmental quality, the conservation of natural resources, and maintaining the economic viability of farm operations. From a social perspective, it also addresses the quality of life for farmers and society. Overall, sustainable agriculture has wide-reaching environmental, economic, and social aspects.

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These include:

- Conservation of soil fertility and the prevention of erosion;
- Efficient water use;
- Preventing and reducing air and water pollution;
- Ensuring biodiversity and protecting ecosystems;
- Storing carbon on farms.

Each of these topics are quite broad and have their own challenges and solutions. As Azerbaijan's agriculture is irrigation-dependent and water resources are scarce, in this IDD Analytic Policy Brief I will focus on ways to utilize efficient water use techniques to achieve sustainable agriculture in Azerbaijan.

Water and Agriculture Practices in Azerbaijan

Access to water is one of the key challenges in achieving sustainable development, in accordance with the UN 2030 Agenda for Sustainable Development, which includes the Sustainable Development Goals (SDGs). Although SDG6 is specifically aimed at ensuring the availability and sustainable management of water and sanitation for all, water is also a crosscutting issue that lies under each SDG. Water not only has environmental, economic, and social significance but is also important for security. Around 60 percent of the world's population is facing water stress, at least seasonally. Azerbaijan is a water scarce country, too—it has limited water resources, with 70 percent originating outside the country and up to 70 percent being utilized for irrigation purposes. Additionally, the water evaporation rate in Azerbaijan is 2.5 times higher than the total amount of rainfall.

Although the country has limited water resources and water losses are recognized as a problem, water efficiency activities are lacking. Traditional irrigation methods, such as flood and furrow, are widely applied in the agriculture sector in Azerbaijan. In a flood and furrow system, it is difficult to estimate the amount of water required. Moreover, the water is not just applied where it is needed but can accumulate in other parts of the farm and severely damage crops. This is the most inefficient irrigation technique because of extreme water losses and soil damage: excess water soaks into the soil but can also evaporate or run off. This reduces the soil quality, which is another agricultural challenge and environmental degradation concern for the country.

Additionally, as water runoff originates far away from irrigation areas, water transport becomes necessary, during which huge losses of water take place. In fact, approximately one-third of losses happen during water transport; and losses in the agricultural distribution system account for 25 percent of the total sum of losses.

The Role of Water Resources Management in Sustainable Agriculture

Currently, in Azerbaijan water resources are managed based on the Water Supply Management (WSM) method, as opposed to the Water Demand Management (WDM) method. The traditional water management method has focused on water scarcity from a supply perspective—extracting and storing more water from the resources—therefore there has been a focus on investing in infrastructure, especially in terms of building reservoirs, digging wells, and improving irrigation channels. Although these steps are helpful to some extent, they are quite expensive and limited—only a certain amount of water can be extracted, due to climate change the amount of precipitation might change greatly, and Azerbaijan is hugely dependent on neighboring countries in terms of both water quantity and quality. For these and other reasons, building additional infrastructure is unlikely to be effective. In WSM, different water consuming sectors receive the amount of water that they historically used to get. However, in the WDM approach, it is the central water resources management body that allocates water resources to different sectors by considering the available water resources, modelling based on upcoming plans, a complex rank-ordering of inter- and intra-institutional priorities, and the legal framework. By switching to this approach, better use of existing water supplies is achieved in the country overall, through a reduction of losses and misuse, optimizing the available water, and increasing the role of water as an economic resource.

Countries like Egypt and Israel are great examples of the WDM approach. As Middle Eastern and North African countries have been coping with water challenges for centuries, WDM has provided the way towards achieving the sustainable use of water resources and development since the 1970s; as a result, these countries now have decades of experience in testing, trialing, and implementing this approach.

There are various supporting mechanisms for WDM, which can be divided in three areas: *one*, infrastructural and technical support (water saving technologies); *two*, economic incentives to promote green technologies; and *three*, better regulations. Each will be briefly addressed below.

The infrastructural improvements in Azerbaijan are satisfactory—there are around 140 small, medium, and large sized reservoirs and water irrigation canals that have been recently upgraded to reduce water losses. Some of traditional techniques for efficient water use and soil quality—e.g., rotating crops and crop types, optimized watering times—are widely practiced by farmers. However, the preference for mainly drought resistant crops and mulching is not common for farmers in the country. Azerbaijan is also lacking water saving technologies that are applicable for its needs. Water efficiency is accepted as a "new source" of water in light of climate change, limited water resources, and an increasing demand for water.

At present, sprinkler and drip irrigation is not used often, mainly because of a lack of awareness and affordability challenges. Only a few private agricultural businesses are equipped with advanced irrigation techniques. Thus, experience in the country is still limited, standards are not yet set, and increased capacity-building efforts geared towards the Water Users Associations and farmers is required. While drip irrigation is forgiving of errors in design and installation, the amount of water irrigated is quite sensitive. Improper irrigation scheduling results in the largest loss of crops, and so proper calculations are necessary for productivity and efficiency. Therefore, the introduction of drip irrigation and the improvement of irrigation scheduling is considered key to improving low water use efficiency. Other challenges related to drips and sprinklers are maintenance issues, including the sun affecting drip irrigation tubes and poor water quality. These can easily cause clogging, however; such and similar challenges can be managed with proper planning and increased farmers' capacity building. The main advantage of this system is that it can lead to 30-70 percent water savings, with increased productivity.

Aquaponic systems are another water efficient practice. This involves the integration of fish culture with hydroponic plant production in a recirculating setup. This system has been tested by several development projects in Azerbaijan and the main issues identified were related to building the system—considering the wind, heat, and other external factors with constant access to electricity. However, if developed properly, Aquaponic systems can help to achieve 89 to 99 percent water use efficiency.

Smart monitoring and advanced water metering are other examples of efficient water saving technologies. Leakages are one of the main contributors of water loss. The distribution network is vast, and, in most instances, the pipes are hidden; however, repairing leakages is only possible when a pipe is visible, which results in excessive water loss and socio- economic disruptions like landslides and road damage. Thanks to advanced metering infrastructure and the improved quantity and quality of water networks even small leaks can be found and repaired immediately. Lack of water metering is also becoming a limitation in conducting comparison analysis of water-saving technologies, drought resistant crops, and other ways of achieving more productivity and water efficiency. However, smart grid systems are expensive and replacing an already existing water network with a new one would involve a high upfront cost. Therefore, instead of applying it throughout the whole country, it can be applied in the liberated areas of Azerbaijan first, as this new infrastructure is currently being built and regular water metering system can then be applied for agriculture purposes.

Some of the economic incentives towards stimulating the expansion of modern irrigation technologies—e.g., exemptions from import duties and VAT payments—are already in place. Agricultural water tariffs are low at only 0.5 AZN for 1,000 m^3 water and do not encourage farmers to invest in water saving measures. However, at

present the tariff is set considering the economic situation of farmers and the overall economic situation in the country. To promote the use of water efficient technologies in the agriculture sector, differentiated tariffs might be applied—higher tariffs for traditional irrigation and discounted tariffs for modern technologies.

As the proposed water management approach is new to Azerbaijan, it appears necessary to assign and establish a central water planning and management institution that would be responsible for conducting modelling studies and deciding on the distribution of water among various water consuming sectors. Additionally, it would be important to set the rules and regulations for the application of the efficient use of irrigation water.

Conclusion

Agriculture is an important sector for both food security and employability, in addition to having a huge impact on environment. It is also the main water consuming sector in Azerbaijan. In the face of increasing water demand and water scarcity, Azerbaijan needs to review its current approach towards water resources management from a holistic point of view and analyze the best practices of other relevant countries from around the world so as to achieve sustainable agriculture and optimize water resources management. In this perspective, Water Demand Management is recommended in terms of making the most use of existing water resources and stimulating the use of advanced water technologies on an institutional and individual level.