



THE USE OF INFORMATION AND TELECOMMUNICATION TECHNOLOGIES FOR GHG EMISSION REDUCTIONS IN AGRICULTURE

TECHNOLOGY DESCRIPTION

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Information and telecommunication technologies that have emerged in recent years provide various benefits to farmers in terms of cost saving, resource efficiency, labour optimization, and could also support climate mitigation activities in the agricultural sector. Examples of Information and Telecommunication Technologies (ICT) use in agriculture include the use of auto pilots at agricultural machinery for more efficient operation, drones for the aerial monitoring of agricultural lands and development of fertilizers input maps, satellite images to analyse the land productivity and other characteristics, tractor mounted sensors, specialized applications and software, etc. Besides, technologies required to use digital data include guidance systems that can be used on all kinds of equipment (e.g. tractors, sprayers, planters, etc.) and variable rate technology (VRT) that focuses on the automated application of materials (fertilizers, chemicals, seeds and water) to a given landscape. The promotion of the technology include support for the switching to modern agricultural machinery and equipment with integrated digital capabilities, as well as capacity building activities for operators of machinery and other agricultural specialists.

CLIMATE RATIONALE OF THE TECHNOLOGY

Agriculture sector is an important driver of national economic growth, expansion of export volumes, as well as food security. At the same time, agriculture sector has significant contribution to total greenhouse gases emissions in Ukraine with the total volume of emissions estimated at the level of 99 Mt CO₂-eq. for 2019. The main sources of emissions include soil organic carbon loss at cropland (51%), agricultural soils (33%), enteric fermentation (8%), fuel use by agricultural machinery (6%), and manure management (2%). Ukraine's updated NDC has a target to reduce GHGs emissions by 65% compared to 1990 levels in 2030 and support of climate technologies in agriculture would contribute to the achievement of the target and sustainable development of agricultural sector.

The application of technology allows reducing nitrous oxide emissions due to more efficient differentiated use of mineral fertilizers, CO₂ emissions from fossil fuel use during fertilizers production (natural gas) and by agricultural machinery (diesel fuel), as well by indirect impact on the GHGs emissions from the land use sector due to control over land use's practices and change in land use.

The extensive diffusion of ICT in agriculture could trigger total GHG emission reductions at the level of 2 Mt of CO₂-eq. per year.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The technology could be broadly applied in all regions of Ukraine, as there is developed IT infrastructure (e.g. high mobile network coverage, internet access rate, smart-phone adoption rate) and there are both local and international service providers available in the market allowing the extension of technology application in a short-term period. The effectiveness of the technology will be increasing with time due to both new technology developments and accumulation of data on soil characteristics, agricultural practices and yields.

The ambition of the TAP is to achieve the application of modern ICT at the area of at least 10 million ha by 2030 by promoting the transition to modern agricultural machinery and equipment with integrated ICT features, including among small and medium farmers.



EXPECTED IMPACTS OF THE TECHNOLOGY

GHGs emission reduction potential stems from lower emissions from mineral fertilizers, fuel combustion and control over land use requirements.

The use of information and telecommunication technologies allows differentiated fertilizer's input using guidance systems for agricultural machinery and variable rate application technologies leading to fertilizers savings. Savings could reach as much as 20% of fertilizers without productivity losses (especially in fields with significant differences in soil characteristics across different sections).

The use of ICT in agriculture could also improve fuel efficiency by 10-15% per hectare of land cultivated due to the use of GPS trackers, the remote monitoring of fuel consumption and running machinery in auto-pilot mode.

ICT and, in particular, satellite and aerial images analysis could be an important tool for the control of land use practices and identification of land use changes that lead to increased GHGs emissions. ICT tools allow farmers to use their land bank more efficiently by identifying excessive unused land areas (e.g. field entry and exit points). According to the estimates of experts, approximately 2-4% of land areas could be added to harvesting area due to the use of ICT. The satellite imagery analysis and machine learning techniques could provide valuable information about the practices of land use and related violations (e.g. arable land within the territories of natural protected areas, water protection zones, forest areas, and on the slopes) and contribute to land conservation efforts.

The development of the proposed mitigation technology (i.e. modern agricultural machinery and equipment) could have synergies with the development of an agrometeorological early warning system, which is defined as a priority adaptation technology within the TNA project, and also serve as an enabler for other mitigation technologies in agricultural sector (e.g. conservative tillage practices and organic agriculture) due to increased operational efficiency.

Additional positive impacts of the technology include:

- health protection due to lower nitrates content in agricultural products and reduced soils and water pollution,
- reduction of operational cost of agricultural enterprises and improving economic efficiency of their operations,
- environmental benefits due to reduction of water pollution, improving soil quality and reduction of air emissions.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

One of the goals prescribed by the Law of Ukraine On the Main Grounds of the State Environmental Policy of Ukraine for the Period till 2030 (2019) is ensuring the integration of environmental policy in the decision-making process with respect to the social and economic development of Ukraine, including the task of climate change mitigation and adaptation, as well as the sustainable low carbon development of all areas of the Ukrainian economy.

The agriculture sector is reflected in the existing strategic documents related to national climate policy but there is insufficient coverage of climate change mitigation activities in sector-specific policy documents and the lack of policy tools which promote climate technologies in the agriculture sector. New policies are expected to be developed to support the transformation of agricultural sector and achievement of updated NDC target under the Paris agreement.

Ukraine has a state support scheme for agricultural enterprises and farmers, which partial compensation of the cost of agricultural equipment and machinery produced in Ukraine. Ukraine also started implementation of regulatory framework on nutrients management by adopting Methodology for the Identification of Vulnerable Zones.



PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

The common policy measures that could streamline the diffusion of climate technologies in agriculture in Ukraine include introduction of environmental and climate related conditions for the provision of state subsidies, strengthening and improving regulatory requirements, capacity building policies, information policies and supporting the development of project-based carbon crediting mechanisms. Specific actions and activities to support the development of ICT in agriculture are presented in the table below.

Actions	Activities
1. State subsidies	1.1 The amendment of paragraph 3 of the Order of the Use of Funds Dedicated in the State Budget for Financial Support of Agricultural Producers (approved by the Decree of the Cabinet of Ministers of Ukraine #77 dated 08.02.2017) with inclusion of ICT in the list of activities supported.
	1.2 The adoption of the Order of the Cabinet of Ministries of Ukraine On the Procedure of the Use of Funds Dedicated in the State Budget for the State Support of ICT in agriculture (Order for the Provision of State Support for ICT in agriculture) with annual adjustment of the procedure
	1.3 Gradual increase in the financing volume for the support of ICT in agriculture in the state program of agricultural support (e.g. starting from UAH 50 million and increasing at least 20% per year)
2. Regulatory Framework on Nutrients Management	2.1 The adoption of regulations on compulsory action plans for agricultural producers working in vulnerable zones defined using the Methodology for the Identification of Vulnerable Zones, in particular limitations related to the input of mineral and organic fertilizers.
	2.2 The approval of the Code of Good Agricultural Practices to provide additional incentives for the application of ICT for increased efficiency of nitrogen fertilizers use.
	2.3 Setting up and implementation of a programme for promoting the application of the code of good agricultural practice, including the provision of training and information for farmers, to disseminate good practices on using ICT for increased efficiency of nitrogen fertilizers use
3. Capacity building policies.	3.1 The inclusion and promotion of ICT in agriculture in the activities of farm advisory services, involvement of private advisory service providers, and capacity building activities for the experts of farm advisory services in line with the Law of Ukraine On Agricultural Farm Advisory Services
	3.2 Developing educational program for universities and vocational schools about climate technologies in agriculture (including ICT in agriculture)
4. Information policies	4.1 The dissemination of information on nitrogen management and ICT in agriculture for reducing the emissions of greenhouse gases
	4.2 Improving soil monitoring and provision of reliable soil quality data

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

The implementation of actions and activities included in the TAP will require investment in new agricultural machinery and equipment, other hardware and software, as well as capacity building via promotion of ICT in agriculture within the activities of farm advisory services and developing educational program for universities and vocational schools about climate technologies in agriculture.

Potential capital expenditures are mainly related to indirect costs for the investment in the machinery and equipment, which will allow the practical application of recommendations, developed using ICT tools (tractors with computer-based guidance systems, specialized software, machinery for differentiated fertilizers input, and other variable rate technologies). Direct capital expenditures could be also quite significant in case of establishing own divisions for ICT application as an alternative to use specialized service providers, especially for small and medium farms.

Initial expenses for the implementation of activities required for the creation of the enabling framework for the dissemination of technology is estimated at the level of up to UAH 516 million per year with the most significant share of funds for state subsidies.



USEFUL INFORMATION

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LINKS TO TNA REPORTS

Reports prepared within the TNA Project:

- Technology Needs Assessment
- Barriers Analysis and Enabling Frameworks
- Technology Action Plan

Full texts of the TNA reports are available at: <https://tech-action.unepdtu.org/country/ukraine/>

TNA Project page at the web-site of the Ministry of Environment and Natural Resources of Ukraine:
<https://menr.gov.ua/news/33450.html>