PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme: **Resilient food systems through climate services for agriculture in Uzbekistan**

Country: **Republic of Uzbekistan**

Thematic Focal Area: **Agriculture**

Type of Implementing Entity: **Multilateral Implementing Entity**

Implementing Entity: **International Fund for Agricultural Development (IFAD)**

Executing Entity: **Agency for Hydrometeorological Services (Uzhydromet) under the Ministry of Ecology, Environmental Protection and Climate Change of the Republic of Uzbekistan**

Amount of Financing Requested: **10,000,000 (in U.S Dollars Equivalent)**

Project Formulation Grant Request (available to NIEs only): Yes ☐ No ☒

Amount of Requested financing for PFG: **(in U.S Dollars Equivalent)**

Letter of Endorsement (LOE) signed: Yes ☒ ☐ No ☐ ☐

NOTE: LOEs should be signed by the Designated Authority (DA). The signatory DA must be on file with the Adaptation Fund. To find the DA currently on file check this page: https://www.adaptation-fund.org/apply-funding/designated-authorities

Stage of Submission:

☐ This concept has been submitted before

☒ This is the first submission ever of the concept proposal

In case of a resubmission, please indicate the last submission date: Click or tap to enter a date.

Please note that concept note documents should not exceed 50 pages, including annexes.

A. Project Background And Context

Location and climate

Uzbekistan is a landlocked country located in Central Asia. It borders Kazakhstan to the north, Tajikistan to the southeast, Kyrgyzstan to the northeast, Afghanistan to the south, and Turkmenistan to the southwest. The country's location in the heart of Central Asia gives it a diverse landscape and climate. The geography of Uzbekistan varies from vast plains to rugged mountains. The expansive Kyzylkum Desert dominates the northern part of the country. At the same time, the southern regions are home to Pamir and Tian Shan mountain ranges. The Fergana Valley, nestled in the eastern part of the country, is a fertile and densely populated region.

In terms of climate, Uzbekistan experiences a continental climate with hot summers and cold winters. The country is known for its extreme temperature variations throughout the year. Summers span from June to August and can be scorching hot, with temperatures frequently exceeding 40 degrees Celsius in the lowland areas. Winters, from December to February, are generally cold, especially in the mountainous regions, with temperatures dropping below freezing. Spring and autumn, from March to May and September to November, are relatively short seasons characterized by mild temperatures. Precipitation in Uzbekistan is generally low, particularly in the arid regions. Most rainfall occurs in the spring and autumn, although it is still relatively scarce. The Fergana Valley, more influenced by the mountains, receives a slightly higher amount of rainfall than the rest of the country.

Environmental and agro-ecological conditions

A significant portion of Uzbekistan's land is classified as agricultural, making up about 61% of the country's total land area. It includes arable land used for crop cultivation, permanent pastures, and meadows for livestock grazing. The fertile soil in the valleys and plains supports agricultural activities, particularly in the Fergana Valley and the Zeravshan and Syr Darya river basins. The main crops grown in Uzbekistan include cotton, wheat, barley, corn, rice, fruits, and vegetables. Cotton production is significant to the country's economy and accounts for a substantial portion of the agricultural land use. Uzbekistan is one of the largest cotton producers globally. Wheat is also a staple crop, with other grains supporting the domestic food supply. Besides crop cultivation, livestock rearing is essential to Uzbekistan's agricultural sector. Livestock, including cattle, sheep, and goats, grazes on the available pastures and contributes to meat and dairy production. The country also has a small but growing poultry and aquaculture industry.

Uzbekistan has some forested areas, primarily in the mountainous regions, accounting for about 3% of the total land cover. These forests are a valuable resource for timber and provide habitat for diverse plant and animal species.

The agroecosystem of Uzbekistan faces various problems. Water scarcity and inefficient irrigation systems limit agricultural productivity. Soil degradation, including salinization and erosion, affects soil fertility and reduces crop yields. Overreliance on cotton monoculture leads to ecological imbalances and limits crop diversification. Finally, pest and disease management poses challenges, requiring sustainable and integrated approaches to minimize the use of chemical pesticides and ensure crop health. Addressing these problems is crucial for promoting sustainable agriculture, preserving natural resources, and enhancing food security in Uzbekistan. Climate change is exacerbating most of these problems, for example, through increased average temperatures and increased incidence of heat waves, droughts and extreme rainfall events, and thawing at higher altitudes. Rising temperatures and altered precipitation patterns likely influence pests' range, abundance, and behaviour, leading to increased pest pressure and disease outbreaks in agricultural systems. At the same time, the

country lacks a practical integrated climate services framework for agriculture, which poses a significant adaptation deficit to the agricultural sector.

Socio-Economic Characteristics

Population, economy and poverty

Uzbekistan declared its independence from the USSR on September 1, 1991. Since then, the country has transitioned to a Presidential Republic. The present presidency has brought some reforms and focused on economic development and regional cooperation. After an initial phase of market liberalization, the Government of Uzbekistan has initiated a second phase of reforms addressing land, labour, capital markets and structural constraints such as dominant state-owned enterprises and banks. A significant medium-term challenge is ensuring reform inclusivity and transparency.

Based on data from the Statistics Agency[1] in 2023, the population was approximately 36 million. The economically active population is about 15 million people. Life expectancy for men is 72.1 years and for women, 76.6 years. Currently[2], Uzbekistan's population aged 15 to 24 is about 5.54 million people, 12% smaller than the age group of 25-34 (6.2 million people). Within the next ten years, a less numerous age group of 15-24 will gradually replace a considerably more numerous age group of 25-34, bringing down the absolute number of births in the population. This pattern will probably last for the next 15-20 years until the most numerous age group of 0-9 years starts to take effect. Based on the IFAD Uzbekistan web page[3], 49.5 per cent of the population live in rural areas and 75 per cent of the lower-income population. Of these, almost two-thirds make their living from agriculture.

Migration from rural areas of Uzbekistan to other countries has been a significant phenomenon with multiple drivers and implications. Factors such as limited economic opportunities, poverty, and challenges related to agriculture, including climate change, water scarcity and land degradation, have contributed to rural-to-urban and rural-to-international migration in Uzbekistan. Rural migration challenges rural communities: the outflow of labour from rural areas lead to labour shortages, impacting agricultural productivity and rural development. It may also contribute to an ageing population in rural areas as younger generations migrate. From 1990 to 2019, the share of households headed by single women increased from 17.6 per cent to 22.6 per cent. *De facto*, however, there are numerous female-headed households due to male out-migration, with personal remittances constituting 20.8 per cent of the GDP. Recent data also highlight a strong gender digital divide, especially in rural areas[4]. The maternal mortality ratio in Uzbekistan has improved from 41 in 2000 to 29 in 2017. World Bank data shows maternal mortality[5] in Uzbekistan is higher than its regional average.

The 2021 average GNI per capita was approximately $2,150, making the country a lower-middle-income country. Uzbekistan's Human Development Index (HDI) value was 0.722 in 2021, ranking 101 over 191. The agriculture sector involves crop cultivation, livestock rearing, and fisheries. The industry sector encompasses manufacturing, mining, and construction. The services sector includes trade, finance, transportation, tourism, and professional services. These sectors contribute to the country's economic output and employment. One critical vulnerability is its heavy reliance on commodity exports, particularly in the cotton and natural gas sectors. Another vulnerability arises from the limited diversification of the economy, including the rural economies. The dominance of certain sectors, such as agriculture and

[1] https://stat.uz/
[2] https://www.eurasian-research.org/publication/a-brief-review-of-uzbekistans-demographic-profile/
[3] https://www.ifad.org/en/web/operations/w/country/uzbekistan
[4] https://www.undp.org/sites/g/files/zskgke326/files/2023-03/Final_Gender%20Digital%20Divide%20in%20Uzbekistan_d.pdf
[5] The maternal mortality ratio is the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births.

energy, exposes Uzbekistan to risks associated with market fluctuations, climate change impacts on agriculture, and volatility in energy prices. Additionally, the country's infrastructure, including transportation networks and industrial facilities, may be vulnerable to natural disasters, such as earthquakes and droughts, disrupting economic activities and hindering recovery. Furthermore, socio-economic vulnerabilities, such as a large informal economy and income inequality, can exacerbate the impact of shocks on vulnerable populations, making it challenging to achieve inclusive and equitable economic growth.

Uzbekistan has made significant progress in reducing poverty over the past few decades. According to the World Bank, the poverty rate in Uzbekistan decreased from around 28.1% in 2001 to approximately 11.8% in 2017. This decline in poverty reflects the country's sustained economic growth and various poverty reduction initiatives implemented by the government. The government has focused on diversifying the economy, improving infrastructure, expanding access to education and healthcare, and promoting employment generation to reduce poverty and improve living standards.

Based on ADB poverty data[6], 17.0% of the population lived below the national poverty line in 2021, the proportion of employed population below $1.90 purchasing power parity a day in 2022 is 6.6%, and for every 1,000 babies born in Uzbekistan in 2021, 14 die before their 5th birthday. Of Uzbekistan's 32.9 million people, 49.5 per cent live in rural areas and 75 per cent of the lower-income population. Of these, almost two-thirds make their living from agriculture. Though rural poverty gradually decreased to 13.7 per cent in 2015, it remains above the regional average. Free compulsory education for all has lead Uzbekistan to achieve one of the highest literacy rates in the world.

Based on a World Bank study[7], due to the strong economic growth Uzbekistan made progress in reducing gender inequality. However, several demographic and structural challenges remain, including effectively engaging women in the economy. While modernizing various sectors of the economy will foster progress and development, it may also result in setbacks for women, as they lack the skills and education needed to adjust to a changing reality successfully. Women still face low labour demand and a lack of formal employment opportunities. Rural women are insufficiently integrated into the formal labour market.

Agriculture, nutrition, health, and food security

Agriculture plays a major role in the country’s economy, in 2019 generating 25.5 per cent (combined agriculture, forestry and fisheries sectors) of gross domestic product (GDP), 8.4 per cent of total exports, and employing about 26.2 per cent of the country’s labour force, which amounts to more than 3.5 million people (2020). Uzbekistan has 20.26 million ha of farmland and almost 4.2 million ha of irrigated land. Crop and livestock production are equally important for the agricultural sector, accounting for 50.2 per cent and 49.8 per cent of total agricultural production (in USD) in 2019. Forests cover almost 25 per cent of the country’s entire territory, while around 80 per cent of the country is classified as desert or semi-desert. Therefore, limited access to water has a strong influence on state land policy and the issue of land privatization. To ensure national food security, the area under irrigated winter wheat has increased in recent years. The shorter crop rotation of spring cotton and winter wheat largely replaced a long-cycle cropping system for cotton and alfalfa. As a result, wheat production in Uzbekistan for the 1991–2016 period increased 17-fold, while cotton production decreased by about 21 per cent due to the reduced planting area (Nurbekov et al., 2018). Most of the

[6] https://www.adb.org/countries/uzbekistan/poverty
[7] https://documents.worldbank.org/en/publication/documents-reports/documentdetail/542521504159371275/diagnostic-study-of-barriers-for-strengthening-livelihoods-of-low-income-rural-women-in-uzbekistan

achievements in cotton and wheat production are based on high-input-use technologies, which are not sustainable on a long-term basis. The demand for agricultural production is expected to grow in Uzbekistan as the government plans to increase the export potential of many agricultural crops, including fruit and vegetables.

Agriculture plays a crucial role in providing employment and income for rural communities. Many rural households engage in crop cultivation, livestock rearing, and horticulture as their primary economic activities. They rely on the produce they cultivate for subsistence and sale in local markets. Additionally, remittances from migrant workers also play a significant role in the rural economy of Uzbekistan. Many individuals from rural areas migrate to other countries, primarily Russia and Kazakhstan, in search of better job opportunities. They send back remittances to their families, which contribute to the income and livelihoods of rural households. These remittances often support rural communities' education, healthcare, and well-being.

The latest World Agricultural Budget[8] review reveals that public agricultural expenditures are large compared to other countries. However, neither the enabling policy environment nor the public funds' allocative efficiency is fully conducive to generating high, climate-resilient, and inclusive agricultural growth.

Livestock production is a major livelihood support system and a social safety net for 49 per cent of the population (15.3 million) living in rural areas[9]. FAO Global Hunger Index 52nd place among 119 countries in 2018 and reached a "moderate" level with a score of 12.1. In 2019, it took 48th place with a score of 10.7 and ranked 21st out of 116 countries in 2021 with a score of 5.9. Undernutrition remains challenging in rural areas, and anaemia is prevalent among women and children. Inadequate dietary diversity and poor feeding practices contribute to these issues. According to the Global Nutrition Report (2020), Uzbekistan is currently off track in reaching a number of global targets designed to address malnutrition. At the same time, there is not enough data to assess the malnutrition of children under five years old. Access to healthcare services, especially in remote areas, can be limited. Rural populations often struggle to access quality healthcare facilities, trained medical professionals, and essential medications. Maternal and child health remain areas of concern, with issues such as high maternal mortality rates and malnutrition among children requiring attention.

Climate Change Vulnerabilities, Impacts and Risks, and adaptation deficit

Being part of Central Asia, climate change is evident in Uzbekistan, where the average annual temperature has been increasing since the 1950s by 0.27°C every 10 years. In 2007 – 2016 the mean annual temperature was 0.6 – 2°C higher than in 1961 – 1990[10]. Precipitation gradually decreased from 1950 until 2013, with the strongest changes observed in south Uzbekistan. Heat waves have been registered in all parts of the country, with the highest growing numbers of affected days in the delta of the Amu Darya [11]. Throughout 2011 – 2016 droughts exacerbated by heat waves were registered every year [12].

Uzbekistan's climate projections indicate that the growth of average air temperature will continue and by 2030 may reach 1 – 1.4°C. Climate modelling further suggests a steady and

[8] https://openknowledge.worldbank.org/entities/publication/e008199e-76f0-5651-8a3c-66f5d37ccb5c
[9] https://www.fao.org/3/cc1905en/cc1905en.pdf
[10] Uzhydromet national official data
[11] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[12] FAO, IFAD, UNICEF, WFP and WHO. The state of food security and nutrition in the world 2018. Building climate resilience for food security and nutrition. FAO: Rome, 2018

significant increase in the number of days with the air temperature above 39°C, which is the least favourable for plant development. By 2030 in many regions, especially in the south of Uzbekistan, climate conditions may reach critical levels for the currently grown crops. The impact of a changing climate on Uzbekistan's agriculture, including on the production of fruit and vegetables, is well documented [13,14,15,]. Specific impacts are manifested through short-term or long-lasting severe weather (frost, warm/cold winters, heat waves, persistent droughts) as well as through more fundamental shifts of seasons, phenology, productivity, and agroecological conditions. Reduced water availability and drought have underscored these risks, as has the presence of agricultural pests that may not have previously been found in Uzbekistan

Uzbekistan is vulnerable to various dimensions of climate change, which challenges the country's socio-economic development and well-being. It faces water scarcity due to multiple factors, including climate change, inefficient water management practices, and upstream water use by neighbouring countries. Changes in precipitation patterns, increased evaporation rates, and reduced glacier melt contribute to reduced water availability for irrigation, domestic use, and ecosystems. Adaptation deficits linked to poor water management techniques, lack of water accounting methods to how much water exactly has been delivered to whom, and recurrent conflicts between farmers and water consumer associations are expected. Rising temperatures, changing rainfall patterns, and increased frequency of droughts can lead to desertification, soil erosion, and biodiversity loss. Addressing the adaptation gap requires a comprehensive and multi-stakeholder approach that considers a reliable assessment of climate and human intervention's impact on the environment. Lack of data and uncoordinated data collection reduces institutional capacity. Without improving knowledge and knowledge sharing, promoting sustainable land and agricultural management practices and mobilizing financial resources for adaptation initiatives continue to be complex.

A climate service for agriculture is a decision-aide derived from climate and agronomical information that assists agricultural sector stakeholders in making improved ex-ante decisions. It provides information on future agro-climate conditions and the potential impacts of climate change on crops, livestock, and other agricultural systems, including recommendations on crop selection, planting dates, irrigation, and other management practices. Based on the results of the IFAD mission for developing the present concept note, there are challenges to establishing a coordinated framework for climate services production and distribution in Uzbekistan. Various un-harmonized crop monitoring systems are in place (table 1), and the production of services to farmers is duplicated (table 2). Duplication strains government systems, leading to inefficiencies, increased costs, and conflicting information. Coordination and resource allocation suffer, hindering agricultural productivity and informed decision-making for climate-resilient farming.

In addition, regardless of the enormous effort made in the production of climate information bulletins, the present climate services provided by Uzhydromet are not readily usable to farmers due to multiple issues: i) Uzhydromet does not actively engage with farmers and considers their perspectives to address the issues and enhance the usefulness of their climate services; ii) The bulletins are retrospective; they do not include any weather forecast-related

[13] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016

[14] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013

[15] Чуб В. Е. Изменение климата и его влияние на гидрометеорологические процессы, агроклиматические и водные ресурсы Республики Узбекистан. НИГМИ: Ташкент, 2007

information; iii) Climate services are not provided in a user-friendly actionable format that is easily understandable by farmers. There are no crop recommendations.

Entity	Type of reporting	Collection method	Spatial resolution	Time
Uzhydromet	Crop phases and soil moisture	Manual/paper/Telegram	By station	Decadal retrospective reporting
	Weather data	Mostly automatic transmission	By station	Multiple times per day
	Hydrological data – natural streams	Manual/paper/Telegram	By station	Multiple times per day
MoA Department of Chemicalization, Plant Protection and Quarantine	Crop phases and pest and diseases	Advanced real-time IT system	By field	Fields visited on demand (tbc during project preparation phase)
MoA Land Planning Department	Analysis of planting and growing season of 6 types of main crops	Satellite data	Raster	Once a year
	Planned under PQ[16]-273 online real-time collection of field data and productivity mobile monitoring	-	-	-
MoA	Crop productivity statistics	Tablet	By administrative level	Every three months
MWR	Hydrological data – artificial and irrigation streams, irrigation accounting	Advanced real time IT system	By station	Multiple times per day

Table 1 Entities involved in data collection related to real time use of the agricultural land

Entity	Type of service	Distribution method	Spatial resolution	Time of service	Usability for farmers
Uzhydromet	Agrometeorological bulletin compilating phenological forecasts of development rates for crops; forecast of the average yield and gross harvest for cotton and cereal crops; recommendations on the optimal timing of field	Distributed to regions and farmers' organizations	National with subdivision of the country into three areas	10 days	Scarcely actionable by farmers, scale scarcely relates to ground conditions
MoA Department of Chemicalization, Plant Protection and Quarantine	Field-by-field information on crop phases, pests and diseases, and written pest management recommendations prepared by the MoA officer that visited the farmer's field. Available at https://efito.uz	Not accessible. Paper document	Field	On-demand	Not agro-meteorological, pest and disease only
MoA Land Planning Department	A system that helps farmers face many daily questions (marketing, produce storage, land rights, water supply, irrigation water quality, water conservation, soil fertility, equipment, credit, seed selection, erosion control, and plant protection. Available at https://akis-agro-uz.	Public	National	Static with regular updates	The advisory is not agro-meteorological
	PQ-273 online real-time collection of field data and productivity mobile monitoring	-	-	-	Planned
MWR	Water inflow, outflow, and water distribution within the irrigation system.	Password	Field	Near-real-time	Not agro-meteorological

Table 2 Entities providing services to farmers

[16] PQ stands for Prezidentining Qarori which can be translated to Presidential Decree

General assessment of data management for the agricultural sector

Uzbekistan has been making significant strides in digitalising its environmental and agricultural sectors. The Government has recognized the importance of technology in improving agricultural productivity and efficiency. Initiatives such as AgTech startups, e-agriculture platforms, mobile applications, and the digitalization of land and agricultural data demonstrate Uzbekistan's commitment to leveraging digital solutions in agriculture. These efforts aim to provide policymakers and farmers with advisory services and digital tools for better decision-making. However, there is still an uncoordinated approach to climate services for agriculture production and distribution; it can pose challenges for effective climate change adaptation, which requires a near-real-time advisory system based on the weather and seasonal forecast. Issues that may arise from such an uncoordinated approach to climate services production and distribution include:

1. *Data Inconsistency and duplication*: As the table above shows, data collection is duplicated. Lack of coordination results in inconsistencies in collecting, analysing, and interpreting climate data. Repetition can lead to discrepancies in the information provided by different climate service providers, making it difficult for users to rely on accurate and consistent data for decision-making.
2. *Limited Accessibility*: Climate services are produced for the Government to plan agricultural activities and are not widely accessible to all relevant stakeholders, including key users such as farmers, water resource managers, urban planners, and policymakers who require up-to-date and localized data to develop effective climate adaptation strategies. When strictly necessary (i.e. in case of a request for index based insurance payment), farmers can purchase observation data from the weather stations)
3. *Fragmented Efforts*: Duplication of efforts and inefficient use of resources among different organizations involved in climate services production, lack of collaboration and communication can lead to redundant activities, wasted time, and overlapping responsibilities, undermining the overall effectiveness of climate services for agriculture.
4. *Weak User Engagement*: A lack of coordination results in limited engagement and involvement of end-users in utilising, developing and improving climate services. It also reduces the relevance of the information provided, as users' specific needs and priorities may not be adequately addressed.
5. *Insufficient Capacity Building*: Although agricultural authorities report the existence of numerous present and past projects on climate resilient and climate services, capacity-building initiatives, training programs, workshops, and knowledge sharing among stakeholders are uncoordinated, scattered, and limited, hindering the development of expertise and skills needed for utilizing climate services effectively.

In the face of such complexity, the Government's ability to deal with food security issues linked to climate change is inadequate. Intending to reduce vulnerability and increase adaptive capacity, the Government requested IFAD support to prepare the proposal to strengthen i) the system of data collection and analysis at the national and regional levels on all food-security-related issues ii) to improve agrometeorological monitoring, analysis and long term decision making based on climate change to better inform the policy at the national level and climate risk reduction at the local level, iii) knowledge management and dissemination and application of information at the local level.

B. Project Objectives

The **project goal** is to contribute to rural poverty alleviation in the country through increased climate services for agriculture, improving resilience, incomes and enhanced economic growth in rural farming communities and at the sector level. The AF funding will be used to achieve this goal through the following objectives:

- **Objective 1:** Develop an agro-climatic monitoring, analysis, communication and information system for local level decision making in agriculture and food security (**Component 1)**
- **Objective 2**: Develop institutional and technical capacity for long term climate scenario analysis, adaptation framework planning and policy making for the agriculture production systems (**Component 2**)
- **Objective 3**: Develop and validate local application of agro-meteorology aimed at testing the climate change resilience through the climate services developed in Component 1, namely 1) agro-meteorological bulletins for 10 days recommendations, and 2) seasonal forecast (hydrological drought forecasting and its impact). (**Component 3**)
- **Objective 4**: Develop and disseminate knowledge on the project's approach to promoting climate-resilient livelihoods (**Component 4**)

Implementation of the AF funding will be complemented by the larger IFAD-supported projects Agriculture Diversification and Modernization Project (ADMP), and Dairy Value Chains Development Project II (DVCDP II) to test and validate the agro-meteorology component. The duration of the proposed AF-funded project is five years. The results are indicated in table 2 regarding project outreach to direct and indirect beneficiaries.

The project demonstrates innovation by integrating advanced technologies, such as data analytics and modelling, to generate climate scenarios. It also utilizes participatory approaches, engaging stakeholders and policy makers to ensure evidence-based policy formulation and adopting climate-smart agricultural practices.

The project will incorporate a strategy to ensure women's inclusion in agrometeorological data use and equitable access to opportunities. Such gender strategy will include the identification of crops that are regularly managed by women, which will primarily benefit female producers, and active communication campaigns on potential new roles of women in the agricultural value chains.

Indicator	Expected results
Component 1 Development of near real time farm advisory informational system	
Automatic weather stations installed	40 automatic weather agrometeorological stations with the capacity to produce a forecast on pest and disease outbreak risk in different fruit trees installed in the regions of Andijan, Jizzakh, Namangan, Sirdarya, Surkhandarya, Tashkent, Fergana, and Khorezm
Information system developed covering the entire national area	A network of inter-ministerial entities learn how to share data and interconnects activities
Climate service available in near-real time	One national level system for the agriculture sector produces two regular climate services: 1) agro-meteorological bulletins for 10 days , and 2) seasonal 10-days and seasonal forecast (hydrological drought forecasting and its impact).
Strengthening of interinstitutional data sharing	A network of inter-ministerial entities learn how to share data and interconnect activities.
Regulation to manage the climate services in place	An interministerial SOP system designed and approved

People trained	200 government experts in the UzHydromet, MoA, and MWR, including central-level and decentralized office staff
Component 2 Improvement of the decision making and planning system for agricultural sector through climate change modelling	
Downscaled crop adaptation projections based on IPCC standard scenarios developed	At least 6 most applicable and realistic IPPC scenarios for Uzbekistan used for at least 60 years in the future
Climate change sectoral vulnerability assessment developed	Regional vulnerability assessments for water and agricultural sectors (method and details tbc at the project preparation)
Application for hosting long term scenario data and policies is in place	One application, integrated withing the application produced in Output 1.1.2 of the project, is in place
People trained in climate and crop modelling	60 government experts in the UzHydromet, MoA, and MWR, including central-level modelling experts
People trained in climate change vulnerability and risk assessment	100 government experts in the UzHydromet, MoA, and MWR, including central-level and decentralized office staff
People trained in climate change adaptation framework, policy and planning development and implementation	100 government trained
Component 3 Reaching the last mile and getting climate services to farmers	
Adaptation packages or policy proposals developed based on future scenarios	At least two sectoral horticultural value chains
Climate services (10 days bulletin and seasonal drought forecast bulletin) farmer testing through the project budget (data from component 1)	1.000 farmers trained in at least three agro-ecosystem through farmer groups
Farmer testing the climate services (10 days bulletin and seasonal drought forecast bulletin) system through targeted radio and mobile phone campaigns	50.000 households for a total of 250.0000 rural beneficiaries
Outreach of the climate services (10 days bulletin and seasonal drought forecast bulletin) for farmers covered through mass and social media campaigns (indirect target)	30% of the rural population
People trained in news developed for agrometeorology and climate services (10 days bulletin and seasonal drought forecast bulletin)	At least 50 journalists or news experts trained
News outlets and social media that have covered the topic	At least five media and one social media covering the agrometeorology information produced in component 1
Component 4 Learning and knowledge management	
Awareness is raised on policies or plans related to climate and crop future scenarios	At least 5 evidence-based policy briefs or future-tested plans (based on data from component 2) are made public through national media, TV, and government web pages
Outreach materials prepared	15 technical leaflets and 3 manuals on the project experiences and lessons
Project is monitored	The M&E plan is approved and applied.

Table 3 Project beneficiaries and targeting

C. Project Components and Financing

Project/Programme Components	Expected Outcomes	Expected Concrete Outputs	Amount (US$)
Component 1: Development of near real time farm advisory informational system	Outcome 1.1 Agro-meteorological monitoring, communication and analysis facilities established at national and regional level	Output 1.1.1 Agro-meteorological station networks improved/re-habilitated with automatic weather stations covering the major agricultural production areas	2,500,000
		Output 1.1.2 Establishment and functioning of a new laboratory for climatology and agrometeorology modelling and geospatial unit to receive, process and analyse near real-time information in collaboration and communication with other existing government systems,	225,000
		Output 1.1.3: Detailed design and pilot establishment of one Climate Database Management System for archiving, storing, processing and analyzing agro-climatic information, including hydrological drought forecasting and its impact on agricultural sector assessment based on hydrometeorological observation and long-terms climate scenarios (in collaboration with C2).	350,000
	Outcome 1.2 Institutional and technical capacity	Output 1.2.1: Inter-ministerial Standard Operating Procedures	100,000

	strengthened to facilitate data sharing, archiving, analysis and interpretation of agro-meteorological information products to users at all levels	(SOPs) for climatology and agro-meteorology in place	
		Output 1.2.2: Development and delivery of training packages for agro-meteorology data sharing, archiving, analysis and interpretation	310,000
Component 2: Improvement of the decision making and planning system for agricultural sector through climate change modelling	Outcome 2.1: Long term scenario and geospatial data access, monitoring, processing facilities integrated within the present government system	Output 2.1.1: Available data and information collated or improved and agro-climate impact scenarios developed	250,000
		Output 2.1.2: Applications designed, developed, tested and delivered with computing facilities for monitoring and assessment of land-use	350,000
	Outcome 2.2: Institutional and technical capacity strengthened to facilitate data sharing, archiving, analysis and interpretation of agro-climatological information products to policy and decision-makers at multiple scales	Output 2.2.1: Modelling and scenario development training programme conducted	240,000
		Output 2.2.2: Impact scenarios and adaptation strategies and policy training conducted	75,000
Component 3: Reaching the last mile and getting climate services to farmers	Outcome 3.1: Knowledge and information sharing for mass application and testing of agrometeorology in the agriculture sector	Output 3.1.1: : National ToT programme for application of agrometerology advisories to farmer groups, extension services, and external projects	190,000
		Output 3.1.2: Development of a dedicated section of extension services in support of the information system	730,000

		developed in connection with AKIS/Extension Service national network	
		Output 3.1.3 Local application of climate information facilitated to test the functionality of the agro-meteorological system	1,765,000
	Outcome 3.2: Participatory stakeholders assessment support refining and scaling up the agro-meteorological system	Output 3.2.1. Agrometeorology's impact, app usability, and impact on crop decision and productivity assessed	1,075,000
Component 4: Learning and knowledge management	Outcome 4.1: Knowledge on promoting climate-resilient livelihoods disseminated and promoted	Output 4.1.1: High-level dialogues conducted, information material disseminated	200,000
6. Project/Programme Execution cost (9.5 percent)			870,000
7. Total Project/Programme Cost			9,230,000
8. Project Cycle Management Fee charged by the Implementing Entity (8.5 percent)			770,000
Amount of Financing Requested			**10,000,000**

D. Projected Calendar

Milestones	Expected Dates
Start of Project/Programme Implementation	June 2024
Mid-term Review (if planned)	December 2026
Project/Programme Closing	June 2029
Terminal Evaluation	September 2029

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Project Components

The project activities will be designed based on the structure of the climate services to be developed by the project. The climate services will be embedded in a single information system that will serve two main types of users. Last-mile users, particularly smallholder farmers and other value chain actors, will benefit from short term and annual information. Long-term projection and production forecasts will help decision-makers at the national and district levels. A list of potential benefits by potential stakeholders is presented in the figure below.

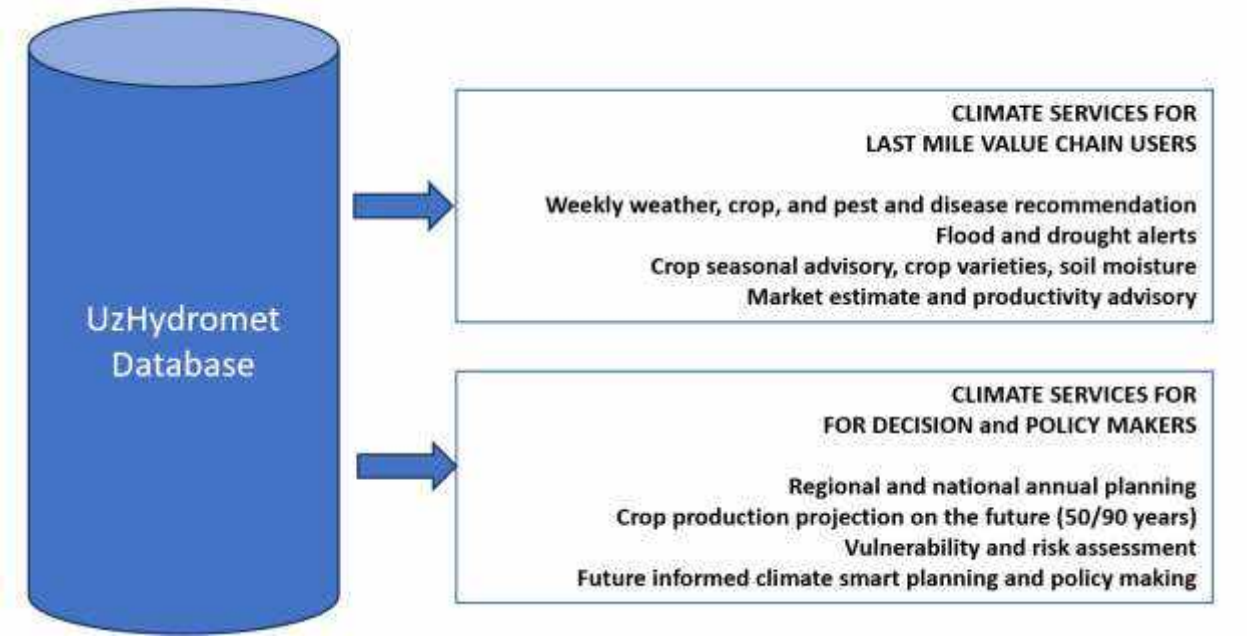

Figure 1 Users and beneficiaries of the various climate services provided by the project

The project activities will be designed based on geographical distribution of the main climate services to be developed by the project.

Based on the Decree № 3893 of 1 August 2018 by the President of the Republic of Uzbekistan, "On supplementary measures to optimise the structure of cultivated land, increase the production of fruit, vegetables and other agricultural crops and their export in 2018", the installation of weather stations will be specifically located in horticultural in the eastern and southern areas of the country, including the Regions of Andijan, Jizzakh, Namangan, Sirdarya, Surkhandarya, Tashkent, Fergana, and Khorezm. However, as presented in the figure below, the climate services will be development on the entire country, as presented in the image below, making use of the existing climatological and agrometeorological near-real-time information network.

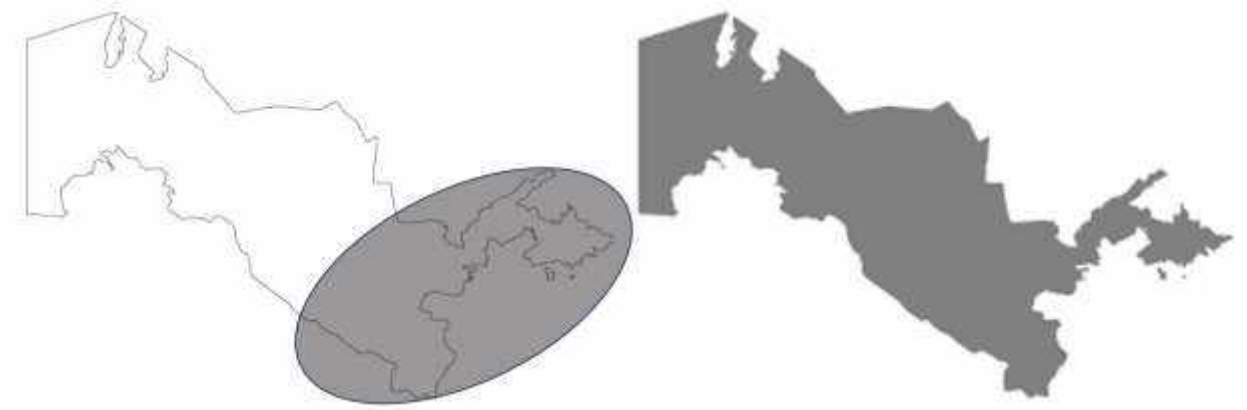

Figure 2 (left) Horticultural areas, covering nine regions, where additional automatic weather station will be installed (right) national coverage of the climate service system development and testing

The scheme of the near-real-time information system is provided in the figure below. The climate services will be housed at UzHydromet, which will utilize status and real-time data from various government ministries, including the Ministry of Ecology, Environmental Protection, and Climate Change (MEEPCC), the Ministry of Agriculture (MoA), and the Ministry of Water Resources (MWR). This collaborative approach ensures that climate services have access to a wide range of relevant data, encompassing meteorological information, environmental data, agricultural resources data, and water-related data. By integrating data from these ministries, UzHydromet can provide comprehensive climate services that support informed decision-making, policy formulation, and planning processes across multiple sectors impacted by climate change. Different government entities will have access to different database sections to manage quality control and modelling relevant to their capacities.

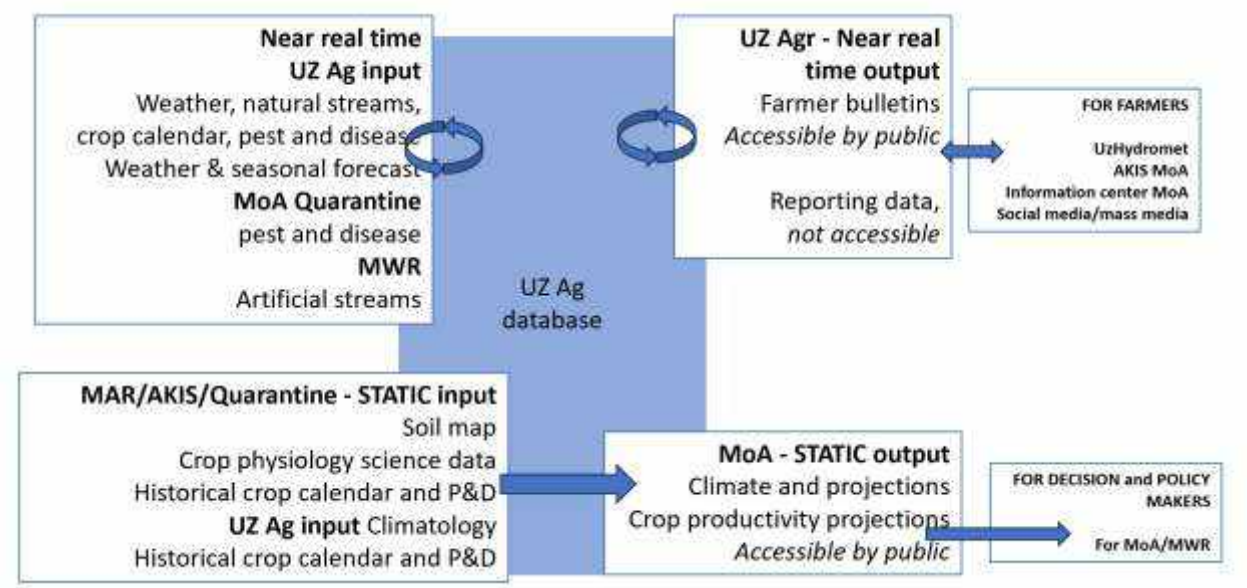

Figure 3 Proposed scheme of the information system database.

Component 1: Development of near real time farm advisory informational system

Outcome 1.1 Agro-meteorological monitoring, communication and analysis facilities integrated at the national and regional level

The outcome aims to strengthen institutional and technical capacity to facilitate data sharing, archiving, and analysis to provide improved agro-meteorological information products. The process will also involve designing the technical collaboration between Uzhydromet, MWR, and MoA.

Output 1.1.1 Agro-meteorological station networks improved with automatic weather stations covering the major horticultural production areas

The project will support investment in new stations in 40 agro-meteorological locations covering nine regions in horticulture production areas. In addition, cheap mobile stations will be installed to strengthen irrigation planning. The number of mobile stations will be defined during the project document preparation. In particular, the project will install stations with predeveloped algorithms for pest invasion and plant disease based on identified triggering meteorological parameters. This approach was adopted by the local manufacturer (local Ltd company), so such automated stations with risk assessment/forecasting capacity are locally available. The project will also ensure that all the stations will be connected to a server, either an existing one at Uzhydromet or a new one to be purchased by the project.

Output 1.1.2 Establishment, connectivity and functioning of a new laboratory for climatology and agrometeorology modelling and geospatial unit to receive, process and analyse near real-time information in collaboration and communication with other existing government systems

The climate and agrometeorology laboratory will collect, digitise, archive, and provide climatic data and information for multiple users at national and international levels. The unit will be refurbished with information systems for quality assessment, agro-meteorological analysis, geospatial monitoring, and data processing. Enhancement of this IT and communications network is needed to support data analysis, communication and dissemination of information with ownership and responsibility for federated data sharing. Specific improvements to the communication network will be identified during project preparation. In particular, the design of a common communication method between entities envisages Uzhydromet as an agrometeorology leader and data repository, MWR as a provider of water resources information, and MoA and MWE as data users and agricultural data production validators. The Uzhydromet climatological database is at present being digitised by Koika. Activities will involve digitalising existing pest and disease (P&D) infestation. However, historical agronomical data will be digitised during the project implementation. In addition, the process will use an algorithm to timely predict crop pests and diseases based on identified triggering meteorological parameters that an automated agrometeorological station measures. This approach was adopted by the local manufacturer (local company) and has already been adopted in pilot areas.

This output will also include establishing a seamless transition from manual to automated data acquisition and homogenization. Existing hydrometeorological networks consist of both manual and automated measuring facilities. Manual data has been accumulating for a few decades (30-100 years), and as such, it is an invaluable informational resource for modelling exercises. However, the transition from manual data acquisition to automated one will be ensured so that no manual data is lost. Homogenization of the manual and automated data is an integral part of the development of the agrometeorological informational system that would provide trustworthy services based on reliable data. As per recommendations made by WMO, the transition period, depending on different measuring parameters, shall be at least

12-60 months long[17]. The process will ensure that there will not be significant distortion through relevant statistical technologies).

Output 1.1.3: Detailed design and pilot establishment of a near real time agro-climate database management system for archiving, storing, processing and analysing agro-climatic information, including hydrological drought forecast

Uzhydromet comprises a vast establishment of advanced in-house servers managed by a state company. The best methodology to host and manage the climatological database will be defined during the project preparation. The database, whose scheme is available in Figure 7, will both collect and share information. Three entities will provide data: Uzhydromet, MWR, and MoA. The system will feed two user platforms, one for farmers and one for decision-makers (see Component 2 for details), as depicted in Figure 6.

The lessons learned from the UNDP project "Developing climate resilience of farming communities in the drought prone parts of Uzbekistan" will be applied. The project will adapt, replicate and automatise the DEWS method in the near-real-time information system. The Drought Early Warning System (DEWS) was designed to assess water availability downstream of the Amudarya River. The system allows for producing reliable water availability assessment with a lead time 6-12 months by statistical and non-parametric modelling (Singular Spectrum Analysis, Regression Tree). These lessons learned, and achievements will be extended to wider geographical coverage. The system implies a number of sub-activities aimed at :

- Improving the existing Drought Early Warning System (DEWS) though extending its capacity in terms of wider geographical coverage (additional watersheds are to be included in DEWS) and ability to produce long-term water availability assessment for the problem river basins based on climate scenarios.
- Assessing the risks related to hydrological drought associated with the agricultural sector.
- Developing the short and long term recommendations on hydrological drought risk mitigation via adaptation measure implementation (water and agro conservation measures).

The visualisation system will ensure easy accessibility for farmers through its user-friendly app and web interface. Farmers will access the system's climate services and information using smartphones or computers. The app will provide recommendations bulletins and a simple and intuitive interface, allowing farmers to receive weather updates, crop-specific information, pest and disease alerts, and recommended farming practices. The system will be in English, Russian, and Uzbek. Similarly, the web interface offers a user-friendly platform accessible through browsers, enabling farmers to navigate and interact with the system's features effortlessly. These accessible and user-friendly tools empower farmers to make informed decisions based on real-time climate information and enhance their agricultural practices. During the project discussion, it was depicted that it is necessary to continue delivering SMS alerts due to the lack of internet connection in some countries' remote areas. This requirement will be re-assessed at the time of project preparation, and a discussion with a telephone company will be undertaken.

The main results of the present output will include the regular production of regional bulletins. The main bulletin that will strategically guide farmers over the season will include a comprehensive seasonal forecast bulletin, risk assessment, drought and flood forecast, and crop, pest, and disease recommendations for all the main crops. Given the drought risk in Uzbekistan, the drought forecast will also be given prominence in the seasonal forecast. A

[17] Guide to Instruments and Methods of Observation (WMO-No. 8), Volume III, 2021

second tool, mostly targeted at tactical day-by-day farmer guidance, will be developed weekly and will contain general weather and crop forecast and heath, frost, and flood alerts.

In total, the following regional climate services will be developed:

- Seasonal forecast bulletin, with strategical cropping phases recommendations such as crop calendar, tillage recommendations, pruning, and risk assessment. In addition, the system will provide forecast pest and disease recommendations. Furthermore, the system will state the risk of drought and floods. All these indicators will be calculated for all the main crops, with a particular focus on fruit trees and vegetables.
- Ten days forecast will include tactical recommendations that will such as weather forecast, flood and drought risk, and simple crop recommendations.

Outcome 1.2 Institutional and technical capacity strengthened to facilitate data sharing, archiving, analysis and interpretation of agro-meteorological information products to users at all levels

This outcome will also involve outlining institutional coordination mechanisms between the technical entities, will undertake capacity development, and will develop guidelines for the installation of instruments and data coding of field observations. The project will facilitate gender equality during the life of the project by ensuring high participation of women in the technical training and the activities of the component.

Output 1.2.1: Inter-ministerial Standard Operating Procedures (SOPs) for climatology and agro-meteorology in place

The activities include preparing and operationalising the Standard Operating Procedures (SOPs) for the climatology and agro-meteorology division of DMH. The SOP, which is to all effect an inter-ministerial regulation, requires multiple steps to be setup, including: 1) Production of a draft with tentative role and responsibility for harmonized data collection and manipulation, distribution, 2) Initial inter-ministerial consultations for revision of the proposed implementation, and initial local level consultation in at least one horticulture and one pastoral production area to explore both the capacities of the AKIS and other local offices, and the needs of farmers, 3) at project mid term, a revision and approval of the revised SOP based on lessons learnt with approval of the new version by the project partner 4) at least two validation of the same version at local level, including the private sector and civil society 5) approval of the regulation. This outcome will also involve outlining institutional coordination mechanisms between the technical divisions within Uzhydromet and with the different Departments of the MoA. In addition, irrigation information will also be gathered from the MWR to facilitate sharing and communication of agro-meteorological data and information. This activity will also consider other sensitive sectors to enhance the synergies with ongoing programmes and projects.

Output 1.2.2: Development and delivery of training packages for agro-meteorology data sharing, archiving, analysis and interpretation

The consultations during the IFAD mission have provided partial details of technical capacity development requirements and proposed activities to outline the component 1 technical assistance, but the training program will need to be developed based on a training need assessment at the beginning of the project. The areas that need capacity development efforts will include (i) introduction to climatology and seasonal climate forecasting, (ii) introduction to agro-meteorology and practical guidance, (iii) remote sensing, GIS, and related information technology and processing, (iv) crop yield forecasting, crop modelling, and crop bulletins, and (v) database management. The modalities for the delivery of training and capacity development will include training-of-trainers and evaluation facilitating partnerships with regional centres and academic centres of excellence (in the region and internationally) to

support training to enhance sustainability. Contrary to the usual developmental approach of most agriculture projects, the proposed project will need to emphasise the development of capacities within the government, particularly within the Ministry of Ecology, Environmental Protection and Climate Change (MEEPCC), the Ministry of Agriculture (MoA) and Ministry of Water Resources (MWR), in order to ensure sustainability and continued operation of the information systems. At the central level, the project will provide the government official with technical assistance, training, and knowledge-sharing activities to enhance skills and knowledge related to climatology, near-real-time modelling, use of statistical packages for data elaboration. Selected technical officials will be trained abroad on enhanced agrometeorology expertise, ability to cope with weather vagaries, seasonal forecasts, and sustainably govern agricultural management. The detailed list of training will be in the prodoc.

Component 2: Improvement of the decision making and planning system for the agricultural sector through climate change modelling

Outcome 2.1: Long term scenario and geospatial data access, monitoring, and processing facilities integrated within the present government system

Output 2.1.1: Available data and information collated or improved and agro-climate impact scenarios developed

The outputs and deliverables of this component are anchored to an integrated workflow to integrate a range of information tools, including climate resources (downscaled historical data and climate projections), agricultural resources (climate, land, soil, water, and crops), and socio-economical data con climate resilience (vulnerability of populations to food insecurity) to run scenarios for agricultural options appraisal. The project will assess climate change impacts on water availability, crop yields, economic sustainability and current and future potential food insecurity risk. Assessments will also focus on impact scenarios of water availability for all major agro-ecological zones, analysis of vulnerabilities, impacts and responses. The main outputs will include land suitability, risk zoning and hotspot identification crop potential, and potential present and future yields for multiple crops under different input levels and climate scenarios. The produced data will be openly available for consultation and download and linked with the AKIS system. For MoA officials to repeat similar modelling in the future, the proposed project will develop capacities within the GIS units of the three project partners. At the central level, the project will provide the government official with technical assistance, training, and knowledge-sharing activities to enhance skills and knowledge related to climate change projections, GIS GRID format modelling including the use of python, satellite analysis including Google Earth Engine and machine learning for crop cover mapping. Selected technical officials will be trained abroad to expose them to GIS-enhanced expertise. By building extensive capacities of these key ministries, the project aims to enhance their ability to copy with climate change effectively and sustainably govern agricultural and natural resources. The detailed list of training will be in the prodoc.

Output 2.1.2: Applications designed, developed, tested and delivered with computing facilities for monitoring and assessment of land-use

Based on the existing GIS system available at the MRS, the project will establish a GIS portal-i.e. a map-centric content management system (related to output 2.1.1). The GIS portal provides access to GIS data from the Uzhydromet database. It organises the flow of information (standardised data formats with adequate metadata) on land resources and agricultural information amongst stakeholders in a user-friendly format. It is easily searchable and accessible through a user-friendly website. Outputs can then be delivered as web-based services to unlimited users, provided they can access information under set conditions and various authorisations. This central website will provide an accessible, up-to-date way to widely share data for multiple uses. Part of the GIS dataset will be freely downloadable upon registration.

Outcome 2.2: Institutional and technical capacity strengthened for agro-climatological information products development and policy and decision-makers at multiple scales

Output 2.2.1: Modelling and scenario development training programme conducted

The consultations during the IFAD mission have provided partial details of technical capacity development requirements and proposed activities to outline the component 2 technical assistance. Still, the training program will need to be developed based on a training need assessment at the beginning of the project. The areas that need capacity development efforts include: (i) advanced GIS and IT capacities; (ii) downscaling of high resolution climate change scenarios, (iii) impact assessment, (iv) participatory and expert based vulnerability mapping, (v) agro-environmental zoning (AEZ) and use of the pyAEZ software.

Output 2.2.2: Impact scenarios and adaptation strategies and policy training conducted

This output provides high-level training on adaptation strategies at national and regional levels for different production systems, particularly for horticulture. It supports the application of the tools and information for running scenarios to inform agricultural options appraisals and decision-making. The training will cover the national scale targeting policy production. The output will assist in integrating the data and information on the impacts of climate change into national agriculture policies, plans and programmes. In addition, it will also support the more localised application in pilot areas.

The adaptation strategies will focus primarily on the agriculture production system. At least 100 government staff will be trained to integrate new information into agriculture development policies and plans.

Component 3: Reaching the last mile and getting climate services to farmers

Outcome 3.1: Knowledge and information sharing for mass application and testing of agrometeorology in the agriculture sector

This outcome focuses on the communication of information generated from Component 1 for agro-meteorology use by farmers' groups and external projects. The outcome will also include improving the capacity and structure of the national extension system to include adapting recommendations based on agrometeorology information.

Output 3.1.1: National ToT programme for application of agrometerology advisories to farmer groups, extension services, and external projects established

The establishment of a National Training of Trainers (ToT) program for agrometeorology advisories involves collaborative efforts. Initial needs assessment identifies gaps and training needs and the development of an initial draft manual based on existing experience in other countries[18],[19],[20]. Stakeholders like meteorological agencies, experts, and project partners collaborate to design a comprehensive curriculum. Skilled trainers will be selected and equipped with tailored materials. Interactive workshops cover weather principles, advisory interpretation, and communication skills. Trainers gain expertise through mentorship and practical experience. Agrometeorological advisories integrate into extension services, projects, and farmer groups. The continuous monitoring and evaluation established output 3.2.1 measure trainers' effectiveness and advisory impact. Scaling to different regions is pursued, with regional centers and with collaborating projects as needed. Sustainability planning includes funding mechanisms through state budgets and partnerships. Certified

[18] Training manual agrometeorology for agriculture extension officers in the Lao People's Democratic Republic available at https://www.fao.org/3/cb7108en/cb7108en.pdf

[19] Farmer's training manual on agricultural climate services https://www.bamis.gov.bd/res/attachment/2020/07/30/19505.pdf

[20] Manuel technique à l'usage des agents publics et privés du développement rural https://blumont.org/wp-content/uploads/2018/02/Climate-Change-Manual_French.pdf

trainers disseminate advisories through events and digital platforms, fostering collaborative networks. Case studies showcase successful applications. This program empowers trainers to bridge agrometeorological insights and actionable practices, benefiting farmers and fostering agricultural resilience. During the last year of the project, feedback loops ensure the refinement and preparation of a final training document that can be used after the end of the project.

Output 3.1.2. Development of a dedicated section of extension services in support to the information system developed in connection with AKIS/Extension Service national network.

The establishment of a dedicated section of extension services within the MoA to support the information system for agrometeorology has been requested during the preparation of this CN. Such a process involves a multi-phased approach. Initially, a meticulous planning phase assesses the need for enhanced agrometeorological information dissemination and evaluates existing extension services' capacity. In the second phase, a specialized team in each region is formed, comprising individuals skilled in agrometeorology, communication, and extension. While the comprehensive curriculum is developed in output 3.1.1, the necessary team and infrastructure is set up, including workspace and technological tools. Capacity-building workshops empower extension workers to utilize the integrated information system and convey advice adeptly to farmers. The dedicated section will be trained in tailored agrometeorological advisories, guidelines, and recommendations for diverse crops, regions, and farming practices. A pilot testing phase in selected project regions ensures the user-friendliness of the recommendations, with refinements based on feedback. Finally, the extension system, which will be embedded in the existing AKIS and extension service, will be scaled up at the national level. The exact activities will be defined during the project preparation, including public launching of the system and awareness raising campaign and monitoring system. The dedicated section of extension services shall become a cornerstone of the project, bridging agrometeorological insights and practical farming applications, bolstering agricultural resilience and productivity.

Output 3.1.3. Local application of climate information facilitated to test the functionality of the agro-meteorological system (component 1).

The output will be constituted by three interlinked sub-outputs, including farmers groups established by the project, farmers groups established by other collaborating projects, and the national scaling up phase through mass and social media campaigns.

At the local level, climate change impact information and adaptation practices will be first disseminated to the farmer groups established by the project. The dissemination of information will be through a knowledge exchange portal and app. There is great demand for agro-meteorological information by farmers. Several methods of providing this information were tested to the last mile users. In the assessment, farmers will be questioned as to their preferences. While the tests will generate location-specific preferences for different dissemination methods, there shall also be clear differences in the effectiveness of the employed tool. The activities will include (i) selection of framer groups, mobilisation, needs assessment and gender-sensitive participation in close coordination with other IFAD projects; (ii) Development of training resources integrating information products ; (iii) implementation of necessary training; (iv) delivery of information products and agro-advisories, (v) monitoring and receiving feedback from the farmer groups and improvement of advisories to be integrated into the activities of 1.1.3. Within the definition of the farmers' group, the project will ensure addressing gender-specific needs, farming systems, and challenges in agriculture. Women's perspectives help shape the usability and relevance of agrometeorological recommendations. This improves the chances of the information being applied effectively on the ground and increases that customized solutions such as user-

friendly formats, language preferences, and timing of information dissemination are taken into account.

The output will also collaborate with the AKIS (Output 3.1.2) which will establish a national extension service supported through the information system developed in component 1 and will cover the existing Extension Service national network.

After the initial two years of project testing, the agrometeorology information system with be tested with collaborating agricultural projects. First, diverse agricultural projects are selected to represent various crops and livestock systems and regions. ToT training sessions will acquaint project trainers with the system's functions, including data interpretation and advisory integration. By focusing on trainers and their interaction with the agrometeorology information system, this testing approach ensures that the training methodology is effective, information transmission is successful, and trainers are well-equipped to convey accurate and relevant agrometeorological knowledge to farmers, ultimately enhancing agricultural practices and resilience.

Within this output, the local application of climate information is facilitated trough mass and social media campaigns. Incorporating mass and social media into agrometeorology initiatives enhances knowledge diffusion, empowers farmers with vital information, and promotes the integration of climate-smart practices, contributing to improved agricultural productivity and sustainability on a larger scale. The design of a social and mass media campaign about the agrometeorological system for farmers will include various steps such as: (i) developing a visibility campaign plan defining clear objectives, identifying the target audience, and choosing relevant social and mass media platforms for content distribution; (ii) create engaging local language content, including videos, infographics, and success stories; (iii) monitor and engage with the audience, fostering a sense of community. Monitoring and receiving feedback from the wider audience will be key for the improvement of advisories to be integrated into the activities of 1.1.3.

Outcome 3.2: Participatory stakeholders assessment support refining and scaling up the agro-meteorological system

Output 3.2.1: Agrometeorology's impact, app usability, and impact on crop decision and productivity assessed

This outcome focuses on the testing and evaluating information generated from Component 1 based on results generated through direct farmers' use and scientific trials produced by component 3. Undertaking full-scale testing of agrometeorology is vital for enhancing the system's agricultural efficiency, resilience, and sustainability. Farmers tailor these recommendations to their specific contexts through comprehensive testing, increasing yields and minimizing losses. By critically examining these factors through an appropriate consultative process, farmers can determine if agrometeorological recommendations are user-friendly, ensuring they can readily integrate the insights into their farming practices for better outcomes.

Based on activities from output 3.1.4, the testing will initially include participatory stakeholders' assessment of agrometeorology's impact on app usability in farmers' groups established by the project. From year 3, the testing will be conducted in collaboration with other projects. A questionnaire for assessing the quality and usability of agrometeorology information should cover various aspects to ensure a comprehensive evaluation. It will be

based on existing experiences from other countries[21],[22],[23]. It aims to gather insights on the accessibility, relevance, trustworthiness, and practical impact of agrometeorology information, helping assess its effectiveness and user-friendliness for farmers. The questionnaire will be repeated annually and will include advise on how to tailor and refine the information system and how it impacts crop management decisions and productivity. Conducting an annual questionnaire assessment of agrometeorology information across multiple farmers and livestock systems in various regions involves a systematic and comprehensive approach. In addition, the project will ensure that the evaluation will cover agrometeorology's impact on and utilization by women to provide insights into gender-specific challenges, needs, and opportunities within the agricultural sector. Such a gender specific evaluation can contribute to a more inclusive and equitable approach to agrometeorological services and information dissemination. During the project's life, the feedback received will help refine the questionnaire and assessment methodology for subsequent years. An external entity will conduct the evaluation to ensure the credibility, objectivity, and effectiveness of the evaluation process.

Within the project's life, scientific trials on agrometeorology will play a crucial role in establishing increased agricultural productivity by providing evidence-based insights related to the success of recommendations and how to tailor them to specific climatic and environmental conditions. These trials, which the research centers of the MoA will conduct, will involve systematic experimentation and data collection, allowing researchers and farmers to understand how weather and climate factors impact crop growth and yield.

Component 4: Learning and knowledge management

The impact of the investments and technical assistance will be assessed through participatory monitoring and evaluation during project implementation. A detailed monitoring plan based on results-based management through appropriate indicators and methodologies is proposed.

Outcome 4.1: Knowledge on promoting climate-resilient livelihoods disseminated and promoted

Output 4.1.1: High-level dialogues conducted, information material disseminated

Supported by the AF funds, the proposed project will document and share the innovative investment/incentives for the climate resilience aspects of the project. It will be pursued through high-level dialogues, in conjunction with universities/research institutions, multilateral agencies, NGOs and technical networks, to ensure broad outreach, as well as through targeted action (derived from bulletins developed in Component 1) and policy briefs (mostly derived from component 2) on the project experiences and lessons regarding e.g. developing climate-resilient value chains. Experiences of integration of gender and local and indigenous knowledge will be included in the knowledge products and dialogues that will be conducted with stakeholders, including policy makers.

Further information is provided in Section G below.

[21] Delivery of climate services to last mile users: challenges and opportunities for scaling https://www.fao.org/3/cc1929en/cc1929en.pdf
[22] Field survey data on the effectiveness of agrometeorological services for smallholder farmers in Niger https://pubmed.ncbi.nlm.nih.gov/37213561/
[23] Really effective (for 15% of the men): Lessons in understanding and addressing user needs in climate services from Mali https://commons.clarku.edu/cgi/viewcontent.cgi?article=1074&context=faculty_idce

B. Economic, social and environmental benefits

Economic benefits

The economic benefits of a near real-time system for agrometeorology for farmers include **improved decision-making and risk management**. A near real-time system provides farmers with up-to-date and accurate weather and climate information, enabling them to make timely decisions regarding crop diversification, planting time, irrigation, fertilization, and pest management. This leads to optimized resource allocation and improved agricultural practices, ultimately enhancing productivity and profitability. They can also make informed decisions regarding insurance coverage or other adaptation strategies, reducing the economic impact of extreme weather events and crop failures.

In addition, a more **efficient resource utilization** is also possible**.** A near real-time system allows farmers to utilize resources more efficiently. By aligning their farming activities with weather patterns and forecasts, they can optimize water usage, reduce energy consumption, and minimize input costs. This improves cost-effectiveness and reduces waste, resulting in economic benefits.

Agrometeorology also increases **productivity and economic profitability**. Numerous studies have demonstrated that access to accurate weather and climate data enables farmers to make informed decisions, leading to improved crop management. For instance, a study by Mendes et al.[24] showed that aligning irrigation schedules with weather forecasts increased water use efficiency by 20% and boosted crop yields by 15% in a semi-arid region. Similarly, research conducted by Smith et al.[25] highlighted that pest and disease forecasting based on agrometeorological models reduced pesticide use by up to 30%, while crop losses due to pests decreased by 25%. Moreover, agrometeorology facilitates precision agriculture, as indicated by a study conducted by Li et al.[26], which reported a 25% reduction in fertilizer application and a 10% increase in grain yields through targeted nutrient management based on weather-informed soil data. Furthermore, the implementation of agrometeorological strategies has been associated by Wang et al.[27] with enhanced climate risk management and improved market timing, resulting in reduced financial losses and higher profits.

Increased resilience is also foreseen. Farmers can build resilience to climate variability and change by using a near real-time system. They can adapt their farming practices and make informed decisions based on the latest weather and climate information. This reduces the vulnerability of their agricultural operations and ensures a more sustainable and economically viable farming enterprise.

It is estimated that 30% of rural households located in horticulture and fruit production areas would benefit indirectly from the broad project's interventions. A high proportion of the target population would be reached by improved crop technology and more resilient activities through social media, mass media, training and technical assistance. The benefits accruing to the primary target population will be reflected in productive physical assets and built knowledge capacities.

[24] Mendes, V. R., Silva, M. A., Pereira, J. P., & Vieira, J. L. (2019). Aligning irrigation schedules with weather forecasts increased water use efficiency and crop yields in a semi-arid region. Agricultural Water Management, 215, 105641

[25] Smith, D., Schilling, M., & Vieira, J. L. (2020). Pest and disease forecasting based on agrometeorological models reduced pesticide use by up to 30%, while crop losses due to pests decreased by 25%. Successful Farming, 28330.

[26] Li, J., Zhang, C., Wang, Z., Liu, H., & Wang, Y. (2021). Targeted nutrient management based on weather-informed soil data reduced fertilizer application by 25% and increased grain yields by 10%. Scientific Reports, 11, 18411.

[27] Wang, X., Li, J., Zhang, C., Liu, H., & Wang, Y. (2022). The implementation of agrometeorological strategies has been associated with enhanced climate risk management and improved market timing, resulting in reduced financial losses and higher profits. Agricultural and Forest Meteorology, 304, 108447.

The economic benefits of using climate scenarios for agricultural planning include **climate smart investments and improved resource allocation**. By considering climate scenarios, agricultural planning can optimize the allocation of resources such as land, water, and inputs. This reduces waste, enhances efficiency, and improves cost-effectiveness, leading to economic benefits. Agricultural planning based on climate scenarios allows farmers to align their production with future market trends and demands while using more climate-resilient crops. This enables them to take advantage of emerging market opportunities, negotiate better prices over the long term, and establish stronger market connections, resulting in increased profitability.

Also, the use of climate scenarios allows for **investment long-term sustainability**. By considering climate scenarios, agricultural planning can promote sustainable practices such as conservation agriculture, agroforestry, and water management. These practices enhance soil health, conserve natural resources, and promote long-term economic viability.

Social benefits:

Agro-meteorology is vital in **enhancing food security** by providing farmers with timely and accurate weather and climate information. Access to agro-meteorological information allows communities to manage risks better and adapt to climate variability, ultimately ensuring a more secure food supply for society. Climatological information, sometimes in conjunction with other data, can significantly reduce disease, injury and death and improve health and health care. The relationship between agro-climate and human health is documented in a large volume of literature. The use of agro-meteorology might, in theory, allow for reduced and more targeted use of pesticides, therefore improving population health. WMO has reported that there is scarce data on the value of this type of information even in terms of lives saved, reductions in morbidity or, e.g. numbers of properties built with the improved local environment. Indirectly, the project will contribute to **tackling the underlying causes of malnutrition** by increasing agricultural production, promoting sustainable natural resource management and supporting income-generating opportunities for women and youth.

Agro-meteorological information plays a crucial role in ensuring **community safety and disaster preparedness**. Early warning systems based on agro-meteorology help predict and respond to extreme weather events, such as storms, floods, and droughts. Timely alerts enable communities to take preventive measures, evacuate if necessary, and protect lives, assets, and infrastructure. Agro-meteorology contributes to communities' overall resilience and safety by providing vital information for preparedness and response to weather-related hazards.

With respect to the climate-resilient value chain, the project will specifically target horticulture which is especially important for women, therefore **addressing existing gender inequalities** with respect to access to and benefit from value chains. Particular attention will be given to female youth who face higher unemployment and who are not in employment, education or training. Women and girls with disabilities suffer more from discrimination, violence, extreme poverty and poor health services. Though the project will not explicitly target people with disabilities, it aims to create awareness and encourage the inclusion of people with disabilities through its climate services.

Environmental benefits:

Agrometeorology and climate scenarios enable farmers and decision-makers to optimize **natural resources** such as water, soil, and energy. By providing timely information on weather patterns, precipitation, and evapotranspiration rates, farmers can manage irrigation schedules more efficiently, reducing water waste and promoting sustainable water management practices. Also, agricultural investments might be tailored to specific zones that are more climate resilient. This leads to a more responsible and efficient use of resources, minimizing environmental impact.

Through the preparation of regular bulletins and policy briefs, agrometeorology and climate scenarios promote sustainable agricultural practices. By aligning farming activities with weather conditions, farmers can reduce the use of agrochemicals, optimize planting and harvesting schedules, and adopt conservation practices. This reduces pollution, soil erosion, and ecosystem degradation, contributing to long-term environmental sustainability.

Agrometeorology and the use of agro-climatic scenarios play a vital role in **climate change mitigation and adaptation efforts**. Farmers can adapt their practices to changing conditions by understanding climate patterns and forecasts, such as shifting planting dates or diversifying crops. Additionally, agrometeorology helps identify climate-related risks and vulnerabilities, allowing farmers to implement measures to mitigate these risks, such as agroforestry or soil conservation practices. These actions contribute to reducing greenhouse gas emissions, enhancing carbon sequestration, and building resilience to climate change.

In addition to the above economic, social and environmental benefits, the project is being designed to avoid or mitigate adverse impacts in compliance with the Environmental and Social Policy of the Adaptation Fund, including in relation to aggravating gender inequalities. The Environmental and Social Management Plan (ESMP) that will accompany the full project proposal will spell this out in detail. As a start, the following measures will ensure that project activities are designed and implemented in a way that does not cause negative social or environmental impacts:

- Inclusive and representative community involvement in planning and implementing the project field activities, including monitoring project activities; consultation and engagement with beneficiary communities, including vulnerable groups;
- Strong collaboration between relevant ministries, both in activity design and implementation, including the preparation of a Standard Operating Procedure for multiple ministries;
- Implementation in accordance with national standards and safeguards articulated in various strategies and guidance documents; and
- Complaints and feedback mechanisms were established to get feedback from communities on the project, with established protocols for the resolution of complaints.

C. Cost-effectiveness of the proposed project

The cost-effectiveness of interventions will be ensured by building them upon Uzhydromet's existing infrastructure and capacities, gradually renovating, replacing and expanding them, and relying on sustainable, cost-efficient and, where possible, locally-sourced technological solutions. In addition, the project will reduce existing duplications within the present government structure by developing a reporting system that will benefit the Plant Quarantine system, the MWR, and the entire structure of the MoA. The project will rely on the best available expertise within and outside of the UN system, as well as the world's best practices in the field of agrometeorology through the application of highly competitive procurement procedures and relying on collaboration with partners such as the WMO, which strongly supports the project rationale and is willing to extend technical and operational support to its implementation.

The above-described strong focus on user needs will ensure project effectiveness. In fact, agrometeorological services will be designed and delivered so that users can receive precisely the information they need and use in the formats and through channels they can access and understand. Consequently, project results will be directly linked to the actual production needs and outputs of fruit and vegetable growers and other players up the agricultural value chain. Agrometeorology mitigates economic losses by countering projected seasonal weather vagaries inpacts on productivity through regular bulletins offering weather forecasts, disease

warnings, and optimal planting/harvesting periods. Informed decisions optimize resource use, reduce crop failure risks, and enhance productivity, safeguarding farmers' incomes and agricultural sustainability.

The UNDP project "Developing climate resilience of farming communities in the drought prone parts of Uzbekistan" developed an "Economic Feasibility Evaluation for installation of the automatichydrometeorological equipment for the modernization of the observational network in the Republic of Karakalpakstan". Assessment of the economic effectiveness of improved hydrometeorological services resulted in identifying financial and intangible unquantifiable benefits. Total annual benefits from the modernization of meteorological services and the introduction of early warning systems can range from USD 11.5 - 109.6 million.

The efficiency and effectiveness will be further increased by building on and complementing other existing or starting projects (Table below) or making the most of lessons learned from past completed projects. Most of the organisations listed in the Table will be contacted for cooperation about the distribution of climate services for farmers and pastoralists, the specific modalities of which will be discussed and agreed upon during the development of the full project framework.

Donor	Agency	Implementing entity	Title	Status	Timing
AF	UNDP	UzHydromet	Developing climate resilience of farming communities in the drought prone parts of Uzbekistan	complete	2017-22
GCF	UNDP	UzHydromet	Enhancing Multi-Hazard Early Warning System to increase resilience of Uzbekistan communities to climate change induced hazards	started	2021-28
ADB	ADB	Indorama	Indorama Climate-Resilient Farmer Livelihood and COVID-19 Recovery Project	approved	2022-29
GEF	UNDP	State Committee on Ecology and Environment Protection	Conservation and sustainable management of lakes, wetlands, and riparian corridors as pillars of a resilient and land degradation neutral Aral basin landscape supporting sustainable livelihoods	ongoing	2022-28
GEF	FAO	State Committee on Forestry; State Committee on land resources, geodesy, cartography and state cadaster	Sustainable Forest and Rangelands Management in the Dryland Ecosystems of Uzbekistan	ongoing	2022-27
GEF	FAO	Ministry of Agriculture, State Committee on Ecology and Environmental Protection	Food System, Land Use and Restoration Impact Program in Uzbekistan	ongoing	2020-26
GEF	FAO	UzHydromet	Capacity-building to establish an integrated and enhanced transparency framework in Uzbekistan to track the national climate actions and support measures received	ongoing	2021-25
JICA	FAO	Uzagrokimyohimoya Joint Stock Company	Project for Improvement of Locust Management	ongoing	2020-25
WB	Min Fin	State Committee of Veterinary and Livestock Development	Second Livestock Sector Development Project (P177825)	approved	2023-28
IFAD	IFAD	Rural Restructuring Agency	Agriculture Diversification and Modernization Project	ongoing	2017-25
IFAD	IFAD	MOA	Dairy Value Chains Development Project II (DVCDP II)	planned	tbd

Table 4 List of projects that will be contacted for distribution of climate services

D. Consistency with national / sub-national sustainable development strategies

Uzbekistan ratified the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement in 2018. IT submitted its updated (Intended) Nationally Determined Contribution in 2021. The project is aligned with the (I)NDC focused on Climate adaptation of the social sphere, including:

- raise awareness and improve access to information on climate change for all population groups;
- develop early warning systems for hydrometeorological hazards and manage climate risks;
- increase participation of public, scientific institutions, women and local communities in planning and management, mainstreaming gender approaches and practices

The project aligns with various key policies reported in the table below.

Policy	**Provisions**
New Uzbekistan 2022-2026 Development Strategy	Strategy 3 "to develop a robust national economy that ensures rapid growth", goal "intensive development of agriculture", mainly supporting the following goals: export-oriented products through developing fruits and vegetable production, protect soil fertility, improving the system of agricultural services based on science and innovation, and deepening the integration of science and practice in agriculture. Strategy 1 "to build a people's state by elevating human dignity and the furtherance of a civil society" goal "adapt the institutional framework of local public authorities to modern processes and procedures", which include "Introduction of IT among local governance bodies"
Agriculture Development Strategy of Uzbekistan for 2020-2030[28]	priorities reported on the Strategy information page[29]: priority 5, development of a modern public administration system; priority 6, gradual diversification of public expenditures on network support; priority 7, development of research, education and system of information and advisory services in agriculture, and priority 9, creating transparent network statistics and data collection systems
President of the Republic of Uzbekistan on 03.02.2021 Decree No. PF-6159[30] "on the further development of the knowledge and innovation system and the provision of modern services in agriculture" and Decision No. PQ-4975 of the President of the Republic of Uzbekistan dated 02.03.2021 "On the establishment of the activities of the National Center for Knowledge and Innovation in Agriculture under the	Relevant on the development of agricultural sercives.

[28] Agriculture Development Strategy of Uzbekistan for 2020-2030.
[29] https://2030.serio.uz/en/
[30] President of the Republic of Uzbekistan on 03.02.2021. Decree No. PF-6159 "on the further development of the knowledge and innovation system and the provision of modern services in agriculture"

Ministry of Agriculture of the Republic of Uzbekistan"[31].	
Decree No. 501 of the Cabinet of Ministers validating the Regulation on the provision of specialized services in the field of hydrometeorology and environmental pollution monitoring[32]	(a) the procedure for providing general government operational and forecasting information to governmental agencies and organizations on the basis of joint programs for mutual data exchange, to natural and legal persons through the Open Data Portal of the Republic of Uzbekistan or the official website of Uzhydromet; (b) the procedure for providing specialized hydrometeorological information and services to all consumers using hydrometeorological data; and (c) the procedure for providing emergency hydrometeorological information in the form of information and notifications to the relevant government agencies and organizations through telecommunications, the official website of Uzhydromet and social media pages. The following main concepts are used in this Regulation: (a) general purpose data - the hydrometeorological data intended for general use, provided to state bodies and the organizations, physical persons and legal entities according to these Regulations; (b) specialized data - information on targeted hydrometeorological and environmental pollution, which requires additional work and costs for storage, analysis, processing and presentation at the request of consumers; and (c) emergency (operational) information - information provided immediately on the occurrence of extremely dangerous hydrometeorological events that may endanger life and health of the population and (or) damage the environment and sectors of the economy and economic entities, the causes of their occurrence.
Presidential Decree No. PP-5185 "On the establishment of the Agency for Quarantine and Plant Protection of the Republic of Uzbekistan[33]"	improving state management in the field of reliable plant protection against, pests, diseases, weeds and other harmful organisms, decrees to set up Agency for Plant Quarantine and Protection, entitling it with the following tasks: improving the forecasting system in the field of quarantine and plant protection, defining coordinated effective methods of combating pests, as well as monitoring their implementation, preventing the penetration and spread of pests in the territory of the country and the destruction of pests that can cause economic damage; and development of scientific, methodological and educational potential in ensuring phytosanitary safety, introduction of modern innovative solutions, planning and management methods, expansion of international cooperation in the introduction of advanced technologies and work methods, organization of systematic retraining and advanced training of the field staff.
Decree No. 573 of the Cabinet of Ministers, "On improvement of the operation of the Ministry of Water Management[34]."	Establishment of the main tasks of the Ministry of Water Management, including water resources management, water accounting, reporting and balance, and protection of the population and national economy against flooding
The Land Code (1998)	Establishes basic rules and regulations for all land use types
The law on water and water use (1993).	Legal document for water resource management
Vision of Uzbekistan-2030	Strengthen the adaptive capacity by at least 40% in the most vulnerable areas affected by drought, water scarcity, salinization and degradation; 2) increase the efficiency of water use, the water metering system and save water up to 25%; 3) create early warning and risk management systems at all levels; 4) expand the area of forest restoration and agroforestry of agricultural land by 30% of the total need; 5) ensure further diversification of the agricultural food production.
Law on "Guarantees of Equal Rights and Opportunities for Women and Men" in 2019	which represents a firm stance against gender-based discrimination and ensures equal rights for both sexes. Among other provisions, the law confirms that women and men have equal access to economic resources, including movable and immovable property, land, financial assets, loans, public funds and freely chosen types of business activity.

[31] Decision No. PQ-4975 of the President of the Republic of Uzbekistan dated 02.03.2021 "On the establishment of the activities of the National Center for Knowledge and Innovation in Agriculture under the Ministry of Agriculture of the Republic of Uzbekistan"

[32] Decree No. 501 of the Cabinet of Ministers validating the Regulation on the provision of specialized services in the field of hydrometeorology and environmental pollution monitoring.

[33] Presidential Decree No. PP-5185 "On the establishment of the Agency for Quarantine and Plant Protection of the Republic of Uzbekistan."

[34] Decree No. 573 of the Cabinet of Ministers "On improvement of the operation of the Ministry of Water Management."

Labor Code	guarantees gender equality in employment and ensures adequate working conditions, pay and promotion.

E. Compliance with relevant national technical standards

The project activities will be carried out in full compliance with national regulations and standards on environment, labour and occupational safety and are not expected to have adverse impacts. The relevant national and sub-national technical standards or regulations that this project will need to comply with include regulations, standards and requirements for the installation of meteorological stations and gauges as set by the WMO Guide to meteorological instruments and methods of observations WMO-#825)

In accordance with Uzbekistan's INDC, the decree № 3281 of September 2017 by the President of the Republic of Uzbekistan requests the optimised placement of agricultural crops, in particular, intensive cucurbit plantations, gardens and vineyards, accounting for soil and climate conditions, the availability of water, regional specialisation, yields and other factors; thus confirming the need and demand for systematically integrating climate-change information in long-term agricultural planning.

In developing the near-real time information system and application, the project will comply with the policies instituting the AKIS Agricultural Service Centers (National Center for Knowledge and Innovation in Agriculture) mentioned in the previous Chapter. The information system developed by the project will be at the forefront of innovation in several aspects. Firstly, it will incorporate cutting-edge technologies to integrate data from various sources, including weather stations and remote sensing, ensuring comprehensive and accurate climate information targeted at the agricultural sector. Secondly, the system will employ advanced modelling techniques to generate climate scenarios and forecast agricultural risks. Results will enable farmers and policymakers to make informed decisions based on reliable projections. Thirdly, the system features user-friendly interfaces and mobile applications, enhancing accessibility and usability for stakeholders. This innovative IT system will potentially transform data management and decision-making processes, finally allowing easy access to actionable recommendations to adopt climate-smart agriculture practices in the country, contributing to sustainable development in the agricultural sector.

F. Measures to avoid duplication of project with other funding sources

Various climate change-related projects and programmes are operating or planned in Uzbekistan; consequently, it is essential to find synergies and avoid duplication to use scarce resources effectively. At the same time, the present project is the only one planned to work on a national scale near-real time information systems for early warning for farmers.

In order to avoid any duplication of efforts, the project modelling processes will be based on the recently ended UNDP project "Developing climate resilience of farming communities in the drought prone parts of Uzbekistan", which was led by Uzhidromet and developed a pilot level actionable farmer bulletin, a Drought Early Warning System (DEWS).

Regarding potential synergies and partnerships, the project will collaborate with ongoing and future interventions of the World Bank (WB), Islamic Development Bank (IsDB), FAO, GIZ[35] and European Bank for Reconstruction and Development (EBRD).

In order to avoid duplications, various projects will be involved through collaboration. The recently approved WB Second Livestock Sector Development Project will be contacted during

[35] Deutsche Gesellschaft für Internationale Zusammenarbeit

the full proposal preparation. It will be involved in distributing near-real time early warning for herders. The Green Climate Fund (GCF) Enhancing Multi-Hazard Early Warning System to increase resilience of Uzbekistan communities to climate change induced hazards project, which is ongoing until 2028, will reformulate some of the activities to align with the present proposal for complementarity and effective use of funds. The IFAD Agriculture Diversification and Modernization Project will also be contacted for using the early warning systems in Fergana Valley in Andijan, Fergana and Namangan regions.

G. Learning and knowledge management

Component 4 is specifically designed to capture and disseminate lessons learned regarding the innovative green investment/incentives for climate resilience aspects of the project.

At the national scale, the application of climate information will also be facilitated through mass and social media campaigns. The design of a social and mass media campaign about the agrometeorological system for farmers will include developing a visibility campaign plan defining clear objectives, identifying the target audience, and choosing relevant social and mass media platforms for content distribution. The media and information units of Uzhydromet and MoA will manage this activity. The project will implement training and capacity development for creating engaging local language content, including videos, infographics, and success stories.

Climate change impact information and adaptation practices will be disseminated at the local level to the farmer groups. The dissemination of information will be through a knowledge exchange portal and app. There is great demand for agro-meteorological information by farmers. Several methods of providing this information will be tested to the last mile users. In the assessment, farmers will be questioned as to their preferences. While the tests will generate location-specific preferences for different dissemination methods, there shall also be clear differences in the effectiveness of the employed tool. In addition, the relevant technical staff will also be trained in using agro-meteorological alerts to provide early warnings. This will include learning related to integrating gender into innovative women- and youth-driven climate resilience activities and achieving gender equality results for climate resilience and adaptation. The KM process will include recording how traditional and local knowledge was incorporated into developing climate-resilient value chains and how it was blended with scientific information. The component will hire a communication expert based at Uzhydromet and will be responsible for the national advisory system of both ministries.

Component 2 also includes some activities about raising awareness on impact scenarios and adaptation strategies for policy training and planning use. This component provides high-level training on adaptation strategies at national and regional levels for different production systems, particularly for horticulture. The component will facilitate MoA staff to develop friendly policy recommendations and narratives for decision-making. It will assist in integrating the data and information on the impacts of climate change into national agriculture policies, plans and programmes through a government-focused awareness-raising campaign. This will be pursued through high-level dialogues in conjunction with universities/research institutions, multilateral agencies, NGOs, and technical networks to ensure broad outreach, as well as through targeted action research and policy briefs on the project experiences and lessons. The net result will be enhanced knowledge amongst policymakers, academia and practitioners on innovative strategies for promoting climate-resilient and green investment in rural areas, which can then be taken up into policy and practice to enhance the outreach of the AF-funded actions. The proposed project will contract a specialised KM service provider to provide short-term technical inputs into designing and implementing this process.

Component 4 will work in the general KM for the entire project and will contract a specialised M&E/KM expert to set up the M&E/KM system. KM will enable the country programme to

contribute to a credible knowledge base of practical and actionable know-how that can be used to address better challenges tackled by the project. It will comprise a project website for the communication of basic information about project features and updates on implementation, platforms for data management to maintain statistics, a repository of knowledge products such as reports and studies for analysis and official reporting, as well as brochures, booklets and audiovisual communication for awareness raising and training purposes.

These targeted knowledge management (KM) elements will be conducted within the project's broader learning and knowledge management activities, which will promote a learning continuum, a need-based knowledge management mechanism, and a flow of communication on innovations and best practices. Local knowledge will be valued, and tech-exchange opportunities will be identified and promoted in order to strengthen development capabilities. The project will engage in developing collaborative actions with research institutions, academic institutions, and higher learning institutions to pursue research-action work on topics of prime relevance to pastoral communities, such as sustainable rangeland /herd management, breed improvement, animal health, coping mechanisms to respond to climate-induced shocks such as drought or landslides, fodder production, socioeconomic studies in agricultural and pastoral areas, including piloting innovative business development approaches.

H. Consultative process

To prepare the proposed concept note, the design team conducted stakeholder consultations from the 12 to the 17 of June 2023. Stakeholder consultations mainly consisted of bilateral meetings with a wide range of government departments, projects, and research institutes with whom the design team discussed different issues with regard to project objectives, activities and implementation. Most meetings followed a similar scheme: (i) An IFAD design team member explained the purpose of the meeting and presented an outline of the agro-meteorological database; (ii) stakeholder representatives presented or gave an update on their institution's objectives, activities and capacities; (iii) the design team and the stakeholder representatives discussed e.g. good practices, project activities and potential areas of collaboration. The list of stakeholders consulted is included in Annexes 2 and 3.

In addition, the project visited one agro-meteorological weather station in the Province of Tashkent and met with the relevant staff. The meeting was composed of the following steps a) An IFAD design team member explained the purpose of the meeting and presented an outline of the agro-meteorological database, mostly focusing on the local level work; (ii) stakeholder representatives presented or gave an update on their institution's objectives, activities and capacities; (iii) the entire team visited the measuring sensors and one example of the field were data are regularly collected.

I. Justification for funding requested, focusing on the full cost of adaptation reasoning

Component 1: ***Development of near real time farm advisory informational system***

Baseline scenario:

Currently, there are certain limitations on the current capacities for, and practices of, the production and publication of analytical agrometeorological information:

- a database for real time data collected by automatic weather stations is in place, but data are not harmonized, are not integrated into a single database, and are stored in separate servers;

- at the moment, agrometeorological forecasts are produced manually, with no use of modern automated analytical systems or software;
- pest and disease forecasts are available at the MoA; there is no digitized information on historical P&D infestation;
- information and forecasts are not sufficiently localised;
- a large array of retroactive agronomical and agrometeorological data which could be used to calibrate models, improve forecasting techniques and analyse longer-term trends are still stored on paper and are at risk of eventually being lost.

Additionality:

The additional value of component 1 lies in its ability to provide crucial climate information and services tailored specifically for the agricultural sector in Uzbekistan. Some of the key additionalities include:

1. Climate information access: the additional agrometeorological station as well as the information system developed by the project, will offer easy access to reliable and localized climate information, including weather data, forecasts, and agronomical risk information. This enables farmers and stakeholders to make informed decisions regarding agricultural activities and adapt to local climate variability.
2. Decision support tools for farmers: the system provides decision support tools that utilize climate data and models to assist farmers in making informed choices. These tools help optimize resource allocation, crop selection, and timing of agricultural operations, leading to improved productivity and resource efficiency.
3. Risk assessment and early warning: the IT system incorporates risk assessment and early warning systems, enabling farmers to anticipate and mitigate climate-related risks. Farmers can take preventive measures to protect crops, livestock, and livelihoods by receiving timely alerts and information about extreme weather events.
4. Climate resilient crop and livestock practices: by being near real time, the information system will promote adopting climate-smart agricultural practices through its software and IT system. It will provide guidance and recommendations based on climate information, helping farmers implement sustainable and resilient farming techniques that enhance productivity, conserve natural resources, and reduce climate impacts.
5. Capacity development at the central and decentralized level: the development of the information system includes capacity-building components, such as training programs and workshops, to enhance the knowledge and skills of government stakeholders responsible for the system's day-by-day management. It empowers them to effectively utilize the software and IT system, manage the server, use the web page back-end, and actively use the app for data sharing.

The additional financing by the AF will be used to upgrade agro-meteorological station networks by adding new ones, replacing old stations with new ones or rehabilitation of existing stations with both conventional and automatic weather stations to increase coverage in the major agricultural production areas. Improved data coding and communication facilities must be established to enhance the connectivity of the national offices with regional-level sub-units. Similarly, investments are also required to improve facilities to access and analyse agro-meteorological information at the national level. A geospatial analysis facility will be established to receive, process, and analyze nearly real-time weather data and agronomical information collected from various centres. Hardware and specialized software for collecting, archiving, processing and analysing data will be installed and tested. A near real time agro-climatological database will be developed. The monitoring and communication infrastructure investment targets the agro-meteorology division. However, the overall requirement for strengthening early warning and climate information services will be considered in close collaboration with other projects and technical divisions of UZHydromet (e.g., forecasting, hydrology, meteorology, and network maintenance).

The technical assistance outcome aims to strengthen institutional and technical capacity to facilitate data sharing, archiving, and analysis to provide improved agro-meteorological information products. The additional activities include preparing and operationalizing the Standard Operating Procedures (SOPs) for the climatology and agro-meteorology division of UZhydromet and the inter-ministerial collaboration with the Ministry of Rural Development. This outcome will also outline institutional coordination mechanisms between the technical divisions that facilitate sharing and communication of agro-meteorological data and information for the agricultural sector and the national early warning system.
To sustain the technical assistance, training curricula in climatology (including seasonal forecasts), agro-meteorology, remote sensing, GIS, crop-yield forecasting, preparation of improved crop bulletins, and information communications will be developed and integrated into Uzhydromet regular activities in collaboration with MWR and MoA. The project will build on AF's previous interventions to strengthen actions to make crop monitoring and yield forecasting operational. A series of training programmes to improve technical capacities of the climatological and agro-meteorological division at central and regional centers organized for the development of value-added forecast and information products and services

Component 2: ***Improvement of the decision making and planning system for agricultural sector through climate change modelling***

Baseline scenario:

The lack of climatic, bio-physical, and socio-economic data currently constrains vulnerability and impact assessments, reducing the capacity for adaptation planning, especially at local level. Several projects and programmes focus on impact assessment. Still, they are highly fragmented and focus on pilots in one or two provinces. Developing a country-wide impact and vulnerability assessment system could guide policymakers to develop climate-responsive agricultural policies and plans and provide farmers with relevant, location-appropriate adaptation options.

Additionality:

The additional AF funding will support the establishment of national information portals on climate scenarios for agricultural planning. The outputs of this component will be achieved by closely collaborating with other initiatives (e.g., GEF, GCF and other initiatives focusing on a national long-term information system for flooding and drought-related hazards and land-use planning in drought- and flood-prone areas). A customized application will be designed to assess climate-change impacts and decision-support products for the development of adaptation strategies. The project funds will be used to assess (i) national climate-change impacts on crop yields and the agricultural economy and (ii) current and potential future risks to food security. The available crop models of the FAO-AEZ portal will be calibrated and validated using the python package for Agro-ecological Zoning (AEZ), also called pyAEZ[36] software, developed by FAO. Assessments will also focus on impact scenarios of water availability for all major agro-ecological zones and crops and a national framework for analysis of vulnerabilities, impacts, and responses. This will integrate stakeholder meetings and feedback to determine appropriate indicators and calibrate the vulnerability assessments.
To sustain these efforts and ensure sustainable use of introduced tools and methods, customized training programmes will be provided for selected staff from MNR and MRD, especially on database management, downscaling of high-resolution climate change scenarios, impact assessment, AEZ, and rural development. The project will help integrate data and information on the impacts of climate change into national agriculture policies, plans, and programmes (consultation workshops at national, regional, and local levels organized). It will integrate stakeholder meetings and feedback to determine appropriate indicators,

[36] https://github.com/gicait/PyAEZ

collect and validate the relevant natural resources information and calibrate the vulnerability assessments. It will also include detailed consultation among the ministries involved in the activity during the systems and model establishing stage, prepare a strategy/policy concerning the use of the systems/models, and share and disseminate the information and products among the relevant ministries.

Component 3: Reaching the last mile and getting climate services to farmers

Baseline scenario:

In Uzbekistan, agrometeorological (and, at large, climate and hydrometeorological) services have been traditionally oriented towards state and regional authorities, with little experience and infrastructure to carry information down to agricultural end-users and to integrate with it directly usable agronomic and agroecological advice. There is also little experience in the country in using climate-change knowledge to support long-term agricultural planning at all levels: from the central government to small and individual farms. Therefore, while Uzbekistan strongly promotes expanding horticulture, it has so far invested little in improving the effectiveness and sustainability of its agrometeorological system.

According to legislation and Uzbekistan's practice, agrometeorological publications, like other weather-related and hydrological information and forecasts, are routinely provided to the President's Administration, the Cabinet of Ministers, the Prosecutor-General's Office and central governmental agencies. These are also sent to regional administrations (Khokimiyats) and central authorities' regional branches (e.g., agricultural departments). Both paper and electronic copies are distributed, the latter by electronic mail.

Noteworthy, the World Bank noticed the first limitation of Uzbekistan's capacity for adaptation in agriculture: "The ability to collect, generate, and provide meteorological data to farmers appears to be high, but the provision of those data to farmers for decision-making appears mixed. Uzhydromet appears to have good infrastructure and well-trained staff able to collect and provide agriculturally relevant meteorological data to farmers… however farmers noted that the agricultural extension service is not oriented toward ameliorating risks from climate, and could provide better integration with hydrometeorological data provision…" [37]

Agricultural producers, including small-scale farmers, are keen to use meteorological and agrometeorological information too and do so to the possible extent. Yet the local reach of such information is at present minimal. Most information products from Uzhydromet are intended for higher management levels or not actionable by end users that often do not get the information contained t all. However, some of it is available online or in other ways by regional and district authorities. And even if they do, they do not necessarily have sufficient knowledge of how to use it effectively.

Small privately-owned weather stations for real-time monitoring of local meteorological conditions also gradually become a reality. Some are being set up through international technical assistance[38]; others are a result of private investments[39]. There is no formal interaction between the owners and operators of such private installations on one side and

[37] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013

[38] "Business Forum for Uzbekistan" project of UNDP and the Chamber of Commerce of Uzbekistan http://www.uz.undp.org/content/uzbekistan/en/home/presscenter/articles/2017/10/27/meteorological-stations-installed-to-help-farmers-in-the-tashken.html

[39] For instance, private horticultural enterprise 'Leo Garden' https://www.facebook.com/pg/OOO-Leo-garden--578072395704831/posts/?ref=page_internal in the Tashkent oblast operates a set of small weather stations which generate data then processed and analysed in France to produce recommendations: Meeting with Mirzayev (Schröder) Research Institute of Gardening, Viticulture and Winemaking, September 2018.

Uzhydromet on the other. However, the fact that there exists tangible demand for such information and its analysis points to new economic opportunities for providers of weather and agrometeorological information and very targeted services – and to the need to strengthen the coordination of data flows and, eventually, the exchange of data.

Additionality:

Activities under Component 3 will communicate information generated from Component 1 to the different national, regional, and local stakeholders, with a particular focus on farmers and smallholder producers. It provides knowledge management and dissemination of information and lessons learned for planning, monitoring and evaluation. The weather, climate, land resources, and climate change impact information will be disseminated to farmer groups at the local level. This activity will be closely linked to other projects (table 3) that are under implementation and will function as testing sites. Though all provinces will benefit from improved agro-advisory services, specific attention will be given to testing several methods of providing information in order to test farmers' preferences. Such testing will allow evaluation of the effectiveness of agrometeorology in the uptake of information at the local level. The project will ensure that women participate in training programs and that their needs are reflected in the training curriculum.

Gender equality lies at the core of all processes of the project. The project will integrate the gender issue in all its aspects and components, including technical assistance and capacity building, and will ensure the high participation of women in the implementation of the project activities. It estimates at least 30-40% of the participants in the training, workshops and project implementation activities to be covered by women. It will also ensure that gender participation and mainstreaming become standard practice during the project's life.

TV, radio, and social media will also be crucial for the diffusion of agro-meteorological information among farmers. TV broadcasts will allow for widespread reach and visual representation of climate services for farmers. Radio facilitated communication in remote areas, while social media platforms enabled quick dissemination of updates and engagement with farmers with good web connections and mobile phones.

Component 4: Learning and knowledge management

Baseline scenario:

Although at least another project has been working in climate services (UNDP AF project) currently in Uzbekistan, there is limited knowledge on the possibilities for climate services to unlock climate-resilient productivity in rural areas. In addition, there is insufficient knowledge on the possibility of using climate services for developing climate-resilient policies and plans. This is related to the limited concrete project action in this regard and the lack of attention paid to documenting and disseminating lessons learned from innovative actions. The result is that stakeholders at different levels across the country lack the knowledge of how to use climate services for resilient rural livelihoods.

Additionality:

The project will apply a comprehensive framework for knowledge-sharing and packaging of lessons learned and experiences. Agro-climatic monitoring and information systems to promote crop and livestock cycle adaptation will be disseminated for broader use at all levels. The use of agricultural climate scenarios and climate risk assessment based on agro-climatic information systems will promote climate-informed planning and decision making. It will be disseminated for wider use at the government level at all scales. The funds will disseminate good practices and lessons learned through publications and organize policy advocacy and knowledge-sharing workshops. The adaptation strategies and practices developed based on

the advanced agro-climatic information systems will be delivered through mass media and social media.

J. Sustainability of project outcomes

The sustainability of the project outcomes is linked to the Uzhydromet mandate to maintain and develop the network of agrometeorological observations and to provide information about current and future agrometeorological conditions, including weather-related risks, to Uzbekistan's agricultural sector, authorities and organisations. With agricultural producers and Uzhydromet being an integral part of the design, the project will establish strong long-term connections between the various data producers and users at all levels and Uzhydromet as the provider of agrometeorological services. These linkages will remain once the project is completed, and users will continue to interact with Uzhydromet to receive the necessary information. With mechanisms for user interaction and monitoring project results and user satisfaction built through the project, external demand will strongly push the continuity of services and project results.

In particular, Uzhydromet will take ownership of the assets established by the project (e.g. the automated observation network, the databases, the servers) and fully ensure their operation and maintenance during and after the project implementation period with its own resources. The detailed operation and management plan will be elaborated during the development of the full project proposal.

The integration of climate services in key policies, strategies, plans and budgets supported by this project will provide a foundation for the uptake of climate information in decision-making and facilitate sustainable service provision in the long term. In accordance with Uzbekistan's INDC, the recent decree № 3281 of September 2017 by the President of the Republic of Uzbekistan requests the optimised placement of agricultural crops, in particular, intensive cucurbit plantations, gardens and vineyards, accounting for soil and climate conditions, the availability of water, regional specialisation, yields and other factors; thus confirming the need and demand for systematically integrating climate-change information in long-term agricultural planning.

Identifying funding modalities for climate information products, including integration into the national budget, will contribute to sustainability. Similarly, climate information increasingly interests potential investors in agricultural business. This highlights the potential for bringing climate knowledge into business planning. It may bring new economic opportunities to Uzbekistan's agrometeorological network and services, thus ensuring its long-term sustainability and replicability.

In summary, in line with national policies, the project will provide a long-term vision for agrometeorological services in Uzbekistan, including user interaction and feedback mechanisms as well as legal and business model changes at Uzhydromet to create a sustainable and replicable service to protect the vulnerable through their enhanced ability to adapt to climate change. The project will result in automated stations installed at multiple locations and soil analysis equipment modernized at 23 laboratories, as well as delivering the facilities for data collection, exchange and knowledge management, thereby complementing and upgrading the existing basic infrastructure. This will be supported by providing extension services for horticultural end users and capacity building and training of some 150-200 Uzhydromet staff. Through these capacity development activities, awareness raising and a dedicated knowledge management component, their capacity will be enhanced and the sustainability of results facilitated. The holistic approach to climate services is tailored to Uzbekistan's circumstances and, therefore, is more likely to lead to sustainability rather than focusing on the provision of technical infrastructure alone.

Uzhydromet is committed to fully integrating project results into its daily operations. The project will not only help modernise the agrometeorological network and service capacities but will also assist Uzhydromet in making legal and operational changes necessary to make the transformation sustainable. Among other elements, it will help adopt a new business model of cost-recovery that will provide a more reliable foundation for the sustainability of Uzhydromet and its services.

K. Overview of environmental and social impacts and risks identified

Potential risks have been identified and are listed below, along with mitigation strategies.

Risk	Category	Mitigation
Lack of capacity, engagement and cooperation among national institutions	Operational and Political	Uzhydromet will be a key executing entity in the project which is based on strong country demand. The project will ensure the full engagement of different ministries and other stakeholders in improving the delivery and use of agrometeorological services. The enhancement of interaction between producers and end-users of information is at the core of project design.
Conflicting interests among stakeholders	Operational and Political	Based on a stakeholder analysis and extensive stakeholder consultations, the project will mitigate potential conflicting interests among stakeholders amongst others through the establishment of an inclusive consultation and coordination mechanism for the development and delivery of agrometeorological services.
Lack of data harmonization and data sharing	Operational	Given the current policy environment, the risk of lack of data sharing appears low. Instruments such as data-sharing agreements will be set up to further reduce such risk. Standard Operating Procedures should also reduce risks of lack of compliance by multiple government entities.
Socio-economic risks	Operational	The project has been identified as low risk and will ensure that the socio-economic diversity, vulnerability and livelihood risks will be considered in all project activities. The risk should be mitigated through the actions of component 2, which will directly estimate vulnerability in local areas.
Operation and maintenance of infrastructure and equipment	Operational	The project is based on a strategy and commitment to long-term operation and maintenance of equipment and observation infrastructure to ensure the sustainability of project results.
Unavailability of data for the development of information products and impact assessment	Operational and Political	Non-availability of data is not a risk, while the lack of digitalization of historical crop cycle data is the major weakness the project aims to address in component 1.

Improper use of climate data leading to unsustainable farming practices, and potential overreliance on irrigation leading to water resource depletion	Environmental	To overcome such risks, timely and accurate climate information for sustainable farming will be provided, including weather forecasts, rainfall patterns, and temperature trends.

During the design of the proposed project, a Review Note of the Social Environment and Climate Assessment Procedures (SECAP) will be completed. This is a tool used by IFAD to assess the social, environmental and climate change issues relevant to the project in order to identify how the project might impact them and how IFAD's mainstreaming themes (gender, youth, nutrition, environment and climate change) could be addressed through an integrated approach.

According to the IFAD preliminary screening, the project is considered in a low environment and social risk category, meaning that it is not expected to have any significant adverse environmental or social implications. The screening also rated the project's climate risk classification as Moderate, given that some of the Uzbekistan's mountainous landscape is subject to extreme climatic events, such as flooding, mudslides and drought.

Under Component 1, the main risks include lack of capacity, reduced engagement and cooperation among national institutions, and conflicting interests among stakeholders. Conflicting interests will be tackled by promoting dialogue and fostering a shared understanding of the benefits and objectives. Also, the development and approval of the Standard Operating Procedures (SOP) will ensure clear roles and responsibilities as well as alignment with national priorities, environmental conservation goals, and sustainable agricultural practices.

Under Component 2, there are no foreseen risks. The project will contribute to the sustainable governance and integrated management of agricultural resources in changing climatic conditions. As the activities will be specifically targeted at enabling climate-smart future-adapted activities, they will not have any adverse environmental or social effects. By supporting land use planning, agro-environmental resource monitoring, and agricultural impact assessment, the assessment system developed in component 2 contributes to effective environmental protection and conservation efforts. It enables evidence-based decision-making, fosters sustainable resource management practices, and facilitates the integration of environmental considerations into various sectors of land governance. By enabling local level participatory mapping, facilitating participatory decision-making, and promoting capacity building and empowerment, it also helps ensure the meaningful involvement of indigenous people in the planning phase.

Under Component 3, risks include:1) improper use of climate data leading to unsustainable farming practices, 2) potential overreliance on irrigation leading to water resource depletion, and 3) inadequate consideration of biodiversity conservation in agricultural decision-making processes. To overcome such risks, timely and accurate climate information for sustainable farming will be provided, including weather forecasts, rainfall patterns, and temperature trends. Armed with this data, farmers can make informed decisions on when to plant, irrigate, or harvest crops, leading to more sustainable agricultural practices. By aligning their farming activities with climate conditions, farmers can reduce environmental impacts, optimize resource use, and minimize risks associated with climate variability. This system prioritizes capacity building among farmers, extension workers, and agricultural stakeholders. Training programs on climate-smart practices, water management, and soil conservation are

organized to disseminate knowledge and build skills. Best practices and success stories are shared through knowledge-sharing platforms, fostering peer-to-peer learning and innovation. This exchange of information strengthens farmer prosperity by increasing their understanding of climate-related risks and opportunities, leading to more sustainable and profitable agricultural enterprises.

Component 4 KM activities will not have any negative environmental or social impacts.

Moreover, the project mirrors the priority strategic actions set out in IFAD's COSOP for the country. In addition to the above IFAD procedures, the entire project was screened for environmental and social risks against the 15 principles outlined in the AF's Environmental and Social Policy, as set out in the table below. An Environmental and Social Management Plan (ESMP) and Grievance Mechanism will be included in the full project proposal, as is required by the AF and IFAD. The ESMP designed for this project will track identified risks, or any new risks, ensuring they are properly monitored, evaluated, reported on, and addressed. A gender assessment will be carried out during the development of the full project proposal to fine-tune the proposed project's activities to promote gender equality and women's resilience to climate change.

Checklist of environmental and social principles	**No further assessment required for compliance**	**Potential impacts and risks – further assessment and management required for compliance**
Compliance with the Law	**X**	**Low/no risk**: Relevant national, regional and district authorities have been and will continue to be consulted during the proposal development process to ensure compliance with all relevant laws. The project is implemented by the GoU, which will host the project's management and will assign or recruits its staff. The project will be implemented under the relevant agricultural, digital technologies, and data-sharing policies listed in Chapter D.
Access and Equity	**x**	**Low/no risk**: Through the development of vulnerability and climate risk assessment mapping, this project will ensure that no activity will interfere with access to basic services or exacerbate existing inequities. This project will promote equitable access to activities and assets by women and youth in targeted communities.
Marginalized and Vulnerable Groups		**Low/no risk**: Marginalized and vulnerable groups – especially women and youth - will be consulted during the proposal development process to ensure that their identified threats, priorities and mitigation measures are reflected. This project will empower vulnerable groups to make decisions on concrete adaptation actions, valuing their traditional and local knowledge and developing easy-to-access, user friendly crop recommendations in local languages.
Human Rights	**X**	**Low/no risk:** This project affirms the rights of all people and does not violate any pillar of human rights.
Gender Equity and Women's Empowerment		**Low risk**: The project will incorporate a strategy to ensure women's inclusion in value chains and equitable access to opportunities, including identification of non-traditional livestock products and diversification beyond livestock to benefit women; promotion of women's employment at higher levels of the value chains; and active communication campaigns on potential, new roles of women. At least 30 percent of the beneficiaries of Component 3 will be women or female youth. A gender assessment of climate services for agriculture will be conducted during full project formulation to deepen the strategy and fine-tune activities.
Core Labour Rights	**X**	**Low/no risk**: The project will ensure respect for international and national labour laws and codes, as stated in IFAD's policies.

Indigenous Peoples	**X**	**No risk**: No stakeholders or communities have raised concerns about the violation of indigenous peoples' rights. Despite this, the project affirms the rights of indigenous peoples in line with IFAD's policy on engagement with indigenous peoples.
Involuntary Resettlement	**X**	**No risk**: The project will not lead to involuntary resettlement.
Protection of Natural Habitats	**X**	**Low/no risk**: By implementing a system for climate services for farmers, the project will ensure the protection of agricultural habitats. In addition, consultations with government stakeholders, community leaders and communities will ensure that the conversion or degradation of critical natural habitats (including those that are legally protected, officially proposed for protection, recognized for their high conservation value, or recognized as protected by local communities) is avoided.
Conservation of Biological Diversity	**X**	**Low to moderate risk**: By implementing a system for climate services for farmers, the project will ensure the protection of biological diversity and agrobiodiversity. All climate services will include options for organic agriculture based on national legislation.
Climate Change		**Moderate risk**: The project area is, however, moderately vulnerable to the impacts of climate change. Thus all project components and activities are designed to contribute to increasing local capacities to sustainably face climate change in the long-term and climate variability in the short and medium terms.
Pollution Prevention and Resource Efficiency	**X**	**No risk**: The project will not release pollutants.
Public Health	**X**	**Low/no risk**: The project will not have any detrimental effect on public health. The project will contribute to tackling the underlying causes of malnutrition by increasing agricultural production, promoting sustainable agriculture and indirectly supporting productivity opportunities for women and youth.
Physical and Cultural Heritage	**X**	**Low/no risk**: The project will seek to understand the role of traditional and local knowledge and how it is blended with scientific information for climate resilience and conveyed through a near real time advisory system. Such knowledge will be incorporated into the climate advisories developed in Component 1 and submitted to local level testing and validation by local population.
Lands and Soil Conservation	**X**	**Low/no risk**: Project activities will not pose risks to land and soil conservation, as support to policy development in component 2 will specifically promote sustainable land management and long term conservation of the agro-environment.

PART III: IMPLEMENTATION ARRANGEMENTS

The Project will establish a Project Management Unit (PMU) in Hydromet for execution. The Ministry of Finance will act as the official representative of Uzbekistan as the recipient, fulfilling the government fiduciary oversight and management responsibilities. The Project will also establish a Steering Committee chaired by Hydromet and including key staff from other ministries relevant to the Project, whose responsibility will be approval of the annual work plans and budgets (AWPBs) as well as serving as an inter-ministerial coordination body.

The PMU in Tashkent will be responsible for the day-to-day management and execution of project activities, including overall administration, fiduciary aspects, procurement, monitoring and evaluation. Additional capacity will be provided to sustain project implementation throughout the project's life. The project management unit will work closely with government agencies, especially with the MoA and the MWR. The implementation arrangements are described in the image below in more detail.

The service providers hired by the project will be vetted as competent individuals, consultancy firms, NGOs and government agencies. They will provide technical services such as capacity building and implementation support.

IFAD will supervise the project directly. A mid-term review will be conducted to evaluate the project's progress, identify areas for further improvement and revise the project approach.

The gender focal point of the project management unit will be responsible for overseeing the implementation of the gender action plan. The expert will ensure that gender aspects are reflected in monitoring and evaluation, such as the collection of gender-disaggregated data.

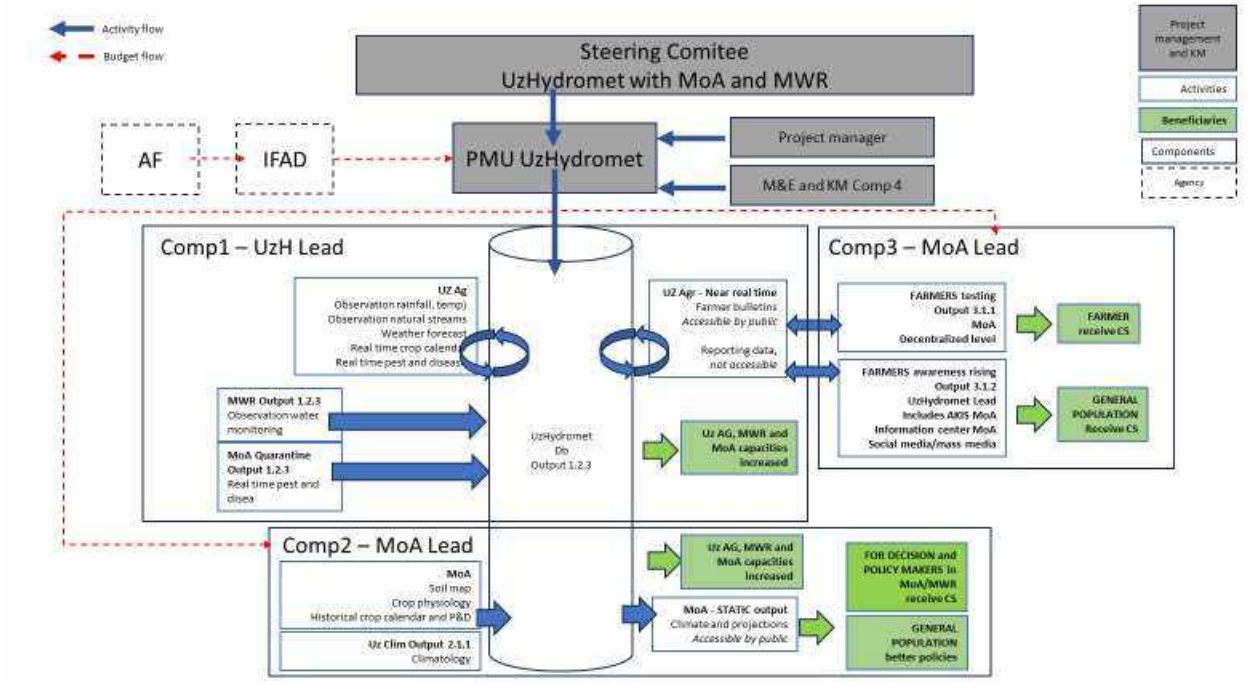

Figure 4. Implementation arrangements

A. Project alignment with the Results Framework of the Adaptation Fund

Project Outcomes	Project Outcome indicators	Adaptation Fund Outcome	Adaptation Fund Outcome Indicator	Grant Amount (USD)
Component 1: Development of near real time farm advisory informational system				
Outcome 1.1 Agro-meteorological monitoring, communication and analysis facilities established at the national and regional level	A predefined number of weather stations installed	Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets	4.2. Physical infrastructure improved to withstand climate change and variability-induced stress	3,075,000
Outcome 1.2 Institutional and technical capacity strengthened to facilitate data sharing, archiving, analysis and interpretation of agro-meteorological information products to users at all levels	A network of inter-ministerial entities learn how to share data and interconnect activities	Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	2.1. Capacity of staff to respond to, and mitigate impacts of, climate-related events from targeted institutions increased	410,000
Component 2: Improvement of the decision making and planning system for agricultural sector through climate change modelling				
Outcome 2.1: Long term scenario and geospatial data access, monitoring, processing facilities integrated within the present government system		Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	2.1. Capacity of staff to respond to, and mitigate impacts of, climate-related events from targeted institutions increased	600,000
Outcome 2.2: Institutional and technical capacity strengthened to facilitate data sharing, archiving, analysis and interpretation of agro-climatological information products to policy and decision-makers at multiple scales	At least two horticultural evidence based value chains policy or plan proposals developed using future crop productivity scenarios	Outcome 7: Improved policies and regulations that promote and enforce resilience measures	7. Climate change priorities are integrated into a national development strategy	315,000
Component 3: Reaching the last mile and getting climate services to farmers				
Outcome 3.1: Knowledge and information sharing for mass application of agrometeorology in the agriculture sector and improvement of the AKIS national extension service system	30% of the rural population	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses	2,685,000

Outcome 3.2: Participatory stakeholders assessment support refining and scaling up the agro-meteorological system	30% of the rural population (same as above)	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses	1,075,000
Component 4: Learning and knowledge management				
Outcome 4.1: Knowledge on promoting climate-resilient livelihoods disseminated and promoted	Awareness is raised on information systems and policy and plans related to climate and crop future scenario	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses	350,000

Project Outputs	**Project Outputs indicators**	**Adaptation Fund Output**	**Adaptation Fund Output Indicator**	**Grant Amount (USD)**
Component 1: Development of near real time farm advisory informational system				
Output 1.1.1 Agro-meteorological station networks improved/re-habilitated with automatic weather stations covering the major agricultural production areas	40 automated weather agrometeorological stations with capacity to produce a forecast on pest and disease outbreaks risk in different fruit trees installed in the regions of Andijan, Jizzakh, Namangan, Sirdarya, Surkhandarya, Tashkent, Fergana, and Khorezm	4.1.2. No. of physical assets strengthened or constructed to withstand conditions resulting from climate variability and change (by sector and scale)	40 automatic weather stations installed and recording agroclimatic observation in near-real time	2,500,000
Output 1.1.2 Establishment and functioning of a new laboratory for climatology and agrometeorology modelling and geospatial unit to receive, process and analyse near real-time information in collaboration and communication with other existing government systems	Output 4: Vulnerable development sector services and infrastructure assets strengthened in response to climate change impacts, including variability	4.1.1. No. and type of development sector services modified to respond to new conditions resulting from climate variability and change (by sector and scale)	One national level climate service system for the agriculture producing regular agro-meteorological bulletins	225,000
Output 1.1.3: Detailed design and pilot establishment of a Climate Database Management System for archiving, storing, processing and analysing agro-	Output 4: Vulnerable development sector services and infrastructure assets strengthened in response to climate change impacts,	4.1.1. No. and type of development sector services modified to respond to new conditions resulting from climate variability and change	One national level database for agro-meteorology, including near-real time data from Uzhydromet, MRA, and MWR data, in place and connected with regional level data	350,000

climatic information including hydrological drought forecasting and its impact on agricultural sector assessment based on real hydrometeorological data and long-terms (decades) climate scenarios (in collaboration with C2).	including variability	(by sector and scale)	collection	
Output 1.2.1: Inter-ministerial Standard Operating Procedures (SOPs) for climatology and agro-meteorology in place	An inter-ministerial SOP system designed and approved	2.1.2 No. of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale)	Output 2.1: Strengthened capacity of national and sub-national centers and networks to respond rapidly to extreme weather events	100,000
Output 1.2.2: Development and delivery of training packages for agro-meteorology data sharing, archiving, analysis and interpretation	200 government experts in the UzHydromet, MoA, and MWR, including central-level and decentralized office staff	2.1.1. No. of staff trained to respond to, and mitigate impacts of, climate-related events (by gender)	Output 2.1: Strengthened capacity of national and sub-national centers and networks to respond rapidly to extreme weather events	310,000
Component 2. Improvement of the decision making and planning system for agricultural sector through climate change modelling				
Output 2.1.1: Available data and information collated or improved and agro-climate impact scenarios developed	60 government experts in the UzHydromet, MoA, and MWR, including central-level modelling experts, trained in crop and climate modelling 100 government experts in the UzHydromet, MoA, and MWR, including central-level and decentralized office staff in vulnerability and climate risk assessment using future scenarios		2.1.1. No. of staff trained to respond to, and mitigate impacts of, climate-related events (by gender) 2.1.2 No. of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale)	250,000
Output 2.1.2: Applications designed, developed, tested and delivered with computing facilities for monitoring and assessment of land-use	One application, integrated withing the application produced in Output 1.1.2 of the project, is in place	n.a.	n.a.	350,000
Output 2.2.1: Modelling and scenario development training programme conducted	At least 6 IPCC scenarios used for at least 60 years in the future Regional vulnerability assessments	n.a.	n.a.	240,000
Output 2.2.2: Impact scenarios and adaptation strategies and policy training conducted	At least two horticultural value chains policy proposals developed	Output 7: Improved integration of climate-resilience strategies into country development plans	7.1. No., type, and sector of policies introduced or adjusted to address climate change risks	75,000

Component 3. Reaching the last mile and getting climate services to farmers				
Output 3.1.1: : National ToT programme for application of agrometerology advisories to farmer groups, extension services, and external projects	See 3.1.3	Output 3.2: Strengthened capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning	3.2.2 No. of tools and guidelines developed (thematic, sectoral, institutional) and shared with relevant stakeholders	190,000
Output 3.1.2. Development of a dedicated section of extension services in support to the information system developed in connection with AKIS/Extension Service national network.	Regional extension services strengthen by supporting capacities to distribute climate services to farmers	Output 3.2: Strengthened capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning	3.2.1 No. of technical committees/associations formed to ensure transfer of knowledge	730,000
Output 3.1.3: : Local application of climate information facilitated to test the functionality of the agro-meteorological system	One climate service shared with 1.000 farmers trained in at least three agro-ecosystem through farmer groups One climate service shared with 50.000 households for a total of 250.0000 rural beneficiaries	Output 3.2: Strengthened capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning	3.2.2 No. of tools and guidelines developed (thematic, sectoral, institutional) and shared with relevant stakeholders	1,765,000
	At least five media and one social media covering the agrometeorology information produced in component 1	Output 3.1: Targeted population groups participating in adaptation and risk reduction awareness activities	3.1.1 No. of news outlets in the local press and media that have covered the topic	
Output 3.2.1: Local application of climate information facilitated through farmer groups to test the functionality of the agro-meteorological system	Output 3.2.1. Agrometeorology's impact, app usability, and impact on crop decision and productivity assessed through participatory assessment and scientific trials	Output 3.2: Strengthened capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning	3.2.2 No. of tools and guidelines developed (thematic, sectoral, institutional) and shared with relevant stakeholders	1,075,000
Component 4: Learning and knowledge management				
Output 4.1.1: High-level dialogues conducted, information material disseminated	At least 5 evidence-based policy briefs or future-tested plans (based on data from component 2) are made public through public dialogues, national media, TV, and government web pages 15 technical leaflets and 3 manuals on the project experiences and lessons	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses	3.2.2 No. of tools and guidelines developed (thematic, sectoral, institutional) and shared with relevant stakeholders	200,000

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[40]

Sh.Khabibullayev *National Designated Authority Director of Uzhydromet* *Focal Point of UNFCCC in the* *Republic of Uzbekistan*	*Date: 24 July 2023*

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O'ZBEKISTONRESPUBLIKASITABIAT RESURSLARI VAZIRLIGI
GIDROMETEOROLOGIYAXIZMATI AGENTLIGI
AGENCY OF THE HYDROMETEOROLOGICAL SERVICE
MINISTRY OF NATURAL RESOURCESOF THE REPUBLIC OF UZBEKISTAN

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E-mail: info@meteo.uz, meteo@sarc.uz | Website: www.hydromet.uz

№ 07-01/96 «24»-iyul 2023-yil

To: **The Adaptation Fund Board**
c/o Adaptation Fund Board
Secretariat email:
Secretariat@adaptation-fund.org
Fax. 202 522 3240/5

Letter of Endorsement by Government of Uzbekistan

Subject: Endorsement of the Project 'Resilient food systems through climate services for agriculture in Uzbekistan'

In my capacity of designated authority for the Adaptation Fund in the Republic of Uzbekistan, I confirm that the project proposal entitled *'Resilient food systems through climate services for agriculture in Uzbekistan'* is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Uzbekistan.

The project Concept Note was prepared with the support of IFAD as Implementing Entity vis-à-vis the Adaption Fund. The proposed project's goal is to contribute to rural poverty alleviation in the country through increased climate services for agriculture, improving resilience, income and enhanced economic growth in rural farming communities.

Accordingly, I am pleased to endorse the above grant proposal.

Sincerely,

Sh.Khabibullayev
National Designated Authority Director of Uzhydromet
Focal Point of UNFCCC In the Republic of Uzbekistan

6. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

B. Implementing Entity certification *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address*

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Implementing Entity coordinator: Mr Juan Carlos Mendoza Casadiegos Director Environment, Climate, Gender and Social Inclusion Division	
Date: 18 August 2023	email: ecgmailbox@ifad.org
HQ Focal point: Ms Janie Rioux Senior Climate Finance Specialist ECG Division	email: j.rioux@ifad.org
Project Contact Person:	
Mr Walid Nasr Regional Lead Climate and Environment Specialist	email: w.nasr@ifad.org
Ms Laura Mattioli IFAD Country Director in Uzbekistan	email: l.mattioli@ifad.org

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AGENCY OF THE HYDROMETEOROLOGICAL SERVICE
MINISTRY OF NATURAL RESOURCESOF THE REPUBLIC OF UZBEKISTAN

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To: **The Adaptation Fund Board**
c/o Adaptation Fund Board
Secretariat email:
Secretariat@adaptation-fund.org
Fax. 202 522 3240/5

Letter of Endorsement by Government of Uzbekistan

Subject: Endorsement of the Project 'Resilient food systems through climate services for agriculture in Uzbekistan'

In my capacity of designated authority for the Adaptation Fund in the Republic
of Uzbekistan, I confirm that the project proposal entitled *'Resilient food systems through climate services for agriculture in Uzbekistan'* is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Uzbekistan.

The project Concept Note was prepared with the support of IFAD as Implementing Entity vis-à-vis the Adaption Fund. The proposed project's goal is to contribute to rural poverty alleviation in the country through increased climate services for agriculture, improving resilience, income and enhanced economic growth in rural farming communities.
Accordingly, I am pleased to endorse the above grant proposal.

Sincerely,

Dr.B.Nishonov
Focal Point
of Adaptation Fund
in the Republic of Uzbekistan

ANNEX 1: PEOPLE AND ORGANIZATIONS MET DURING THE DESIGN MISSION (JUNE 2023)

#	Name	Title
1	Firuz Safarov	Deputy Director, Uzhydromet
2	Azim Narzullaev	Head of Hydrometeorological Support Department, Uzhydromet
3	Dilyafruz Akhundzhanova	Head of the Department of Agrometeorological Observations and Forecasts, Uzhydromet
4	Munisa Tutieva	Lead Engineer, Department of Agrometeorological Observations and Forecasts, Uzhydromet
5	Larisa Feldman	Lead Engineer, Department of Agrometeorological Observations and Forecasts, Uzhydromet
6	Irina Zaitseva	Lead Specialist, Climate Services Department, Uzhydromet
7	Ekaterina Petrova	Lead Engineer, Short-Range Forecast Group, Uzhydromet
8	Shavkat Kadyrov	Head of Department of dangerous hydrometeorological phenomena, Uzhydromet
9	Faizulla Agzamov	Director of the Research Hydrometeorological Institute (NIGMI)
10	Irina Dergacheva	Head Laboratory of Dangerous Phenomena, NIGMI
11	Sergei Myagkov	Head Laboratory for Mathematical Modeling of Hydrometeorological Processes, NIGMI
12	Zukhra Tillyakhojaeva	Scientific Secretary, NIGMI
13	Natalya Agaltseva	Head of Climate Monitoring Department, Uzhydromet
14	Nadezhda Gavrilenko	UNDP/Uzhydromet/GCF project manager for the preparation of the National Adaptation Plan
15	Alexander Merkushkin	Task Manager for the UNDP/Adaptation Fund project to develop an early warning system
16	Sardor Kadyrov	UNDP/Uzhydromet/Japanese Foreign Ministry project manager to support climate change adaptation measures in Uzbekistan
17	Munisa Asilkhojaeva	Head of Information Service, Uzhydromet
18	Umid Umirzakov	METEOINFOCOM, Uzhydromet

ANNEX 2: LIST OF PERSONS MET DURING THE FIELD VISIT

Person met	Entity	Date visited	Role
Murtazoyev Mirzaolim	Tashkent region hydrometeorological center	17/6/23	Leader
Gafurov Tokhir	Tashkent region hydrometeorological center	17/6/23	Chief specialist
Kholtojiyeva Oyjamol	Tashkent region hydrometeorological center	17/6/23	Engineer agrometeorologist
Karimov Khamza	Tuyabuguz station	17/6/23	Leader
Khamrayeva Ramuza	Tuyabuguz station	17/6/23	Technical agrometeorologists
Abduvakhobov Shavkat	Tuyabuguz station	17/6/23	Technical agrometeorologists