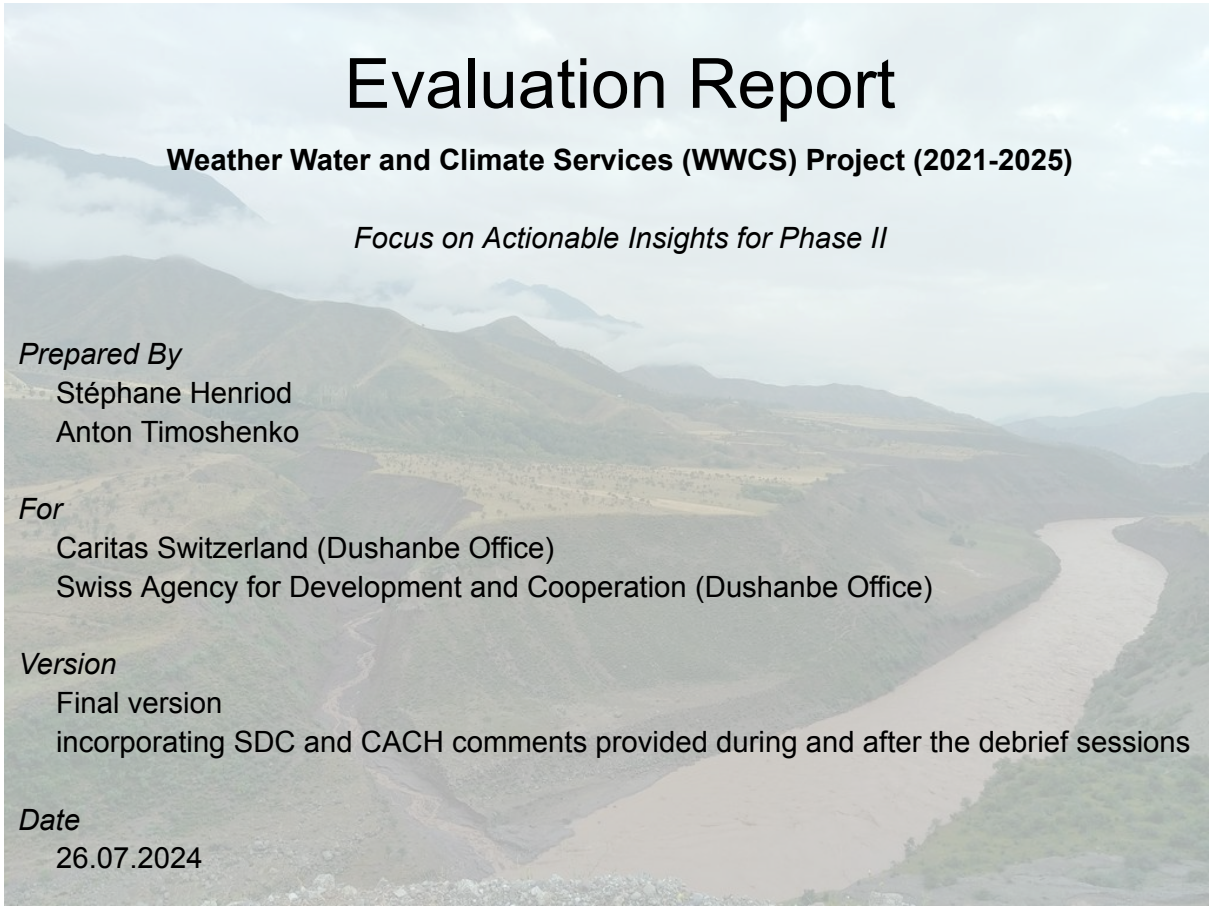

Evaluation Report

Weather Water and Climate Services (WWCS) Project (2021-2025)

Focus on Actionable Insights for Phase II

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For

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Version

Final version

incorporating SDC and CACH comments provided during and after the debrief sessions

Date

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This report has been conceived to be very concise, as requested by the ToR.
All the detailed analyses and recommendations are to be found in the annexes.

List of abbreviations

ALRI	Agency for Land Reclamation and Irrigation
API	Application Programming Interface
BOKU	University of Natural Resources and Life Sciences, Vienna, Austria
CACH	Caritas Switzerland
CoESCD	Committee for Emergency Situations and Civil Defense
EWS	Early Warning System
ICARDA	International Centre for Agricultural Research in the Dry Areas
MoA	Ministry of Agriculture
NSC	National Steering Committee
PO	Public Organization
RAS	Rural Advisory Services
SDC	Swiss Agency for Development and Cooperation
SLF	Swiss WSL Institute for Snow and Avalanche Research
TJHM	Tajik Hydromet
WMO	World Meteorological Organization
WWCS	Weather, Water and Climate Services

Executive Summary

Purpose of the Evaluation

The evaluation aims to provide Caritas Switzerland (CACH) and the Swiss Agency for Development and Cooperation (SDC) with an independent, evidence-based assessment of the WWCS project's effectiveness, efficiency, and sustainability. It evaluates how well the project's approaches have addressed contemporary challenges, contributed to its outcomes, identified lessons learned, and assessed the project's performance against its objectives and targets. Additionally, the evaluation offers actionable recommendations for enhancing implementation and scaling at the national policy level, and validates the project's positive impacts on national ownership and rural communities.

Main Recommendations

- **Focus on Upscale**: Prioritise upscaling successful pilots to create tangible benefits in the real world, rather than piloting new initiatives. This involves operationalizing and replicating successful approaches from controlled environments to broader applications.
- **Technical Infrastructure Upgrade**: Enhance the technical infrastructure to support larger-scale operations, including building a development team, establishing separate development and testing environments, and securing dedicated server access.
- **Identify Impactful Services**: Focus on the most impactful WWCS services, such as the myBabilon App, a simple EWS through Telegram/SMS, and CoESCD's SOS app, to reach a critical mass of users and generate feedback for future improvements.
- **Further improve Forecast Accuracy**: Increase the density of weather stations, closely monitor forecast accuracy, and reactivate the CoESCD radar to enhance the accuracy of forecasts, especially for extreme weather events.
- **Freeze the PO Setup**: Postpone the setup of the Public Organization (PO) until there is clear evidence of a market for services, and focus resources on providing real-life services and gathering demand evidence.
- **Reactivate the Project Trust Fund**: Allocate annual resources to the Project Trust Fund (PTF) to provide flexible, small-scale support, addressing community requests for equipment and enhancing engagement.
- **Market New Seeds**: Partner with private companies to bring innovative seeds to local markets while mitigating the risk of monoculture, ensuring agricultural sustainability and resilience.
- **Upscale Lakhsh Potato Experiment**: Expand the experimental potato fields in Lakhsh to full-scale fields and incorporate drip irrigation to validate the weather-based irrigation approach in real conditions.
- **WWCS as a Global Initiative**: Promote WWCS as a global international initiative and digital public good, leveraging OpenSource and OpenDesign to attract a critical mass of users, developers, and supporters, ensuring long-term viability.

The *Annex 01: Detailed recommendations* provides more details on those recommendations, incl. the outcome that they will impact, and a first indication of when each recommendation should be implemented (end of phase 1 vs. phase 2 vs. both of them).

Introduction

Background of the WWCS Project[1]

The WWCS (Weather, Water, and Climate Services) project, initiated by Caritas Switzerland in partnership with the Swiss Agency for Development and Cooperation (SDC), is designed to enhance food security and resilience among rural communities in Tajikistan. The project focuses on developing need-based WWCS and creating an enabling environment that includes political, economic, and social aspects. It leverages a multi-stakeholder approach and integrates a circular value chain of value-creating services provided within a public-private partnership .

Objectives and Envisioned Activities for Phase 1

In its first phase, the WWCS project aims to establish a network of low-cost, open-source weather stations combined with citizen observations to gather weather, water, and climate data. These data are crucial for providing localised and specific WWCS to support agricultural decision-making and risk management. The project starts with pilot activities in two target districts, Lakhsh and Muminobod, where it focuses on co-designing targeted WWCS, improving communication channels between districts and communities, and integrating WWCS into district development plans .

Objectives and Envisioned Activities for Phase 2

The second phase of the project plans to expand the WWCS infrastructure and services based on learnings from the initial phase. The focus will be on scaling out WWCS for disaster risk management (DRM) and further integrating WWCS into national policies and district ordinances. The project will continue to build capacity at the national and district levels, engage local communities, and promote the use of WWCS for improved agricultural practices and risk management .
The exact scope and duration of the second phase is still being negotiated. Tentatively, it should start in June 2025, and run for a period of 4 years.

Main Stakeholders and Partners

The WWCS project involves a wide range of stakeholders and partners at various levels. Caritas Switzerland leads the coordination with key partners, including the World Meteorological Organization (WMO), MeteoSwiss, the Swiss WSL Institute for Snow and Avalanche Research (SLF), BOKU University (Vienna), Oregon State University, and the International Centre for Agricultural Research in the Dry Areas (ICARDA). National partners include Tajik Hydromet, the Committee of Emergency Situations and Civil Defense (CoESCD), and the Ministry of Agriculture (MoA). These partnerships are essential for ensuring the effective implementation and sustainability of the WWCS project, facilitating data flow, compliance with technical standards, and capacity building.

[1] This chapter describes the initial project vision (as per the project document and other background documents).

The project's value chain

The project's approach assumes a logical causality between the provision of weather, water and climate services, and an increased resilience of the local communities.

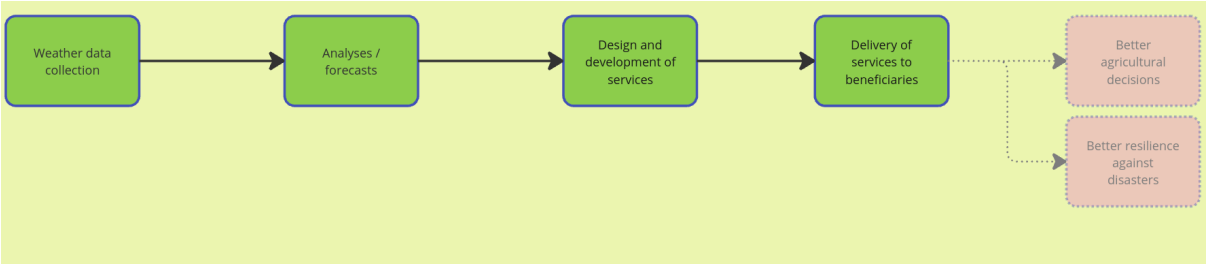


Illustration 1: The project's value chain

Objectives of the Evaluation

The objective of this evaluation is to provide Caritas Switzerland and the Swiss Agency for Development and Cooperation (SDC) with an independent, evidence-based assessment of the WWCS project's effectiveness, efficiency, and sustainability. It aims to evaluate how well the project's approaches have addressed contemporary challenges and contributed to the envisioned outcomes, as well as to identify lessons learned and best practices for future phases. The evaluation will also assess the project's performance against its planned objectives, results, and targets, and provide actionable recommendations to enhance the project's implementation and scaling at the national policy level. Additionally, it seeks to validate the project's positive impacts on national ownership and rural communities.

Scope of the evaluation

The following aspects delimit the main scope of the evaluation:

- The future role of TJHM, especially in the light of the challenges that most NGOs and international organisations have experienced when cooperating with them;
- The future role of the weather stations network, and its upscale at national level;
- The long-term sustainability of the WWCS approach;
- The opportunity to test new approaches during phase 2, and to upscale the already tested and piloted approaches

Limitations of the Evaluation

Given the limited time available for the evaluation, it has not been possible to assess equally all aspects of this multi-year and multi-phases project. We believe however that we have managed to capture the project's core topics, challenges and opportunities.
In particular, the few days spent in Dushanbe didn't allow us to meet with all the project partners. Rather than rushing superficially from one meeting to the next one, we decided to focus on the core stakeholders. This allowed us to gather more comprehensive information from them, with the downside that we couldn't incorporate the views from possible future partners interested in the WWCS approach. Also, a number of imponderables postponed some meetings, or even prevented us from meeting some of our partners (national holiday announced spontaneously, emergency requiring the CoESCD higher management).

Evaluation Methodology

Approach and Methods Used

The approach for evaluating the WWCS project emphasises a comprehensive and pragmatic methodology focused on the project's impact, outcomes, and real-world applicability. The process begins with developing an evaluation framework and conducting a thorough desk review of relevant documents to establish a foundational understanding. This is followed by engaging stakeholders through interviews and focus group discussions to capture diverse perspectives and feedback. The collected data is meticulously analysed to identify and assess any deviations from the original plan, determining whether these deviations should be corrected or embraced based on their impact. Finally, the evaluation culminates in actionable recommendations and the provision of a detailed evaluation report, ensuring the findings are communicated effectively to inform the next phase of the project.

Desk Review

The desk review mostly consisted of reviewing the project's core documents: project proposal (2021), annual reports (2021-22, 2022-23), interim report (2023), initial log frame for phase I (2021), tentative log frame for phase II (2024) and the WWCS policy brief (2021). Additional documents also enriched this review (MoUs, draft of the WWCS national cooperation agreement). The WWCS platform and its API have also been specifically tested and scrutinised.
This allowed us to gain a first insight into the project's aims and activities, but also to identify the key questions for the upcoming interviews and discussions.

Interviews and field visits

Interviews with national and international partners have followed a semi-structured approach, with a few core questions defined in advance, but also ample room for flexibly deviating to other topics.
Interviews and focus groups with the local partners and beneficiaries happened mostly directly in the field, in order to see, and document evidence.

The mission consisted of 14 days in Tajikistan (27.06 - 10.07.2024):

- 10 days in Dushanbe, to launch the mission, meet with the national partners and present the first results of the evaluation
- 4 days (+ travel) in the project regions, where the various sites and activities have been visited:
    - 2 days in Lakhsh and Rasht (trial plots, rangeland, women's group, pasture user union, district authorities)
    - 2 days in Muminobod and Dangara (runoff and innovative crop variety experiments, women's group, rural advisor services, project trust fund)

The summarised notes of all meetings and interviews can be found in *Annex 10: Notes from the partners meetings*.

Key findings and observations

General level of advancement

The project's logical value chain can be presented as a multi-storey construction, which relies on robust foundations. In other words, no storey can efficiently fulfil its role if the lower ones aren't sufficiently strong.

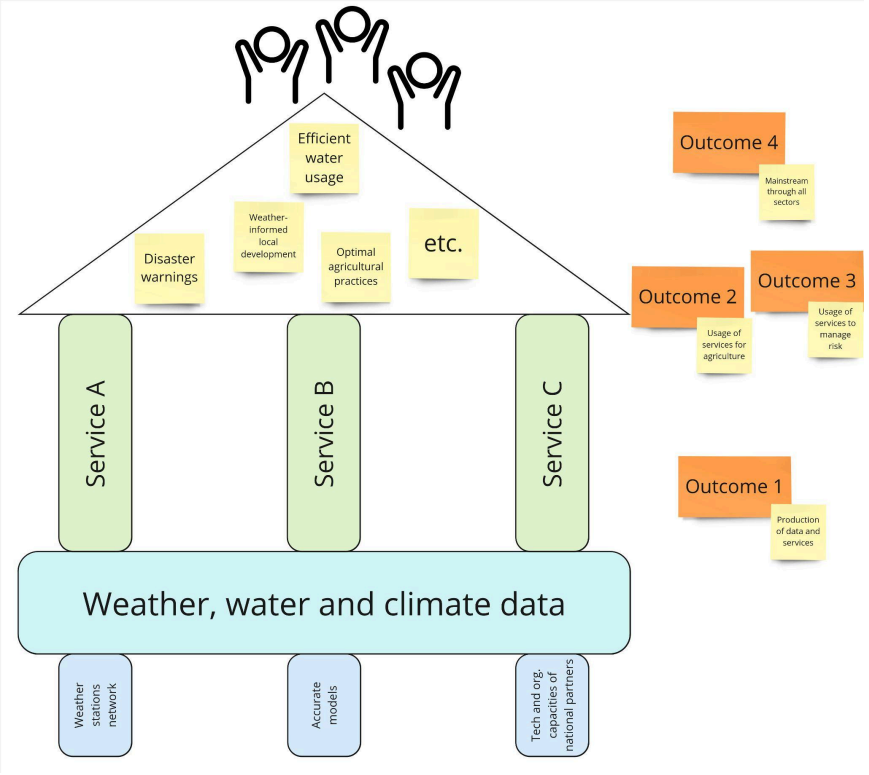


Illustration 2: Outcomes building on top of each other

Following this logic, the phase 1 has strongly focused on the foundations (provision of reliable weather, water and climate data and services), while less activities have been conducted to support the other outcomes:

1. **Outcome 1**: although not yet fully functional and upscaled, a functioning infrastructure to collect and provide weather, water and climate data has been set up
2. **Outcome 2**: the utilisation of WWCS to inform their decisions has been piloted in a few limited use cases, in a controlled environment
3. **Outcome 3**: first simple activities have been conducted with the CoESCD
4. **Outcome 4**: the governmental structures at all levels have been gradually onboarded, but no concrete activities towards the integration of WWCS in the development planning processes have been initiated so far

As a direct consequence, this report will also focus much more on the activities and results related to Outcome 1.

Overall management and steering of the project

Project steering: the NSC

During the 1st phase, the National Steering Committee (NSC) has been primarily serving as an information-sharing platform led by CACH, with very little strategic input from the national partners. This has resulted in a lack of co-development and limited engagement from the national stakeholders, with the notable exception of TJHM, which has been directly involved in the design of the project and of its activities.

Project management: the core project implementers

Strategic and operational discussions on the conduction of the project happen mostly within the CACH team, or bilaterally between CACH and its core partners (ICARDA, SLF, BOKU and MeteoSwiss), but there lacks a platform enabling all implementing partners to keep a full overview of the project's progress and activities. As a consequence, those core partners are not always fully aware of each other's activities, which can lead to missed opportunities for collaboration and synergies among the project's core stakeholders.

Outcome 1: Timely and Effective WWCS Provision by Tajik Hydromet

In general

It is well-known that most development projects cooperating with TJHM face substantial difficulties (TJHM's unwillingness to share data with partners, support requests focusing on equipment, tensions between TJHM and other governmental organisations, etc.). Many past projects have provided TJHM with support and equipment that have not led to substantial and visible improvements of their ability to provide adequate and targeted weather services. In the context of the WWCS project, many signs seem to indicate a significant paradigm change from TJHM's side, opening many windows of opportunities for the second phase. In particular:

- TJHM's initial scepticism towards the low-cost weather stations has been overcome to a point that the WWCS forecasts are now used by the forecasts department. They even praised the low-cost approach, due their budgetal tightness
- TJHM has explicitly expressed their high opinion of the cooperation with CACH ("*We like the project because CACH listens to our needs*", "*We like this project because, unlike others, we see concrete results*")
- TJHM's wish to expand the weather stations network beyond the project's districts, their implication in the deployment of the additional stations, and their requests to expand the network further are a clear demonstration of their increasing interest and commitment

Achievements until July 2024

Until July 2024, the project has achieved the following demonstrable results:

- A network of 180 low-cost and 10 mid-range stations has been deployed throughout the country
- The design of the stations (sensors, connectivity, parameters,...) has gradually evolved throughout the project
- Despite initial doubts, TJHM is now convinced of the relevance of the approach, for two main reasons:
    - The low cost of procuring and maintaining the stations, as opposed to the very heavy costs of their current infrastructure
    - The high level of accuracy of the forecast[2], that TJHM now uses for to feed their own weather bulletins, and that has accurately and timely captured extreme events (cold wave of January 2023, and heavy rains of May 2024)
- Several prototypes of services have been developed and tested on a few users, in a controlled environment. None of the services are however ready for full-scale production
- Due to the anticipated challenges for TJHM to maintain the network in the long-term, feasibility studies have been conducted for the setup of a Public Organisation (PO), which shall ultimately be responsible for providing WWCS services to users, while maintaining the network, under a licensing agreement with TJHM. The envisioned business model builds upon the idea that users will pay a fee for specific services. TJHM is generally supporting the idea, but the PO has not been formally created yet
- Some experiments with citizen science measurements (soil temperature) have been conducted, but have been stopped, due to inconsistencies in the data provided

Challenges and open questions

- The implementation agreement with TJHM was signed only in February 2023, which significantly delayed the implementation of many activities
- Maintenance of the stations: at the time of writing, around 25% of the stations are not responding, and there are no clear and standardised processes to ensure the regular maintenance and repairs (Who notices that a station is down? Who will go to service / repair them? Who will keep logs of the maintenance actions? etc.). It must however be noted that many of the non-responding stations most likely only require a reboot, or a system update.
- Operationalization of the services: now that several services have been tested, the project needs to identify which one(s) should be upscaled and brought into a full productive state
- Technical infrastructure: The development environment is not ready for production yet (e.g. no test environment, limited HW resources for scaling-up, very low bus factor)
- The creation of the PO assumes a market-based business model, in which the PO shall financially self-sustain itself. There is however no strong evidence yet that there is a sufficient market for paid weather services in Tajikistan

[2] TJHM estimates the accuracy to be 90%, which is, according to them, comparable to the accuracy of their own forecasts. They have however not provided specific information on how this accuracy rate has been benchmarked. This number must therefore be taken with caution.

Outcome 2: Utilisation of WWCS by Farmers for Effective Agronomic Practices

In general

The actual utilisation of WWCS by farmers so far is demonstrated by a few concrete examples:

- Some farmers in Lakhsh inform (via Telegram) the WWCS project on the amount of irrigation applied to the trial fields
- Some farmers (in Lakhsh and Muminobod) have been informed about incoming extreme weather events (cold wave, heavy rains), and could proactively act to protect their harvest

The core of the activities contributing this outcome are not directly related to the WWCS, but rather to the testing and piloting of innovative agricultural practices:

- High-performances varieties of wheat and fodder crop
- Run-off experiments
- Seed cleaner (to provide purer seeds, and increase the expected yield)
- Laser-leveller (to reduce water consumption and soil erosion)
- Livestock tagging

In the 2nd phase, once WWCS services are upscaled and made available to a broad number of users, all those experiments can be enriched with WWCS. In turn, the (expected) higher yields and income can further incentivize the WWCS.

So far, only the weather-informed irrigation approach (“the field trials in Lakhsh”) is making an active use of some WWCS (weather forecasts, and measured soil moisture).

Achievements until July 2024

- The trial sites have demonstrated that the weather-based irrigation generates higher yields on potatoes, while reducing water consumption and soil erosion
- Some of the high-performing wheat sorts have been distributed to farmers by the RAS. Fields where those sorts were planted visually indicate a probable higher yield (at least for the first harvest)

Challenges and open questions

- Upscaling those experiments will allow to address some of the biases that were necessarily introduced in the pilot phase. For example, for the Lakhsh trial fields:
    - How many soil moisture sensors will need to be disseminated throughout the community? Does every field need its own sensor, or can we get reliable approximations by sampling the moisture measurements?
    - The treatment field relies on a reservoir, ensuring that it can always be irrigated at the optimal time, as suggested by the model. How well will the approach scale up to the whole community, when water will be actually available only every 14 days?

    - Since most farmers grow potatoes, and experience the same weather patterns and very similar geomorphological conditions, it is expected that most fields will require irrigation at the same time. Will the absolute amount of water available provide for those peaks?
    - How to transition the whole community from the traditional irrigation scheme to the weather-informed approach? This transition might be very challenging if the majority of the village still irrigates “according to schedule”, while some “champion farmers” jump in from time to time saying “now is the right time for my field, please let me access the water”. ?

NB: during the evaluation’s debrief, CACH provided an additional insight: the field experiment meant to be upscaled is the *treatment 1* field (WWCS-based, but without reservoir), and **not** the *treatment 2* field (WWCS-based, with reservoir). Therefore, some of our comments might lose their validity. However, the following needs to be taken into consideration:

1. The local farmers with whom we spoke clearly indicated that the *treatment 1* field was the successful experiment, that shall be upscaled. In particular, they see the reservoir as the main success factor. Expectation management and clarification are needed to ensure that CACH and the local communities remain on the same line for phase 2
2. The upscale of the WWCS approach will still require most (if not all) potato fields in one community to be irrigated at the same time (similar soil moisture, same weather conditions,...). It must be specifically scrutinised whether the actual water supply will be sufficient to absorb those demand peaks, and whether the benefits of the WWCS-approach remain sufficient, when upscaled

- ICARDA works mostly remotely, without a team in-the-country, which slows or hinders their interaction with the local communities. In the 2nd phase, local experts (English speaking and equipped for remote communication) could serve as permanent local counterparts for ICARDA and BOKU, to ensure the continuity of activities in-between their field visits.

Outcome 3: Risk Management by Communities and Authorities

In general

The activities under this outcome have been rather limited so far. However, it will be possible in the 2nd phase to build upon two explicit wishes from CoESCD:

- The ongoing internal digitalization process: the provision of digital services directly to CoESCD staff’s phones and computers (instead of through the kiosks) would directly support this process
- The acute need for “operational information”: what CoESCD is seeking for (localised weather forecasts, Precipitation, Snow levels, Water levels in the water bodies, Avalanche forecast) is exactly what the WWCS project aims at providing.

According to CoESCD, the Hissor hail radar is fully functioning, and nothing prevents them from sharing the data with TJHM. See *Annex 01: Detailed recommendations* for more details on this.

Please note: the current focal point Tojidin Mahmadov informed us that he has been promoted to another position, and might no longer be the project's focal point. Who will replace him, and when, was not known to him.

Achievements until July 2024

- A WWCS kiosk has been installed at CoESCD. The localised weather forecasts are apparently checked daily by the CoESCD officers, who then call their district counterparts to inform them about any relevant weather events

Challenges and open questions

- The comparatively lower involvement of CoESCD, and the behind-the-scene tensions between CoESCD and TJHM have strongly hindered the activities under this outcome

Outcome 4: Integration of WWCS into Development Planning

In general

The activities under this outcome aim at mainstreaming WWCS throughout sectors (education, health, construction, transportation, economy, insurances, etc.). It is therefore evident that no impactful results can be expected after the project's first phase. However, a few activities indirectly contribute to this mainstreaming, either by making the WWCS approach known to a wider audience (NSC, information sessions, conferences, publications, etc.) or by preparing the backbone of a future WWCS broker in Tajikistan (PO or TJHM).

Achievements until July 2024

- Despite being a rather static platform, the NSC contributes to sensitising several sectors and institutions to the WWCS approach. Once productive services will be available, those institutions and sectors might embark more easily, thanks to their prior knowledge of the approach
- A legal feasibility study has been conducted for setting up the PO. TJHM seems to (preliminarily) support the idea

Challenges and open questions

- The lack of active participation of the NSC members in the actual steering of the project prevents a growing national ownership over the WWCS approach
- It is still highly unclear whether the PO can financially self-sustain itself in a foreseeable future. It is also expected that, despite their early agreement, TJHM might become more reluctant, depending on the PO's actual charter and statuses, and on the possible risks of (perceived) concurrence

Deviations from Plan

The following table highlights the most prominent deviations from the original plan that have been observed during the evaluation. As discussed earlier, a deviation must not necessarily be understood as a flaw. Rather, many of the deviations are a demonstration of the project's ability to flexibly and strategically react to change (new partner requests, new opportunities, emerging learnings, etc.). Some "negative" deviations (those that have slowed the project down) are mainly due to external factors (the Covid-19 pandemic delaying the procurement of goods, or the lengthy bureaucratic process to get all the cooperation agreements signed).

Topic	**Deviation**	**Comments**
Geographical scope	Upon TJHM request, the stations have been deployed throughout the country, and not only, as initially planned, in the project regions	This deviation is very welcome, from a scientific perspective (500 stations in the project regions would have been a serious oversampling), and also demonstrates the increasing level of ownership and interest from TJHM
Type of stations and sensors	10 more expensive mid-level stations have been deployed, in addition to the low-cost ones, and additional sensors have been added (solar radiation, e.g.)	This deviation is very welcome, demonstrates the project's ability to flexibly react to emerging learnings, and increases the accuracy of the forecast.
Number of stations	The originally planned 500 stations have not been fully deployed so far	The assumption "more stations = better forecasts" is valid, but only up to a certain point. It is now crucial to setup a robust monitoring system, allowing to better apprehend the "optimal" number of stations to be deployed throughout the country, but also to identify the need for additional improvements (e.g. integration of weather data, deployment of stations in high-mountain areas, etc.). Therefore, we strongly recommend against focusing too strongly on this value of "500 stations". Only a close monitoring of the forecast' accuracy can inform SDC and CACH on the optimal (and cost-efficient) number of stations to be deployed.
OpenSource	The code of the WWCS system, and the design of the stations have not been released yet as OpenSource, and significant work is still required (integration of all parts of the code into one single codebase, documentation, security tests, etc.)	This deviation could be considered critical, but signs from CACH and its partners demonstrate that efforts are underway to a public release. In the light of openness, sustainability, future developments, and to attract additional partners and donors, a specific attention must be put on this, latest at the beginning of the 2nd phase.
PO vs. TJHM	While the project initially envisioned that TJHM would ultimately be the owner and main user of the WWCS system, and the provider of the main	The idea that the PO could financially self-sustain itself is, based on currently available evidence, wishful thinking. Moreover, the energy, time and

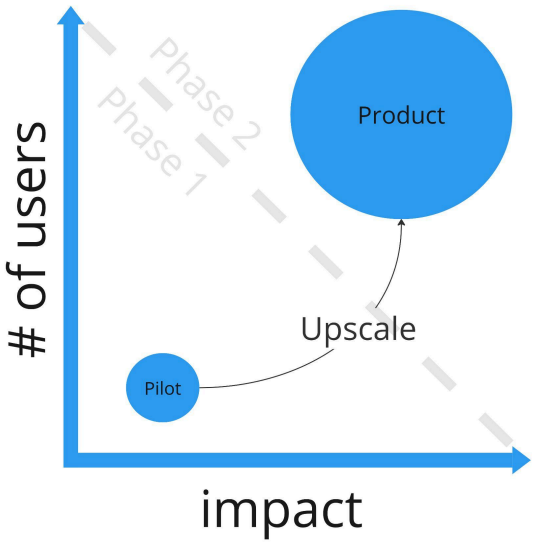
	services, CACH now suggested setting up a Public Organization (PO), which could, unlike TJHM, financially self-sustain itself. Also, the PO could theoretically offer higher salaries than TJHM, thus attracting and keeping competent specialists.	resources that will need to be invested in the creation of the PO seem to not be cost-efficient, or goal-oriented at the time being of the project.
WWCS to inform the experiments	Currently, the WWCS services / forecasts are not used explicitly for informing the optimal irrigation patterns of the potato trial fields. Only soil moisture information (collected through sensors) feeds the process. The other experiments (new wheat and fodder crop variety, water run-off, rangeland, etc.) do not explicitly take advantage of WWCS.	Currently, recommendations on harvest, irrigation and planting scheduling are tested on the WWCS dashboard, but are not directly accessible to the farmers. The recommendations have also not been explicitly evaluated and benchmarked. In the frame of the 2nd phase, specific services can be further tested, fine-tuned and disseminated.
WWCS for disaster risk reduction	During the first phase, no WWCS directly aimed at managing the risk towards natural hazards has been put in place.	Several options are suggested in the detailed recommendations to intensify the cooperation with CoESCD in this direction (WWCS within the CoESCD SOS app, closer cooperation with TJHM for better anticipation of heavy rains,...)

Recommendations for Phase II

This chapter only provides a high-level overview of the recommendations. Please refer to *Annex 01: Detailed recommendations* for operational details.

From piloting to upscaling

The first phase of the project was essentially exploratory, and has focused on testing and piloting various services (telegram bot, forecast dashboard, sms, kiosks, API) and agricultural and pastoral practices (weather-informed irrigation, livestock-tracking, laser-leveller, no-till seeding, etc.), without fully scaling them up. All those experiments happened in controlled environments that do not fully acknowledge the complexity of a full end-to-end implementation. For example:



- Although the **trial sites** have demonstrated the great potential of weather-informed irrigation, the treatment plot (irrigation based on soil moisture) benefited from a reservoir, meaning that the optimal amount of water could be applied at the optimal time. In reality, households from this community receive water only once every 14 days, which might prevent them from optimally irrigating.
- The **irrigation advice services** (telegram, sms) are currently provided to a handful of farmers, and exclusively to ask them to provide information about how much irrigation was applied to their field on a specific day. The actual advice ("please irrigate today") is currently provided in an *ad-hoc* manner, through sms or phone calls from CACH.
- The **weather stations network** demonstrated a great potential, and already very accurate forecasts, but the topographic complexity of Tajikistan, as well as the relatively low spatial resolution of the underlying meteorological model require an even higher density of stations, especially to increase the system's ability to capture extreme and rare events (*Annex 03: Study case on the weather forecast*).

In order for the project to fully unleash its potential, and to create a real impact on the beneficiaries, it will be necessary to focus the project's objectives and activities on the upscaling, mainstreaming and anchoring of the most successful approaches, rather than multiplying new additional pilots and tests.

It must however be highlighted that such upscale will trigger a new range of challenges. For example, in the current pilot phase, a downtime of the WWCS system will not massively disrupt anyone or anything. If, in the second phase, the data is served to the myBabilon

mobile application (with its over 500.000 users), the expectations will reach a fully different level, and it must be ensured that the system can reliably serve a vast amount of users.

Many innovative development projects in Tajikistan stop at this piloting phase, and never succeed in scaling it up to something widely adopted and fully functioning. **With an anticipated 2nd phase of 4 years, the WWCS project has a unique opportunity to really disseminate and upscale some of its successfully tested approaches.**

Key recommendations

1. Focus on upscale

Many development cooperation projects never progress beyond the pilot phase. Given that a day has only 24 hours and partners have limited resources to contribute, it's crucial that in its second phase, this project focuses on upscaling successful pilots rather than piloting too many new initiatives. While some additional piloting might be necessary in some areas, real impact will be achieved by operationalizing and replicating successful pilots to move from controlled tests to creating tangible benefits in the real world.

In particular:

1.1 Get ready for upscale

To support the upscaling of services, it's essential to upgrade and professionalise the technical infrastructure, ensuring scalability and flexibility. Currently, the development infrastructure is minimal, with only one server for development, testing, and production, and a single developer, Omar. While this was manageable during the pilot phase, a more robust environment is necessary for larger-scale operations. This includes building a development team around Omar, establishing separate development and testing environments, and securing access to a high-end server in a dedicated server room.

2. Identify the (few) most impactful WWCS services to upscale

To effectively upscale, identify the few most impactful WWCS services by considering factors such as the potential to reach more people, low-hanging fruits, and the most requested services. The objective is to reach a critical mass of users to create evidence and generate feedback. Initially, deliver these services for free, focusing on a few key services rather than attempting to do everything at once. Once these services are widely adopted and used, we can then start considering a viable business model, e.g. by developing more advanced and complex services, aimed at companies and private sector.

A few services have been pre-identified as being the possibly most impactful ones:

2.1 Simple EWS through Telegram / sms

The evaluators have received very positive feedback from early recipients of the Simple Early Warning System (warnings mostly communicated by phone calls), with many users expressing, "*We really need that*" and “*Most people in our community have access to a smartphone, and the network is usually sufficient to receive simple messages*”. It is

recommended to further develop this EWS, in a very user-centric way, and to focus first on one single type of warning (cold wave, or heavy rains, etc.). Additional features and types of warnings (other weather events) shall be gradually added, based on the feedback from the users. This EWS should also be accompanied by capacity development measures to ensure recipients understand how to react effectively to warnings. This will enhance the overall impact and usability of the EWS, making it a valuable tool for the community.

2.2 The myBabilon App

The myBabilon App presents a significant opportunity for CACH to reach 500,000 users by integrating a "localised weather forecast" service through the WWCS API. By pushing this service to the existing myBabilon app, Babilon subscribers can benefit from localised and accurate weather forecasts. This is a low-hanging fruit because CACH does not need to create an app themselves, allowing them to easily reach a large number of users. This approach will create a strong impact and enable CACH to collect substantial user feedback for future improvements.

2.3 CoESCD’s SOS app

The CoESCD’s SOS app offers a low-hanging fruit opportunity for CACH, targeting 500 users by integrating the "localised weather forecast" service through the WWCS API. By pushing this service to the existing SOS app, users can benefit from localised and accurate weather forecasts. This integration not only has a direct impact on the users but also serves to consolidate cooperation with CoESCD, increasing their interest and ownership in the project. This approach will strengthen the partnership and enhance the app's utility for its users.

3. Further improve the forecast accuracy

The accuracy of the WWCS forecast, currently estimated by TJHM at 90%, is comparable to their own forecasts. However, capturing some extreme events, particularly rain and thunderstorms, remains challenging. To address this, several directions can be envisioned to further enhance forecast accuracy and reliability.

3.1 Increase the density of stations

Increasing the density of weather stations will improve forecast accuracy and make the network more robust. However, there is a limit to how many stations are optimal. It is essential to closely monitor the impact of additional stations on forecast accuracy to determine the optimal number needed for the best results.

3.2 Closely monitor the forecast accuracy

The ultimate goal is to achieve accurate forecasts, with the number of stations being only a means to this end. It is crucial to closely monitor the forecast accuracy to understand how factors like "more stations," "different types of stations," and "stations in other locations" impact the accuracy. Implementing a dedicated dashboard for this monitoring will provide valuable insights and guide further improvements.

3.3 Reactivate the CoESCD radar

The Hissor hail radar, owned by CoESCD, has operational issues that need addressing to ensure continuous functionality and data transmission. Despite CoESCD's claim of operational status during hail season, international experts report it as non-functional due to infrastructure problems. Rehabilitating this radar and ensuring it provides live data to TJHM and the WWCS system will significantly enhance forecast accuracy, particularly for extreme rain events. The necessary cooperation with TJHM can also be presented as an “exchange”: by providing radar data, CoESCD will enable TJHM to provide them back with the "operative information" that they are wishing (more accurate automatic forecasts on snow and precipitations)

4. Freeze the setup of the PO

Given the unrealistic business model for the short- to mid-term, it is recommended to freeze the setup of the Public Organization (PO) until there is evidence of a market for services. Without clarity on the type of services and number of users, it's premature to dimension the PO effectively. The resources spent now on setting up the PO would be better utilized in providing real-life services and gathering evidence of demand and viability. Focus on scaling a few key services to production-level first; only then will it be possible to determine if a PO is the optimal vehicle for service provision.

5. Reactivate the Project Trust Fund

Reactivating the Project Trust Fund (PTF) is recommended as it provides a very flexible way to offer small-scale, impactful support. The PTF has proven to be a great asset, incentivizing and supporting beneficiaries with concrete outcomes. Allocating annual resources for the PTF will address community requests for both minor and more substantial equipment needs, enhancing engagement and solving real-life issues. This approach shifts focus from individual requests to a structured fund, ensuring broader and more effective support, thereby contributing to the project's overall objectives.

6. Bring the new seeds to the local markets

Successful experiments with innovative seeds show promise, but these seeds cannot be recycled indefinitely. To ensure their availability, CACH should partner with private companies, and with local seed multiplication associations, to bring these seeds to local markets. However, it is important to anticipate and mitigate the risk of monoculture and monovariety, promoting diversity in crop cultivation to maintain agricultural sustainability and resilience.

7. Upscale the “Lakhsh potato experiment”

CACH should upscale the experimental potato fields in Lakhsh to full-scale fields to build evidence that the weather-based irrigation approach works effectively on a larger scale, and to identify any necessary adjustments. This upscale could also incorporate drip irrigation, as an additional water-saving measure. The initial trials showed promising results with lower water consumption and higher yields. However, to ensure these results are replicable in real conditions, it is crucial to account for factors like hydric stress, when the water is not

available at the optimal irrigation time. Gradually increasing the number of fields using this approach will help validate the effectiveness and sustainability of the method.

8. WWCS as a global international initiative and digital public good

WWCS requires continuous improvement, including new services, parameters, and models. The market in Tajikistan is too small to sustain it independently through the private sector or international development cooperation. To achieve sustainability, WWCS needs a critical mass of users, developers, and supporters to lower costs for all involved. Leveraging OpenSource and OpenDesign, similar to the openIMIS model, will facilitate global collaboration and innovation. By promoting WWCS as a global initiative, CACH can expand its reach, attract more stakeholders, and ensure the system's long-term viability.

List of annexes

Annex 01: Detailed recommendations

The recommendations for the remainder of the project are organized by thematic topics, but not by outcomes, since most of them will directly impact more than 1 outcome. The most directly impacted outcomes are indicated with the following code:

1

Outcome 1: Tajik Hydromet provides timely and effective WWCS.

2

Outcome 2: Farmers utilize WWCS to inform their decisions for effective agronomic practices, diversified crop mix associations and Sustainable Land Management practices.

3

Outcome 3: Communities and authorities in target areas employ WWCS to manage risks from natural hazards.

4

Outcome 4: Governmental structures at all levels (national, oblast, district, jamoat) incorporate WWCS into their development planning processes.

In addition we indicate whether each recommendation targets the last year of the 1st phase, or the 2nd phase, or both:
First phase
Second phase
First phase & Second phase

Upscale the WWCS pilot services to production-level services

Focus on identifying the few key services that seem the most promising ones, and concretely scale them up to a productive level

1 2 3 4

First phase & Second phase

Explanation	During the project's first phase, some WWCS services were provided as pilots in a controlled environment: ● A very limited number of users ● Sporadic use of ad-hoc communication methods (e.g., direct phone calls) ● Testing various options and approaches (SMS, Telegram bot, kiosks, dashboard, API) ● Limited technical infrastructure ● No autonomous registration or unregistration for new users Conducting such a pilot was a valid approach and in line with industry standards. Initial learnings and experiences were gathered, unpromising options were discarded, and a foundation was laid for future upscaling. Based on these learnings, a few selected services should now be scaled up to production level to evaluate their relevance on a larger scale, in real-world conditions. At this early stage, it is crucial to offer these services for free to end-users. The primary objective should be to build a useful system that provides real value to a large number of users, rather than focusing on immediate self-sustainability. In the future, farmers may be willing to pay a monthly fee if they have concrete evidence that the services can, for example, save their harvest from frost. Without this evidence, convincing them to pay is challenging, let alone convincing 10, 20, or 30,000 farmers. If the services prove genuinely useful and are recognized as such, it will be easier to convince individual users to pay a small fee and attract big companies to pay for more specific services. Once WWCS services specifically targeting farmers' needs are deployed, special attention must be given to ensuring that women's groups receive the relevant information and understand how to act on it, as not all women have direct access to a smartphone.
Possible actions	● Identify the most promising services (see the recommendations below for the 3 services that the evaluators see as the tentatively most relevant ones) ● Use tools and approaches such as The 2-lanes approach (see *Annex 04: The 2-lanes approach*) and the product vision board (see *Annex 09: Identify the right weather services*) to identify, specify and track the services that will be upscaled
Expected benefits	● Reaching a critical mass of users will allow to concretely demonstrate the relevance and appropriateness of the WWCS services, which will lay the ground for possible future business models.

Possibly most promising service #1: simple EWS through Telegram Bot and sms

1 2 3

First phase & Second phase

Explanation	First phase's pilot indicated very positive feedback from the initial users, but also a keen interest from farmers and stakeholders who were not included in the pilot. It seems that the provision of such a service (warning the users from heat and cold waves, strong precipitation, droughts, sandstorm, landslides and avalanche risk) is both relevant and adequate. The provision of such a service must however be accompanied by targeted capacity development measures for some user groups. For example, a warning about an upcoming cold wave is not particularly useful if the local communities do not know how to protect their orchards against it, or if they lack the means to do so. Providing a reliable EWS service for many risks will be a long endeavor (e.g. thresholds must be selected, for each weather parameter, and adjusted for each geographical area). Therefore, CACH should not immediately aim at developing a fully complete service before releasing it to users. Quite the opposite: 1 single weather parameter must be selected (e.g. the most requested one, or the one that can be deployed with the least effort, or the one that will allow to collect more user feedback), and provided, at large scale, to as many users as possible, also beyond the project's regions.
Possible actions	● Identify the one and single weather parameter that shall be supported by the service in a first version ● Develop an end-to-end service and deploy it on an infrastructure that can support the anticipated load ("how many users are we expecting to interact with the service on a regular basis?") ● Gradually add and deploy additional features, prioritized according to users' feedback, and to the product vision. Possible new features could be (amongst many others): ○ Allow easy registration from new users to the service ○ Include additional weather parameters ○ Allow the users to modify the information provided by the service (e.g. "my favorite places", "specific thresholds", "allow the users to provide their feedback and wishes", "allow the users to see the current warnings for another geographic area",...)
Expected benefits	● Address a need that has been expressed by many of the project's beneficiaries and stakeholders ● Release an early version of the service as soon as possible to collect user feedback and generate a real impact quickly. For instance, if a cold wave strikes next winter, it would be unfortunate if farmers across Tajikistan are not informed simply because the service has not been released yet.

Possibly most promising service #2: the myBabilon App

1

Second phase

Explanation	Integrating the WWCS forecasts into the myBabilon app is a possible low-hanging fruit: with comparatively limited effort (no app must be developed), CACH can reach up to 500.000 people. However, the radical change of scale (from serving a few irregular users to serving up to 500.000 daily users) requires a specific attention to the upscaling of the technical infrastructure (servers, maintenance, development environment, etc.). See more details below, under *Enable an upscale of the WWCS infrastructure (from pilot to product)*. In the future, if the service is successfully deployed on the myBabilon app, it could also raise the interest of other mobile phone providers, dramatically increasing the reach, and impact of the WWCS system. The myTcell and Alif Mobi apps both have more than 1.000.000 users. It is therefore highly important that the agreement with Babilon doesn't contain any exclusivity clause.
Possible actions	● Develop a first version of the product vision board for this service, without involving Babilon-M. The goal here is to only identify the vision, from the CACH / SDC perspective. ● Based on this vision, develop a tentative implementation plan, from CACH's side (e.g. adjustments to the backend infrastructure, further development of the API, additional IT resources, consistent maintenance of the weather stations network, etc.). ● Armed with the vision, the implementation plan, and a sufficiently concrete understanding of how the service could look like in the end, approach Babilon-M again, to discuss concrete steps towards a successful cooperation ● Adjust the product vision board, together with Babilon-M ● Start the actual implementation, deployment and testing of the service
Expected benefits	● Comparatively low entry costs to reach up to 500.000 users, thus significantly increasing the demonstrable impact of the project ● Depending on the ultimate technical architecture of the service, most of the technical heavy-lifting could be located on Babilon-M's own IT infrastructure. In other words, from CACH's perspective, the API could serve only 1 user (Babilon-M), who will then bear the load of servicing all apps' users

Possibly most promising service #3: CoESCD's SOS App

1 3

Second phase

Explanation	CoESCD released its "SOS" app in February 2024. This application currently displays (among others) the weather forecast from Hydromet, at Oblast level. It could be improved by displaying localized forecasts fed by the WWCS API. CoESCD indicated a strong interest in this. This integration can also be considered a low-hanging fruit: with comparatively limited effort (no need for CACH to develop its own app), WWCS services can reach up to 500 users (and growing), and foster a stronger cooperation between TJHM and CoESCD. In particular, CoESCD highlighted their wish to digitize and automate the usage of the kiosks: currently, CoESCD officers in Dushanbe would check the weather forecast on the kiosk, and call the district offices with specific instructions. If the forecast were integrated in the mobile app, CoESCD officers at national and district level could be automatically informed.
Possible actions	● Develop a first version of the product vision board for this service, together with TJHM and CoESCD. ● Based on this vision, develop a tentative implementation plan (adjustments to the backend infrastructure, further development of the API, additional IT resources, consistent maintenance of the weather stations network, etc.). ● Start the actual implementation, deployment and testing of the service NB: since the source code of the SOS app is, as far as we know, not OpenSource, it would be very helpful to involve its developers early on. This would allow for direct agreement on the technical requirements, ensuring a smoother integration and implementation process.
Expected benefits	● Comparatively low entry costs to reach up to 500 users (but possibly much more, if the app was to become a standard for CoESD staff in the districts), thus quickly increasing the demonstrable impact of the project ● Increase CoESCD's buy-in for the project, by providing them with a service that they have asked for themselves ● Increase the cooperation between TJHM and CoESCD through a concrete common project

Enable an upscale of the WWCS infrastructure (from pilot to product)

Reinforce and professionalize the WWCS technical infrastructure 1 2 3 4 First phase & Second phase	
Explanation	The current technical setup does not allow for significant scale-up of the WWCS technology: ● The development and maintenance of the backend almost exclusively rely on one staff from MeteoSwiss (Omar). What happens if Omar "disappears"? Or after the end of the project? There exists also no evidence that other MeteoSwiss staff are sufficiently involved in the development and maintenance of the system that they could quickly jump in, should a need arise ● The whole development and deployment environment is not designed for upscaling (e.g. difficult to deploy new functionalities without interrupting the system) ● The available hardware (server) is not sufficient to support massive upscaling (more stations, more requests, more services, etc.) One concrete example: In the week 10-14.06, Omar integrated the Hydromet stations into the WWCS system. Due to the lack of a development environment, this integration happened directly into the production system, which caused the system to be not fully functioning during this period. This is not problematic in the current pilot setting, but will be unacceptable as soon as the services will be provided to real users (e.g. through the myBabilon App).
Possible actions	● Hire a local IT company / developers to form a development team with Omar. This will better distribute the working load, but also ensure that technical competencies are available in the country after the end of the project. This local company should also be in charge of the monitoring / maintenance / trouble-shooting of the technical infrastructure (server and database administration, updates, internet connectivity, security, etc.) ● If possible, identify interested and competent TJHM IT staff and include them in this development team ● Refactor the architecture and increase the scalability of the system (e.g. to have 1 development instance, 1 test instance and 1 production instance) ● Relocate the system's hosting to a more robust and scalable production environment (e.g. to one of the few computing centers in Dushanbe). Active cooperation with a company like Ilmhona could be extremely beneficial for the project (e.g. through the involvement of young IT professionals).
Expected benefits	● Build a robust and resilient technical infrastructure that can support the scale-up of the WWCS to thousands (or more) of daily users

Clean up the source code and release it under an OpenSource license

14

First phase

Explanation	The code stored on GitLab is currently not ready for release and widespread adoption: ● Not all developments are centralized on GitLab: some modules are on a MeteoSwiss GitHub repository, while others developed by CACH are stored internally. ● There is a lack of documentation within the code. ● The code has not undergone external review. These issues present several challenges for the future uptake of the WWCS approach: ● Other developers cannot replicate or contribute to the code. ● There is a lack of transparency, creating a "black-box" effect. ● There is uncertainty about whether the code is "clear enough" for future external contributors or if it can only be understood by its original creators.
Possible actions	● Refactor the structure of the code to have all the repositories in one single project, so that someone interested to replicate the approach, or to contribute to it, can access everything in the same place ● Ensure complete and clear code documentation, also in-line ● Organize an external code review (to ensure that the code is secure, and comprehensive for external developers) ● Move the clean codebase to an open GitHub / GitLab repository (with appropriate license) ● Start using the open GitHub / GitLab repository as THE one and only codebase for future development (incl. feature requests, etc.)
Expected benefits	● The project has consistently aimed for "OpenSource" and "OpenDesign." This recommendation represents the final step to fully open the WWCS code base to new users and contributors.

Facilitate the uptake of WWCS by other projects (incl. in other countries)

CACH as a broker to upscale WWCS to other countries 1 Second phase	
Explanation	One of the central risks of the WWCS approach and technology is that it might become obsolete after the project's conclusion if TJHM (or the PO) is not equipped to maintain and further develop it in the long term. To keep the WWCS infrastructure relevant and efficient, it will need regular maintenance (repairs on the stations, updates to the dashboards and services code) and expansion (new stations, support for additional sensors, other communication standards besides 2G). Without dedicated funds and a long-term backstopping concept, TJHM (or the PO) might not be able to fulfill these tasks. Making the WWCS available under an OpenSource license can be a very effective sustainability strategy to address these challenges: ● If other projects in different countries adopt and replicate the approach, they will contribute to further developing the software, directly benefiting the Tajik WWCS network. ● A broader community of users and developers might attract commercial interest from private companies to provide goods and services (e.g., manufacturing custom boards and sensors, offering technical backstopping). ● Achieving a critical mass of users and use cases would increase the interest of donors and investors in financially supporting the WWCS approach, in Tajikistan and worldwide. ● An increased density of stations in neighboring countries will improve the reliability of forecasts, especially in border areas, provided that national meteorological institutions agree to cooperate. However, successful OpenSource projects rarely thrive on their own. They are typically supported, backed, or led by an institution that coordinates developments, ensuring strategic coherence and quality. This role could be undertaken by CACH. See more details in *Annex 07: WWCS business model as a global international initiative and digital public good*
Possible actions	● CACH and its technical partners take the lead over the GitHub repository, coordinate contributions and ensure consistency. ● CACH promotes the WWCS approach in their projects worldwide, but also among the broader development cooperation community ● CACH facilitates a robust supply chain for setting up and maintaining a WWCS network (e.g. continuously up-to-date list of trusted manufacturers and technical backstoppers, and minimum quality guidelines for all the stations' components)
Expected benefits	● The replication of the WWCS approach and technology in other countries is simplified and streamlined ● The Tajik WWCS directly benefits from developments conducted in other countries (e.g. development of new dashboards and services, that are integrated into the main codebase) ● Reaching a critical mass of WWCS users worldwide, which shall raise the interest of additional donors and investors

Increase awareness around the WWCS API

First phase & Second phase

Explanation	The data collected (measurements) and computed (forecasts) by the WWCS system is made available through an API (Application Programming Interface). In non-technical terms, an API is like a waiter in a restaurant. *Just as a waiter takes your order, tells the kitchen what you want, and brings the food back to you, an API takes requests from one software program, tells another program what you want, and returns the results. It allows different software systems to communicate and work together without you needing to know how they function internally.* Practically, the API allows any developer to retrieve data from any station and use it in their own application. Currently, the API is fully open for testing purposes. In a real production environment, the WWCS project and TJHM might decide to restrict API usage to authorized users only. For instance, initially, only Babilon and CoESCD might be granted access to the API (along with TJHM and core project partners). Alternatively, the project might choose to leave the API fully open to all to encourage innovation. Although this might sound technical, the API is a powerful tool to significantly increase the impact of the WWCS project. Any authorized developer or application could utilize the data, extending the project's reach far beyond its core beneficiaries. Therefore, a global communication and dissemination strategy is essential to ensure that the API is widely known and used.
Possible actions	● Ensure that the API is “clean” (well documented, free of major security concerns, equipped to collect usage statistics, etc.) ● Work with partners outside of the project to develop a few relevant use cases, to demonstrate the usefulness of the API (see, e.g. next recommendation “Organize a hackathon”) ● Work with TJHM to ensure they understand the potential of the API, particularly that it allows them to share useful information while retaining sole ownership of the raw data. Collaborate with them to agree on an access policy that is as open as possible.
Expected benefits	● Multiply the number use cases for the WWCS services and, consequently, amplify the direct and indirect impacts of the project

Organize a hackathon

1 2 3 4

Second phase

Explanation	Currently, the data collected by the stations (measurements and forecasts) is accessible through the API but, concretely, is not being used by anyone outside of the project's core actors (CACH, TJHM, MeteoSwiss, SLF). A common approach to increase awareness on available datasets, but also to identify new use cases and to ideate new services and tools, is to organize and host hackathons, and to invite students, IT companies, NGOs and the civil society to participate. Participants first receive information about the project's scope and objectives, the functioning of the weather stations network, and the technical aspects (API, data model and data format, etc.). They are then invited to ideate, prototype and test ideas that build upon the weather data (measurements and forecasts). This can encompass a broad array of areas, such as: ● Developing new weather-informed models (e.g. landslide risk, irrigation, etc.) ● Developing mobile applications targeting a specific user group (e.g. the paragliding community, interested in specific wind thresholds) ● Designing attractive visualizations to display the data (measurements and forecasts) in a way that is intelligible and intuitive for the target groups ● Developing new use cases (e.g. by identifying and formalizing the needs and requirements of specific user groups) ● etc. At the end of the hackathon, the ideas and prototypes are evaluated by a jury, based on their relevance and on the likelihood that the idea can be implemented in the frame of the WWCS project (scope, complexity, risks, anticipated costs, etc.). In order for the hackathon to be really helpful for the project, some resources must be allocated to finalizing the development and deployment of the "best" ideas. This can also act as a strong incentive for the participants, some of which shall then receive a stipend from the project to materialize their idea. Involvement and backstopping (or, even, active participation) from the project's partners (MeteoSwiss, SLF, ICARDA, etc.) will play a key role to ensure that whatever developments happen during and after the hackathon can then be integrated into the broader WWCS infrastructure. External sponsors can also provide additional technical, financial, logistical or organizational support to the winning teams. Relevant partners to organize such hackathons could be the American Corner Dushanbe and the company Ilmhona (skills accelerator).
Possible actions	● Ensure that the API is correctly documented, to facilitate uptake by the hackathon's participants ● Ensure institutional support for the hackathon (presence of the partners, commitment to support the participants by providing insights and testing the prototypes, etc.) ● Ensure that financial resources and support are available to allow the

	winning teams to further implement their idea after the hackathon, with support and backstopping from the project ● Ensure a strict follow-up with the winning teams, after the hackathon ● If concrete products / services are developed, ensure that (where possible and meaningful) their source code is harmonized and integrated into the codebase of the WWCS ● Develop dedicated communication material showcasing the breadth of ideas that can be generated, and implemented, in a short timeframe, when high-quality data are made openly available
Expected benefits	● Ideate new use cases that are relevant to achieve the project's goals ● Promote the usage of the API ● Involve the academic and private sectors

Increase evidence-based outreach

1 2 3 4

First phase & Second phase

Explanation	The *special report on the 2023 cold wave* brings clear evidence of the relevance, quality and timeliness of the WWCS approach. Reports about similar events should be systematically documented and widely shared through various channels in Tajikistan (throughout the development / humanitarian community, and throughout the governmental partners at all levels). This could strongly increase the outreach potential of the WWCS approach, and the interest of other partners to join the effort. As a side-effect, growing interest might also increase the pressure on Hydromet to engage seriously on this topic, and to actually provide the very needed weather services.
Possible actions	● Create a template for a series of "*WWCS in practice*" publications. The template should also contain sections such as "*How can your organization join the WWCS effort in Tajikistan, or worldwide?*" and "*Contact us for more information*" ● Document each major event (hot / cold wave, intense precipitations, drought, etc.) that has been accurately forecasted by the WWCS. ● Also document major events that have not been sufficiently accurately forecasted, to highlight which areas require further support and investment ● Each such report should be very visual (more illustrations than text), be no longer than 2-3 A5 pages, and be available in at least English and Tajik (also Russian?) ● Those reports should be systematically distributed, in both electronic and paper formats ● Events and conferences can also be used for disseminating the "*WWCS in practice*" publications
Expected benefits	● Increase awareness and interest in the WWCS approach by providing clear and demonstrable evidence of its effectiveness and accuracy. ● Enhance the likelihood of attracting additional donors and partners to join the WWCS effort.

Further improve the forecasting accuracy

Rehabilitate and sustain the Hissor hail radar

1 2 3 4

Second phase

Explanation	The status of the Hissor hail radar, owned and maintained by CoESCD, remains unclear. Several international experts who visited the site reported that the radar was not operational due to a lack of electricity, diesel for the generator, and internet connectivity for data transmission. However, CoESCD claims the radar is fully operational, mostly during the hail season from February to June. With a 200 km radius, the radar does not cover the entire country. Consequently, CoESCD wishes to acquire and install a second radar in Sughd. MeteoSwiss confirmed that incorporating the radar data (as nowcast) could significantly enhance the accuracy of the WWCS forecasting model, particularly for extreme rain events, which are crucial for identifying landslide and erosion risks. Also see *Annex 03: Study case on the weather forecast* NB: Dushanbe airport also operates a radar that could serve a similar purpose. Engaging with the airport administration could be a possible alternative approach, if CoESCD remains reluctant to share the data with TJHM. The evaluators have however not been able to interact directly with the airport administration, and cannot assess their willingness or interest.
Possible actions	● Identify the support needed to ensure that the radar is constantly working and providing live information TJHM and the WWCS system ● Provide said support ● Improve the WWCS model by ingesting live radar data ● Closely monitor the increased accuracy of the model, in order to provide recommendations (to WB, e.g.) on the relevance or not of providing CoESCD an additional radar Since CoESCD has, so far, seemed rather unwilling to grant access to the radar data to other Ministries, some adequate arguments and compensations need to be identified. For example: ● Present it as an "exchange" with TJHM: by providing radar data, CoESCD will enable TJHM to provide them back with the "operative information" that they are wishing (more accurate automatic forecasts on snow and precipitations) ● As long as there is no evidence that the radar is providing useful data to CoESCD and TJHM, the chances are very little that any donor would invest in a second expensive radar for the Sughd region ● Identify Necessary Support: Determine the support needed to ensure the radar is continuously operational and providing live information to TJHM and the WWCS system. ● Provide Required Support: Offer the identified support to keep the

	radar functional, including securing electricity, diesel for the generator, and internet connectivity for data transmission. ● Ingest Live Radar Data: Improve the WWCS model by incorporating live radar data. ● Monitor Accuracy: Closely monitor the increased accuracy of the WWCS model to provide recommendations, such as to the World Bank (WB), on the relevance of providing CoESCD with an additional radar. Emphasize that without evidence that the radar provides useful data to CoESCD and TJHM, it is unlikely that any donor would invest in a second expensive radar for the Sughd region. ● Facilitate Data Sharing: Since CoESCD has been reluctant to grant access to the radar data to other Ministries, identify suitable arguments and compensations. For instance: ○ Present it as an "exchange" with TJHM: By providing radar data, CoESCD will enable TJHM to provide them with the "operative information" they need, such as more accurate automatic forecasts on snow and precipitation.
Expected benefits	● Further increase the accuracy of the WWCS forecasts, especially for extreme and unexpected precipitation events that were not captured by the underlying meteorological model

Further increase the density of the stations

1 2 3 4

First phase & Second phase

Explanation	As of 02.07.2024, and according to the data fetched through the API, 180 low-cost weather stations are currently deployed throughout Tajikistan. A higher density of stations will be required to further improve the accuracy of the forecasts. This increased density will help account for local particularities and high-altitude locations, as well as provide redundancy to mitigate the impact of occasional hardware failures at some stations. At this stage of the project, it is more important to further optimize and improve the overall quality of the data than to prioritize TJHM's autonomy and leadership. If it is too challenging to activate TJHM to take the lead on network expansion, CACH should continue to lead and install additional stations, always in close coordination with TJHM. The rationale is that WWCS forecasts need the highest possible accuracy to attract traction and interest from users and partners. Once the WWCS network is recognized for providing highly accurate forecasts, the demand for data and services will naturally increase, along with the institutional pressure on TJHM to play a central role. Very concretely, to ensure the WWCS network includes data from less accessible areas, such as high mountains that are not reachable by road in winter, a deployment and maintenance campaign should be conducted between Summer and Autumn 2024. However, it is crucial not to focus solely on the number of stations, as the optimal density for the network is currently unknown. Adding more stations is simply a means to an end—improving forecast accuracy. We should consider this: when adding more stations no longer improves forecast accuracy, we can assume we have reached the optimal number. Therefore, the accuracy of the forecast must be carefully monitored - see next recommendation. CoESCD informed the evaluators that they have a list of locations where weather stations could be installed. Facilitating a discussion between CACH, CoESCD, and TJHM regarding these locations could enhance both ownership and collaboration between CoESCD and TJHM. The Tourism Committee could also be included in these discussions to broaden awareness of WWCS throughout the government and address the clear need for better weather forecasts in Tajikistan's tourism sector.
Possible actions	• Work with TJHM to develop a concrete implementation plan for the dispatch and installation of additional stations, as well as for the maintenance and monitoring of the existing ones. Once the plan is finalized, proceed with the installation and necessary maintenance.
Expected benefits	• Further increase of the forecast's accuracy • Increased robustness of the network (more stations = less sensitivity to non-responding stations) • Increase the global interest of other partners

Closely monitor the accuracy of the forecasts

First phase & Second phase

Explanation	To enhance the effectiveness of the WWCS network, we recommend building a comprehensive monitoring system of the forecast's accuracy. This system should include a dashboard that synthesizes and compares forecasted values (such as temperature, wind, and precipitation) with actual measurements from the stations[1]. By systematically tracking and analyzing this data, CACH can identify trends, improve forecast accuracy more effectively and, in general, more efficiently steer the project. For instance, the dashboard could reveal patterns such as: "*The accuracy improved significantly until we reached the 200th station; beyond that point, the trend was less pronounced. However, accuracy saw another boost when we integrated TJHM's historical data into the model and further improved when we began placing stations in remote, high-altitude areas.*"
Possible actions	● Co-design the dashboard together with MeteoSwiss and TJHM (what metrics need to be computed, how to ensure that specific actions can be visualized / queried in the dashboard[2], etc.) ● Develop the Dashboard ● Integrate as much historical WWCS data as possible ● Regularly extract the trends (raw numbers, visualizations, etc.), ● Systematically document those trends ("how much has the deployment of X new stations improved the global accuracy") ● Wisely expand the number of stations, based on the insights provided by the dashboard
Expected benefits	● Such a monitoring system will enable CACH to make data-driven decisions about where and how to deploy additional stations and refine the models. This approach ensures that CACH's and SDC's investments lead to tangible improvements in forecast accuracy, ultimately benefiting the communities that rely on these forecasts for their agricultural and safety needs. ● Ensure that the number of stations deployed is treated as a means to an end, rather than an end in itself.

[1] The existing dashboard currently allows to visually compare forecasts and measurements for each individual station, but doesn't offer synthetic insights over the whole network

[2] E.g. "compute the forecast accuracy for district X until 31.12.2023, when we deployed 10 additional stations, and compare it with the current forecast accuracy"

Push TJHM to provide historical data

1 2 3 4

Second phase

Explanation	MeteoSwiss and BOKU need access to TJHM's historical precipitation data to further improve their models. In addition, BOKU would also need historical data on river runoff, which is most probably owned by TJHM. So far, TJHM has been unwilling / unable to provide this data. CACH and SDC need (maybe also together with other project partners) to further lobby and convince them that the provision of the data to the WWCS project is for their own interest, as it will further improve their ability to provide accurate and reliable forecasts and services. If some of the historical data does not exist in a digital format yet, the project could "compensate" (or incentivize) TJHM by offering technical support for digitizing it.
Possible actions	● Prepare a short narrative, with MeteoSwiss and BOKU, demonstrating the concrete added value of integrating the historical data into the forecasting and agronomic models ● If necessary, organize technical support for digitizing the historical data into a machine-readable format
Expected benefits	● Improve the models from MeteoSwiss and BOKU, and, ultimately, the quality and accuracy of the WWCS services ● Further increase TJHM's ownership on the WWCS approach

The Public Organization (PO)

Postpone the creation of the PO

First phase & Second phase

Explanation	As explained in *Annex 05: SWOT analysis for the setup of the Public Organization* and in *Annex 06: Raw business model for the PO*, there remains lots of open questions regarding the PO: ● It will be extremely complex, and time-consuming for all the involved stakeholders to agree on the PO's relationship with TJHM (e.g. *under TJHM* vs. *fully independent*), and on its governance model (*fully market-oriented* vs. *oversight of TJHM, CoESCD and other institutions*) ● Early and rough calculations indicate that more than 15.000 monthly paid users will be needed to cover the bare minimal costs of running the PO (see *Annex 06: Rough business model for the PO*). At the time of the evaluation, there exists no evidence that this market exists ● As long as the WWCS are still operating in a pilot environment, and are not yet production-ready, it is very difficult to correctly dimension the PO (initial number of staff, with which profile?, dimensioning of the necessary IT infrastructure to run the WWCS, etc.). But the most central question is still: "*Besides the experiments conducted in a controlled environment, and despite the very positive results so far, are we sure that there is a very strong demand, throughout the country, for climate, weather and water services?*" If the answer happened to be "no", we should realize it before putting unnecessary energy into setting up a complex and expensive para-governmental structure. In other words, we suggest to first scale a few services up to a real production-level. Only when evidence demonstrates that the results are successful, will it be possible to determine whether or not a PO is the optimal vehicle to further provide those services. In the worst case, not following this approach might lead to a situation where lots of resources have been invested into setting up a PO, but where this PO ends up not having any real services to sell. This recommendation does **not** imply that a PO is the wrong vehicle for long-term sustainability of the WWCS. It only stresses the need to first build evidence that WWCS services can have a broad outreach, before identifying the ideal institutional structure for its further development and maintenance.
Possible actions	● Freeze the setting up of the PO, and focus exclusively, for the time being, on the further development of the services, in close cooperation with TJHM and CoESCD ● Once the impact of the services and the existence of a market can be demonstrated, evidence-based discussions on setting up the PO can be initiated
Expected benefits	● Instead of investing energy into the setting up of an administrative structure, CACH will first invest energy into "providing real services to real people, throughout the country"

Anchor the WWCS approach and system in the institutional ecosystem

Further contribute to scaling-up Hydromet's capacities 1 2 First phase & Second phase	
Explanation	Regardless of whether the PO is established and fully functional, TJHM will always remain the central meteorological institution in Tajikistan. Therefore, their capacities need to be further developed to ensure they can adequately interact with the WWCS system. Currently, it is neither possible nor realistic to hand over the system to Hydromet due to several issues: ● Lack of IT Staff: There is an insufficient number of IT personnel capable of maintaining the system, including server management and code maintenance. ● Unreliable IT Infrastructure and Internet Connectivity: The existing infrastructure and connectivity are not reliable enough to support the system. ● Lack of Ownership: While TJHM uses the system as a source of information for their forecasts, they do not view it as "their system." ● Limited Training: Only 2-3 staff members have been trained on the maintenance of weather stations, posing a significant risk given the high turnover rate among staff.
Possible actions	● Deploy the system to a TJHM server. During a transition period, the TJHM server can also be just a test instance, to allow them to get acquainted with the technical aspects of the WWCS, while the main productive instance remains under the control of CACH / MeteoSwiss ● IT backstopping: CACH hires an IT expert from a local private company to support / backstop Hydromet IT staff on-site, once a week, for server / system management. The external IT expert should not only "do the work themselves", but also take designated TJHM staff on-board, and gradually hand over the maintenance tasks to them ● Demonstrate to Hydromet the benefits of hosting the system externally (e.g. at a local IT / hosting company), to ensure 99.9% availability of the system, while Hydromet remains the owner of the system ● Train more people in the maintenance of the weather stations. Not only at Hydromet, but also locally in the districts (it is unlikely that Hydromet staff will travel to Lakhsh just to reboot one station) See also Reinforce and professionalize the WWCS technical infrastructure and Clarify responsibilities for the maintenance of the stations
Expected benefits	● The skills required to maintain the WWCS system and network in the long-term are anchored within TJHM. Even if the PO ultimately bears the overall responsibility, TJHM will still need to interact with the WWCS system and data

Clarify responsibilities for the maintenance of the stations

1

First phase & Second phase

Explanation	Currently, the staff trained for installing / repairing the stations consists of: ● Some Caritas staff ● 2-3 Hydromet staff ● Some AKAH staff There is however no clear sharing of responsibility regarding the maintenance and repair of the stations ("who shall physically go to station XYZ to check its status and, if necessary, repair it?"). This clarification of responsibilities is also an opportunity to involve the local TJHM offices, or even some community members, since some maintenance actions do not require a specialist to travel from Dushanbe (e.g. simple reboot, or cleaning the dust away, or even just a visual check to inform TJHM about possible obvious failure causes (such as a visible hardware failure))
Possible actions	● Clarify the responsibilities for various types of events, such as “remote monitoring of the network”, “simple visual check of the station”, “update the station’s firmware”, “plan and organize a trip to maintain stations in a specific area”, etc.) ● Monitor the maintenance (who has repaired which station when, and what was the failure), which will be a central cost factor for the PO ● Train additional people on the maintenance of the stations, with the aim to expand the expertise at local level ● Develop SOPs (Standard Operating Procedures) - see Develop Standard Operating Procedures (SOP)
Expected benefits	● Increase the sense of ownership from TJHM ● Ensure that the maintenance is effectively performed (e.g. between 24.06.2024 and 07.07.2024, the number of non-responding stations fluctuates around 40)

Develop Standard Operating Procedures (SOP)

1 2 3 4

Second phase

Explanation	In order to increase the operational efficiency, but also to boost the ownership and institutionalization, SOPs should be negotiated between all stakeholders, documented and enforced. Those SOPs can for example concern the following topics / processes / activities: ● Regular maintenance on the stations ● Repair of "down" stations, and monitoring of the repairs ● Reaction in case of a forecasted extreme weather event (e.g. ensuring that all relevant stakeholders and possibly affected persons are adequately informed) ● Managing external requests to access the data or the services ● Performing regular controls on the station to ensure the accuracy of the data (e.g. to identify if a station needs to be recalibrated) Those SOPs should facilitate the operations, and not hinder them, or make them more heavy than necessary. Therefore, they should be as light and non-bureaucratic as possible. In most cases, as long as all stakeholders agree on the procedure, the SOP can be no more than a few bullet points, or a simple chart (BPMN, e.g.). Also, those SOPs are not static and are aimed at evolving over time. E.g. some tasks might fall under the responsibility of CACH during a transition period, with the plan to gradually hand them over to the national partners (and to accordingly update the SOPs) During the interviews, TJHM informed that they actively monitor and maintain the stations, and they have been on a maintenance trip just weeks before evaluation. There is however no systematic documentation of this. Also, there didn't seem to be a concrete maintenance plan, indicating which stations should be visited next, or when. This was justified by a lack of time and resources at TJHM.
Possible actions	● Together with the core stakeholders, identify the most central SOPs that must be clarified as early as possible. Possible candidates are: ○ Monitoring of the network and triggering a request for repair / maintenance ○ Planning and conducting a maintenance / repair visit to some stations ○ Reacting to an external request for accessing the data ○ Installing new stations ○ Procuring spare parts for the stations ○ Reacting to a forecasted extreme event
Expected benefits	● Enforce a regular and documented maintenance of the stations, thus ensuring the high accuracy of the forecasts, and the long-term sustainability of the stations themselves ● Shed light on the resources that are effectively needed to maintain such a network on the long-term (which will inform the business model for the PO)

Field experiments and agricultural practices

Upscale the experimental fields in Lakhsh to "real" fields 2 Second phase	
Explanation	The field trials in Lakhsh (potato fields showcasing various irrigation practices) provide a clear demonstration that irrigation informed by soil moisture triggers lower water consumption and higher yields, and are therefore very promising. The experiments however include 2 main biases: ● The intervention field relies on a water reservoir, which means that the field was systematically irrigated at the optimal times. In reality, the community has access to water once every 14 days. In the worst case, up to 2 weeks will pass between «the optimal moment to apply irrigation» and «the moment where water is actually available». Although the WWCS model compensates for this, the real impact of this hydric stress on the future yield must be evaluated. The key question here is : «Did the intervention field provide better results mostly because of the weather-based approach, or mostly because of the reservoir ?». ● Most farmers grow potatoes, and all their fields present similar geomorphological characteristics, and are subject to identical meteorological phenomena. It is therefore very likely that, following the weather-based irrigation approach, most (if not all) fields will require irrigation at the exact same moment. Only a gradual upscale of the approach can determine if the amount of water available to the community can absorb these peaks.
Possible actions	● Gradually increase the number of fields using the weather-based irrigation principles. In particular, “real” fields from the farmers (as opposed to the demonstration plots used so far) need to be included, also to account for possible social distortions (farmer applying more irrigation than recommended, or at a different moment), and to ensure that overall amount of water available to the community at each given day can actually sustain the approach ● Alternatively, the field trial can also be brought closer to the reality, e.g. by removing the reservoir, and relying only on the water provided according to ALRI’s *grafika*.
Expected benefits	● Test the successfully piloted approach in a real environment ● Validate the role played by the reservoir in the successfully piloted approach

NB: additional insights provided by CACH during the evaluation’s debrief might impact this recommendation. Please refer to the evaluation report (p.12). The challenges of upscaling the WWCS-irrigation to the whole community are however not completely lifted by those additional insights, and the recommendation therefore remains valid.

Integrate drip irrigation in the experiments 2 Second phase	
Explanation	As explained in the previous recommendation, the successfully conducted pilot on weather-informed irrigation does guarantee that it can perform equally well in a non-controlled environment, aka “the real world”. Given the water shortages experienced by several communities, it might be relevant to combine this approach with other water-saving methods, such as drip-irrigation. See more in *Annex 11: Study case: drip irrigation*. In particular, the farmer conducting the drip-irrigation experiment in this study case applies water “until the top layer of the soil is wet”. This pragmatic approach seemed successful for him, but could be even optimized through the use of soil moisture sensors, and integration of the WWCS forecasts. Companies such as Katra and Agro-Tajikistan can provide locally the equipment needed for drip irrigation.
Possible actions	● Closely work with the farmer whose experiment is described under *Annex 11: Study case: drip irrigation*, to gather initial figures on water consumption and yield increase ● Support him in conducting his experiment further (e.g. by providing soil moisture sensors, and using weather forecasts to inform the irrigation schedule) ● If this experiment (conducted independently from the project) is convincing, add drip irrigation to the Lakhsh trial plot (and / or to other experiments)
Expected benefits	● Possibly further improve the water-saving potential of the weather-informed irrigation mechanism

Address the risks of mono cropping

2

First phase & Second phase

Explanation	The experiments conducted by CACH in Muminobod aim at identifying optimal techniques, but also optimal crop types. One example is the wheat variety "Moskovski 56", which seems to provide much better yields than the local sorts. If the experiments keep on being successful, those new varieties might attract many farmers. Although possibly augmenting the communities' yields and reducing the seeds' prices (due to a higher demand), vastly relying on one single variety also brings its lot of risks. In particular: ● Genetic Vulnerability: Relying on a single variety increases the risk of widespread crop failure due to pests, diseases, or climate conditions to which that variety may be particularly susceptible. This lack of genetic diversity can lead to catastrophic losses. ● Soil Depletion: Monoculture farming can deplete soil nutrients more rapidly than diversified cropping systems. Continuous cultivation of one variety can lead to specific nutrient deficiencies, requiring increased use of fertilizers. ● Pest and Disease Pressure: Pests and diseases can adapt more easily to a single crop variety, potentially leading to outbreaks that are difficult to control. ● Market Dependence: If market conditions change or the demand for "Moskovski 56" seeds drops, farmers could face economic difficulties due to the lack of alternative seeds. ● Loss of Local Varieties: The introduction of a single high-yield variety might lead to the abandonment of traditional varieties that may have unique benefits, such as resilience to local environmental stresses or cultural significance. Although CACH and the local agronomists are most probably aware of this, those risks have not been explicitly mentioned during any interview. At the very least, CACH should ensure that those risks are communicated and understood by the farmers, and that corrective measures systematically accompany the wider dissemination of those innovative yields.
Possible actions	● Diversification: Encourage farmers to plant a mix of varieties, including "Moskovski 56" and local or traditional varieties, to maintain genetic diversity and reduce risk. ● Crop Rotation: Implement crop rotation practices to maintain soil health and reduce pest and disease pressure. ● Integrated Pest Management: Develop and promote integrated pest management strategies tailored to the new wheat variety and local conditions. ● Education and Support: Provide continuous education and support to farmers about the benefits and risks of the new variety, and how to manage them effectively. ● Monitor and Research: Continuously monitor the performance of "Moskovski 56" and other varieties, and conduct ongoing research to address emerging issues.
Expected benefits	● Reduce the negative externalities of introducing new crop varieties ● Keep a high level of crops diversification, which will have direct positive impacts on the biodiversity, the soil erosion, and the resilience of the communities

Combine fencing with living hedges of shrubs and trees

2

Second phase

Explanation	Farmers often ask support for fencing their fields, as a way to protect them from grazing animals. In the frame of the project, some fencing material has been provided to individual farmers through the PTF. Given the high costs of such fences, it can be recommended to consider a 3-steps approach: 1. Procure and install the fence 2. Plant a living hedge (trees and / or shrubs) along the fence 3. As soon as the living hedge reaches a sufficient size to protect the field against grazing animals and strong winds, the fence can be removed, and installed on another field On the long-term, using a living hedge of shrubs or trees instead of a metal fence on a wheat field offers several advantages: ● Cost Savings on Materials: ○ Metal fences need periodic replacement, whereas trees and shrubs, once planted, will serve for a long time. ○ Soil Reinforcement: ○ The roots of trees and shrubs strengthen the soil, preventing erosion and improving its structure. ● Environmental Benefits: ○ A living hedge promotes biodiversity by providing a habitat for birds and beneficial insects. ○ Trees and shrubs absorb carbon dioxide and release oxygen, improving air quality. ● Microclimate Improvement: ○ A living hedge can protect crops from strong winds, creating more favorable conditions for wheat growth. ● Long-term Savings: ○ In the future, when the trees grow and form a dense hedge, the metal fence can be relocated to another field, reducing the need to purchase new materials. ● Fruits and Products: ○ Some types of trees and shrubs can produce fruits or other useful products that can be used or sold. For combining with cereal crops, it is important to choose shrubs that will not compete for resources and will not cause issues with pests or diseases. From the listed options, the least harmful for cereals are: ● Barberry (Berberis): Barberry has a deep root system that does not compete with the shallow roots of cereal crops. It also does not attract pests that could harm the cereals. ● Hawthorn (Crataegus): Hawthorn also has a root system that does not significantly compete with cereal crops. It is resistant to diseases and pests, making it a good neighbor for cereal fields. These shrubs will provide effective protection against livestock while minimally impacting the health and growth of cereal crops.

Possible actions	● Test this approach when farmers request support for fencing their field
Expected benefits	● One single fence can be reused, over the years, on several fields, thus massively increasing the effectiveness and impact of the measure

Put on hold the citizen science soil temperature measurements 1 2 First phase & Second phase	
Explanation	The collection of soil data through citizens / farmers can be very helpful to raise interest and participation from the communities, and to broaden the scope of the collected data. However, the project's attempts in this direction have shown a lot of operational challenges: ● The quality and regularity of the data appeared to be dubious ● The top-up mechanisms (incentives) can trigger harmful behaviors (e.g. providing more measures (even wrong ones) rather than providing good measures) ● The thermometers cannot be calibrated throughout all the project regions, resulting in possibly not comparable results
Possible actions	● In the absence of a strong evidence of the proven benefits of this approach, it might be recommended to put it on hold, in order to dedicate more resources to the other activities that bring more value towards the project's outcomes
Expected benefits	● Reduce the amount of project's energy, time and resources invested in an approach that hasn't proven tangible benefits

Provision of goods to the communities and partners

Acknowledge the need to provide equipment to the communities and partners

2 3

Second phase

Explanation	In most development projects, including WWCS, the provision of goods and machinery is often kept to a minimum. These projects typically focus more on capacity development, policy-level advice, and the testing and introduction of new approaches. The provision of goods (machinery, equipment), although strongly requested by the Tajik Government, is often seen as unsustainable and a potential source of corruption. However, the WWCS project has provided several communities and partners with small and mid-sized equipment (e.g., laser levelers, seed cleaners, tablets). This appears necessary to enable beneficiaries to implement the suggested approaches and thus achieve tangible impact beyond the limited scope of piloting and testing activities. This evaluation cannot prescribe a specific sum or percentage to be dedicated to the provision of goods. However, it emphasizes the importance of continuously assessing beneficiaries' requests and not dismissing them outright. For example, CoESCD and ALRI frequently request international partners to provide bulldozers or other heavy machinery to clean water channels and landslide debris. While there are valid concerns about the actual use of these machines, their long-term maintenance, and the potential duplication of efforts by other development partners, these institutions cannot fulfill their roles without such equipment. This limitation would significantly hinder their ability to contribute to the project's vision and objectives. This recommendation is not an appeal to massively procure heavy equipment for partner institutions and communities. Instead, it acknowledges that the project's current approach, which includes a balanced provision of necessary equipment, appears to be well-judged.
Possible actions	• Continue taking those requests seriously, and not disregarding them under the reason that SDC and CACH do not act as humanitarian organizations in this project
Expected benefits	• Further enable the partners to actually benefit at larger scale of the project's experiments • Keep the partner's level of interest and commitment at a high level

Reactivate the project trust fund (PTF)

2 3

Second phase

Explanation	The Project Trust Fund (PTF) has been successfully implemented to provide small funds for beneficiaries to realize specific projects (e.g., building a greenhouse, fencing a field). As far as we know, the fund has been completely utilized, and there are no concrete plans to reactivate it in the second phase. During interviews, many community members requested support for minor equipment (e.g., seeds, fences, pipes and pumps) and more substantial equipment (e.g., motorcycles for Rural Advisors, motor-cultivators (мотоблок) for women's groups in Muminobod). Instead of addressing each request individually, these needs could be met through the PTF, which could be reactivated with an annual lump sum. In the first phase, recipients of the funds were required to commit to using the WWCS services. This requirement should be removed for the following reasons: ● Such a broad formulation is difficult to monitor (what service should they use? How often? For what purpose?). ● The most effective way to convince people to use WWCS services is to provide them with a useful service that makes a real difference in their lives. See above for details on how to upscale the WWCS pilot services to production-level services. A possible reformulation for the role of the PTF could be: "*flexibly provide communities and individuals with punctual small-scale support that, broadly speaking, contributes to achieving the project's objectives*"
Possible actions	● Allocate in the budget an annual amount of resources for the PTF ● Further communicate with the key beneficiaries and partners on the scope, timeline and rules of this fund ● Allocate the funds each year to support meaningful requests from individuals in the project regions, or from groups already involved in the project
Expected benefits	● Incentive for the communities to on-board the project, and to actively participate ● Solving "real-life" issues, even at small scale, can have a very concrete and positive impact on the people's lives

On the management and steering of the project

Co-development in the project steering: re-launch the NSC  Second phase	
Explanation	The NSC is supposed to be the high-level body overseeing the steering of the WWCS project and approach. So far, it has rather acted as an information mechanism, CACH providing information and updates to the main stakeholders. But no really active discussion or steering mechanisms can be observed. In order to become active, the WGs will need a clear mandate and deliverables and, possibly, some resources to ensure that activities can be conducted. E.g., CACH could allocate a budget to the "Sustainability and business model" WG to conduct a study on possible business models. Although this might sound artificial (Caritas can conduct this study itself), it could, if successful, increase the ownership of the national partners on the whole WWCS approach.
Possible actions	● Transform the steering committee meetings into "real" piloting platforms, where the project's advancement is critically and constructively discussed, with inputs and facilitation from all the key stakeholders, rather than being a static report meeting. This could be facilitated by re-initiating and activating working groups under the NSC. Possible topics for the working groups could be: ○ Maintenance and upscale of the weather stations network ○ Service delivery ○ Sustainability and business model ● In parallel, the NSC in its current form (with external observers) could be used mainly for outreach, while the actual steering and operations take place at the level of the WGs
Expected benefits	● Increase national ownership

Co-development in the project management: monthly meetups

1 2 3 4

First phase & Second phase

Explanation	Strategic and operational discussions on the conduction of the project happen mostly within the CACH team, or bilaterally between CACH and its core partners (ICARDA, SLF, BOKU and MeteoSwiss), but there lacks a platform enabling all partners to keep a full overview of the project's progresses. As a consequence, those core partners are not always fully aware of each other's activities, which can lead to missed opportunities for collaboration and synergies among the project's core stakeholders. E.g. ICARDA didn't seem to be fully aware of the latest developments in terms of the weather station network, while SLF and MeteoSwiss don't know in detail what is happening on the trial sites. A short monthly meetup for all key actors, across all work packages, might facilitate the integration, and the identification of synergies. The objective here is to vastly increase the interconnection between the project's key partners / implementers, but without substantial burden. Those meetups should be, in essence, very light, action-oriented, with a very strict time-keeping (5 min. for each input). Those meetups should be productive work sessions, they are not reporting sessions, and are not meant to control the advancement of the work packages. They should be useful for all project partners / implementers to better understand the overall picture of the project. Therefore the very existence of those meetups, and their form, should be regularly and consciously put into question: if most participants no longer see them as useful, they should be redesigned, or even suppressed. Whether or not the national partners should be included vastly depends on their actual involvement in the project. Should they actively contribute (e.g. by conducting activities on their own), they should definitely be included. If not, their inclusion would rather be detrimental, because the meetup belongs to "those who actually do the work". Including "inactive" participants would quickly turn the meetups into formal reporting sessions, leaving little space for purpose-oriented collaboration, transparency and honesty.
Possible actions	● Set Up a light platform for the project's key partners / implementers to increase their overview of the whole project's activities. E.g. a (monthly?) virtual meetup could be initiated, with the following characteristics: ○ Each partner summarizes [in 5 minutes max.] its activities, successes and challenges of the past month, as well as activities and envisioned challenges for the coming month ○ Each partner is encouraged to jump in proactively, if synergies can help overcome specific challenges, or if they have ideas / suggestions that can positively contribute to achieving the project's goals ○ The content of the virtual meetup is documented in a very light way: no formal protocol, but, e.g. a board on a virtual whiteboard such as Miro.

	○ Especially at the beginning, this meetup will need to be facilitated by someone (ideally someone internal to the project), to ensure that an efficient way-of-working is applied to those meetups. The worst that could happen to them is if they turned into “each participant lists the task achieved during the past month, without anyone really listening”. Several industry-standard facilitation methods can be used to reduce this risk
Expected benefits	● Remove impediments, thanks to a more frequent and direct interaction between all core project partners ● Increase the chance for synergies and direct collaboration between project partners ● Ultimately, increase the impact and the effectiveness of the project

Create and maintain a simple map of all the project activities

Second phase

Explanation	There is no single comprehensive overview of all the project activities (weather stations, women groups, trial fields, kiosks, experiments,...). In order to better comprehend the scope and reach of the project, but also the interactions between activities, it would be very helpful to build a simple dynamic map (Qgis, uMap, Google Map,...) which shows the location of all activities, displayed by categories. As a reporting and communication tool, the key indicators, facts, success stories could also be integrated on the map. Such a map could be either openly accessible to anyone on the www.wwcs.tj website, or could be restricted to authorized users only.
Possible actions	● Create and maintain a geocoded list of all activities, incl. basic information (e.g. category, current status, short summary, key indicators, pictures,...) ● Display this list on a dynamic map, either locally (Qgis) or on the web (uMap, Google Map)
Expected benefits	● Ensure that all staff and partners share a clear understanding of the project's vision and activities ● Efficiently communicate and report on the activities and achievements

Annex 02: Evaluation of the WWCS project against the DAC criteria

This table summarizes the information requested by chapter 3.4 of the Evaluation's ToR.

Criteria	Observations
Relevance	The thematic focus of the project (*better weather, water and climate data for more informed decision making*) is extremely relevant for many sectors in Tajikistan. This has been confirmed by all interviews, at local, district and national levels, and is emphasized in several sections of the National Development Strategy 2030 ("*Prevention or prediction (reduction) of vulnerability*" as one of the Strategy's 3 basic principles; "*Ensuring food security*" as one of the Strategy's core objectives for the next 15 years; "*Integrated water resource management*" and "*Diversify agricultural production, as well as introduce innovations with minimum impact on the environment and quality of land*" as two of the main activities identified to reach the strategic goals). During phase 1, Tajik Hydromet has been much more involved in the project than all other partners, which is perfectly understandable, since the project's 1st outcome ("*Tajik Hydromet provides timely and effective WWCS*") lays the foundation for all other activities. The observed gradually increasing adoption of the WWCS approach by TJHM indicated a strong alignment. At the local level, the project's activities are still in a pilot phase. The first feedback stemming from the local communities and authorities indicate that the approach suits them, but only the upscale planned for the 2nd phase will confirm this hypothesis. During the evaluation's field trip to Rasht, a violent thunderstorm with heavy precipitations has triggered many landslides, blocking the road Dushanbe - Rasht at several locations. This thunderstorm, a very unusual event in this season, has not been forecasted neither by the WWCS system nor by TJHM. Even the commercial company MeteoBlue, despite relying on several high-resolution models, has strongly under-estimated the violence of this event. This anecdote perfectly illustrates, on one hand, the significant challenge of providing accurate forecasts in a mountainous country, but also, on the other hand, the high relevance of this endeavor, even beyond the project's core sector (agriculture). **Notes and recommendations:** Some of the project's activities are based on hypotheses and assumptions that have not been fully proven yet. For

	example, although the interviewed community members asserted that accurate weather forecasts will help them in their farming practices, it is not clear yet to what extent such forecasts will actually trigger significant behavioral change. It is also not clear what exact information (forecasts? warnings? agricultural advice?), and through which channel (telegram bot? mobile app? kiosks? sms?) have the highest potential. The clear recommendation is to co-design the services with the users, in a very iterative way, with frequent feedback loops between the project and the users.
Coherence	As explained above, the project's logic is very coherent with the national development strategy, and with the core mission of the main national partner, Tajik Hydromet. Most national partners either have already started a process of digitalization of their activities (CoESCD, TJHM), or are strongly interested in this (Committee for Food Security). The project clearly supports this. The project's activities themselves are mostly very coherent, with the vision to mainstream weather services into several sectors (agriculture, DRR, local economy, etc.). A few side activities, however, seem to not really leverage the WWCS approach. Examples are: ● The project trust fund: although the grants are supposedly conditioned to the beneficiary's engagement to use WWCS services, this condition seems to not be fulfilled in practice ● The cooperation with the Committee for Food Security: although some activities under this component (early warning on heat and cold waves for herders) are supposed to leverage WWCS, the Committee's interest seems to mostly concern its internal digitalization needs Amongst all national partners, TJHM is demonstrating the highest level of ownership: integration of the WWCS forecast in their own processes, semi-autonomous deployment of new stations, etc. Their limited human, technical and financial capacities obviously hinder a higher level of commitment. The project's National Steering Committee has acted as an information mechanism, CACH providing information and updates to the main stakeholders. But no really active discussion or steering mechanisms can be observed. **Notes and recommendations** The few activities mentioned above that do not seem to be fully coherent (yet) with the project's approach can however be further pursued during the 2nd phase, for 2 main reasons: ● They can help increase the partner's buy-in and trust, which could later result into a deeper integration of WWCS ● As explained the *Annex 04: The 2-lanes approach*, some activities can also be piloted, evaluated and gradually

	enhanced, before being scaled-up The transition towards the second phase could be a perfect opportunity to re-launch the National Steering Committee into a more active and purpose-oriented body. See more details under *Annex 01: Detailed recommendations*.
Effectiveness	The project's first phase has been mostly exploratory, testing and piloting various approaches and ideas. Since none of them has been fully scaled-up yet, the evaluation of the concrete results is rather limited. However, a few very concrete outputs could be achieved (based on the indicators from the project's logframe): ● Impact level: ○ The results at impact level cannot be adequately measured after the pilot phase. Only a broader upscale in phase 2 will allow for a meaningful assessment ● Outcome 1: ○ Deployment of 180 low-cost weather stations, most of which send consistent data to the WWCS system ○ Identification of a few key services that bear great potential for upscale during phase 2. Their broader deployment will allow to monitor the rate of adoption among the population ● Outcome 2: ○ Several new crops have been tested, and, for some of them, disseminated through the RAS. Most of them have been planted this year for the first time, thus not allowing to evaluate the yield increase ● Outcome 3: ○ No systematic EWS could be established so far. Ad-hoc measures have however been taken to inform (per phone call) the local populations of upcoming cold wave or heavy precipitation ● Outcome 4: ○ Due to the absence, so far, of fully deployed services, no development planning process has taken advantage of the WWCS services so far The capacity development measures have been spontaneously praised by the local communities. **Notes and recommendations** Only an upscale of the piloted approaches and services during the 2nd phase will allow to match the actual results against project's targets and objectives
Efficiency	Evaluating the efficiency of the project (in terms of human and financial resources) at this stage is premature, as it has focused solely on piloting activities without yet scaling them up. This is akin to researching and engineering a new car; until the first car hits the market, all investments appear as "pure loss." The true measure of efficiency, in terms of human

	and financial resources, can only be assessed once the project has been fully implemented and its outcomes and impact realized. Therefore, only time will reveal whether the project has been efficient in its resource utilization. One element must however be highlighted here: while TJHM was very doubtful about the low-cost weather stations at the beginning of the project, their cost-efficiency (for the procurement and maintenance) has ultimately convinced them of the approach. In terms of steering, the main challenge seems to lie in the relative passiveness of the National Steering Committee. A relaunch of the NSC, giving a more central role to the national partners, and with reactivated working groups should be attempted (despite the obvious difficulties) in order for the steering to be (at least partially) owned by the national partners. **Notes and recommendations** The project's 2nd phase shall now evolve from a pilot mode to a broad upscale. See specific recommendations on this in *Annex 01: Detailed recommendations*. Only the impact of this upscale (e.g. in terms of beneficiaries reached by the WWCS services, or the increased yields and decreased water usage triggered by the agricultural approaches carried by the project) will allow to comprehensively evaluate the project's efficiency. It is also very important to highlight that, up to now, it is impossible to say whether or not a self-sustaining (and profit-creating) business model can be realistically envisioned for the Public Organization. Therefore, the DAC criteria "efficiency" must be understood through the prism of a most probably subsidized WWCS system. More information can be found under *Annex 05: SWOT analysis for the setup of the Public Organization* and *Annex 06: Raw business model for the PO*. In the worst case, the subsidies will further come exclusively from SDC and CACH, but various recommendations aim at possibly increasing the source of financing and support to sustain the WWCS system. See *Annex 01: Detailed recommendations*.
Impact	Similarly, the actual impact of the project can only be evaluated after a broader upscale of the piloted approaches. However, some observed marginal impacts could indicate that a scale-up could actually prove the impactfulness of the project: ● Behavioral change: ○ Despite initial doubts TJHM uses the WWCS dashboard and really sees advantage of the low-cost approach (while also seeing the limitations) ● Impact on the communities:

	○ Some farmers have already seen a yield increase in some small-scale experiments (weather-based irrigation, new wheat sort,...) ○ The realization of small projects through the Project Trust Fund has had a significant impact on individual farmers, e.g. allowing them to grow vegetables, chickpeas or wheat on previously non-usable fields **Notes and recommendations** The project's 2nd phase shall now evolve from a pilot mode to a broad upscale. See specific recommendations on this in *Annex 01: Detailed recommendations*. Only this upscale will allow to measure the actual impact of the project on the beneficiaries.
Sustainability	A very visible evolution has been observed since the beginning of the project. While TJHM was very doubtful at the beginning, they have slowly taken some ownership, by integrating the WWCS dashboard in their own forecasts, and taking the lead on the maintenance of some stations. But due to a lack of internal capacities, they have not achieved a full level of ownership and leadership yet, which will be key in the long-term sustainability of the WWCS approach. Regarding CoESCD, the amount of activities concretely implemented with them is too scarce to really assess the extent to which they will really demonstrate ownership. Some of the evaluation's recommendations aim at increasing their interest, and ownership in the WWCS approach. The central question regarding the sustainability of the WWCS approach has to do with the long-term maintenance of the WWCS network and infrastructure. While the project initially envisioned anchoring the system at TJHM, the idea of setting up a Public Organization emerged during the 1st phase, moved by the vision that the PO would be allowed (unlike TJHM to sell services and to financially self-sustain itself). At the moment, there are no indications that such a business model is a realistic endeavor in Tajikistan. See *Annex 05: SWOT analysis for the setup of the Public Organization* and *Annex 06: Raw business model for the PO*. At the local level (in Muminobod), the RAS (rural advisory services) seemed to be very well received by the local farmers, and evidence could be collected that the RAS promote some of the approaches and innovations tested by the project. The scope and timeline of the evaluation has however not allowed to conduct a broader survey, and the evaluators' opinion relies only on anecdotal observations, and on the common sense. No unintended negative consequences of the project could be observed during the evaluation. The only identified risk concerns the possible over-usage of mono-crop practices, triggered by the positive results of some experiments (e.g. the higher yields generated by innovative wheat sorts). See specific recommendations on this in *Annex 01: Detailed*

	recommendations. **Notes and recommendations** Regardless of whether or not the PO will be (successfully) established, no one can predict if it will be able to financially self-sustain itself (let alone be profitable), and the risk of the PO collapsing due to a lack of income must be taken into account. With this possible scenario in mind, the WWCS project must ensure that TJHM capacities will continue to be raised and kept up to level with those of the PO, so that TJHM will be, at least technically, equipped to take over the system from the PO. Also, **the one and only best sustainability strategy for the WWCS approach** is to ensure that it provides accurate, timely and adapted services and information to its end-users. Once this is the case, the user base will grow organically, and additional donors, investors and clients will be interested to join the effort. It will also become clearer, whether there is really a meaningful space for a PO, or whether TJHM shall remain the core owner of the WWCS. In other words, the number 1 objective of the project's 2nd phase should be to provide a few selected services ● to the broadest possible user base, ● that effectively address very clearly identified use cases and needs, ● in a professional and industry-standard manner (99% availability of the service, security issues reduced to the minimum, equipped to efficiently, but anonymously, monitor the usage and the behavior of the users, etc.) Therefore financial self-sustainability should not be the first priority, because, at the time being, it is based on non-provable assumptions. The first priority should be to provide useful, reliable, accurate and asked-for services and info. Once this has been done, let's see how to make it self-sustainable.

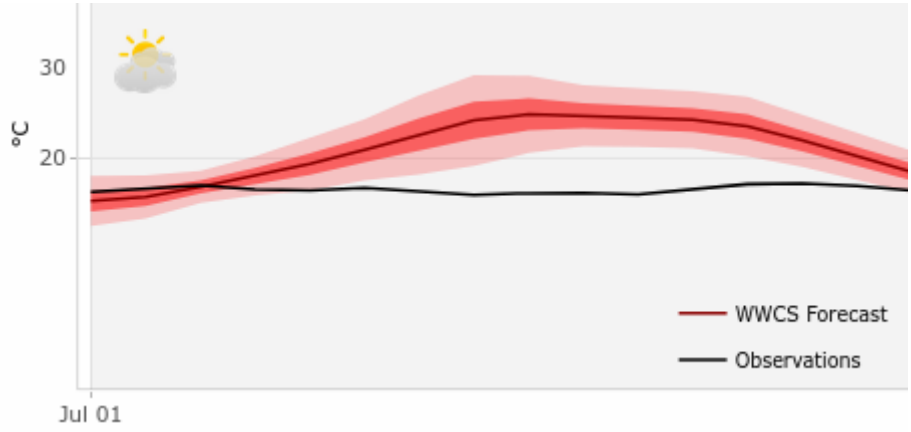
Annex 03: Study case on the weather forecast

Context

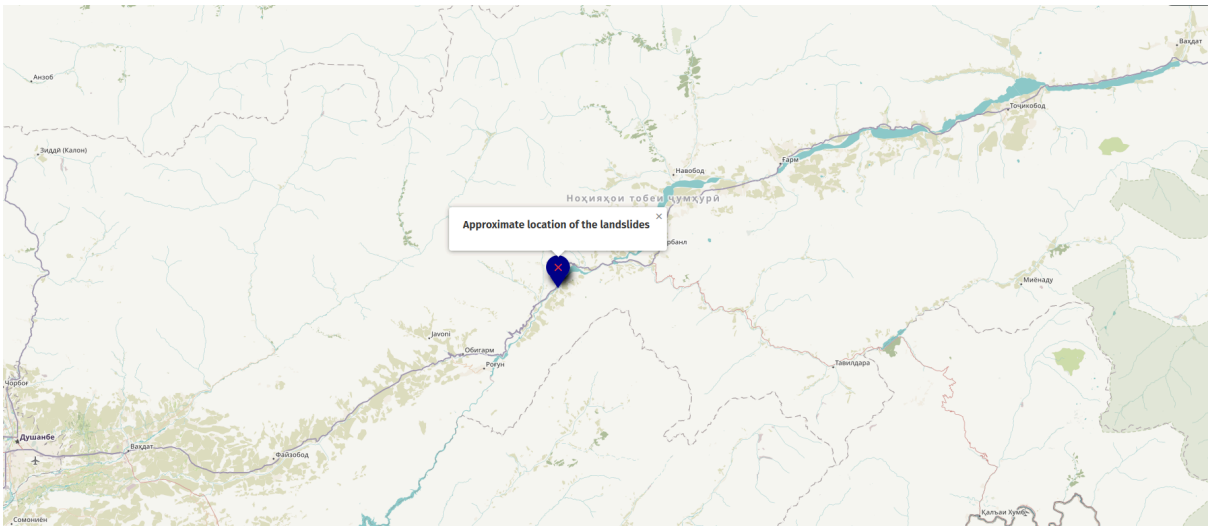
The evaluation's field trip to Rasht valley (29.06-01-07) provided the evaluators and the project with an interesting case illustrating how challenging the accurate forecast of extreme weather events can be.

The event

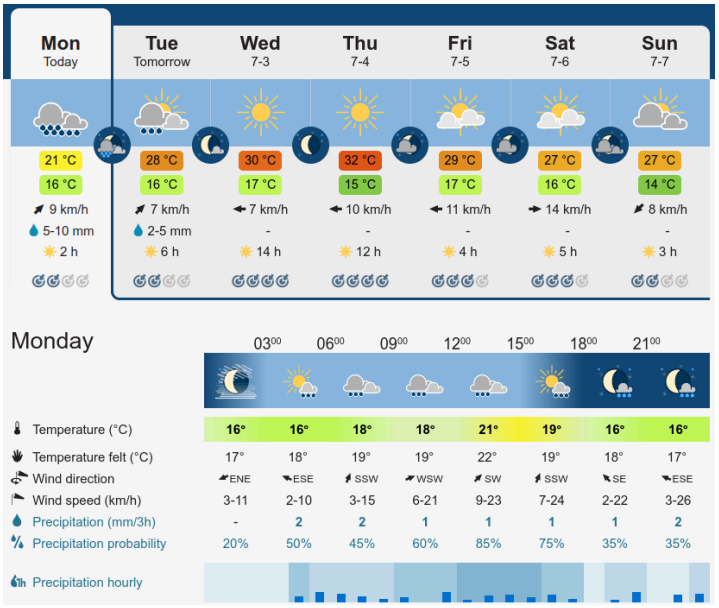
The WWCS weather forecasts for Rasht on Monday, 01.07.2024 anticipated a rather sunny day, with marginal cloud cover, and temperatures up to 24°C. The reality, as displayed with the black line in the below illustration, looked very different:



This unusual gap in temperature was caused by a massive thunderstorm hitting the region from early morning to mid-afternoon, which couldn't be properly forecasted by the model. The sudden amount of precipitation has triggered many landslides, blocking the main road for several hours [in at least 5 locations](#).



It must be noted that MeteoBlue, a commercial weather forecast provider, also vastly underestimated the amount of precipitation on that day, although identifying slightly more accurately the likelihood of showers:



In its daily bulletin, Hydromet had anticipated a residual risk of mudflows, but without any local specifications.

Предупреждение!

1-2 июля в отдельных районах РРП, Согдийской области и по западу Горно-Бадахшанской автономной области сохраняется угроза селевых явлений локального характера. С 1 по 3 июля в отдельных районах Хатлонской области, районах республиканских подчинения и г. Душанбе в связи с метеорологическими факторами (пыль, проникающая в страну с юго-запад и северо-западного направлений) ожидается повышение уровня загрязнения атмосферного воздуха взвешенными веществами (пылью), частицами размером 10 мкр (Рм-10) и частицами размером 2,5 мкр (Рм-2,5).

Approximate translation:
Warning!
On July 1-2 in certain areas of the Region of Republican Subordination, Sughd Region, and in the western part of the Gorno-Badakhshan Autonomous Region, ***there remains a threat of local mudflow phenomena****. From July 1 to 3 in certain areas of Khatlon Region, republican subordination areas, and Dushanbe, due to meteorological factors (dust penetrating the country from the southwest and northwest directions), an increase in the level of atmospheric air pollution with suspended particles (dust), particles of size 10 microns (PM-10), and particles of size 2.5 microns (PM-2.5) is expected.*

Finally, farmers involved in the Lakhsh activities informed us that it hadn't rained a single time during the whole Summer 2023. This event was therefore by all means a statistical outlier, which shouldn't put the WWCS approach, or its underlying model into question, but upon which the project can build to further improve the system.

How to build upon this event?

Several reasons have been identified as being the root causes for the WWCS forecast's inaccuracy for this particular event:

- The local forecasts are, for the time being, only calibrated for temperature. Not for precipitation
- The definition of "light rain" (as depicted by the icons on the meteogram) is calibrated on thresholds developed for Switzerland
- The underlying model (ECMWF) cannot perfectly account for the very complex topography of Tajikistan. The stations can help to reduce the uncertainties up to a certain level only
- A radar-measurement of the current precipitation (*nowcast*) could be integrated into the model, to better react to such localized and unusual events

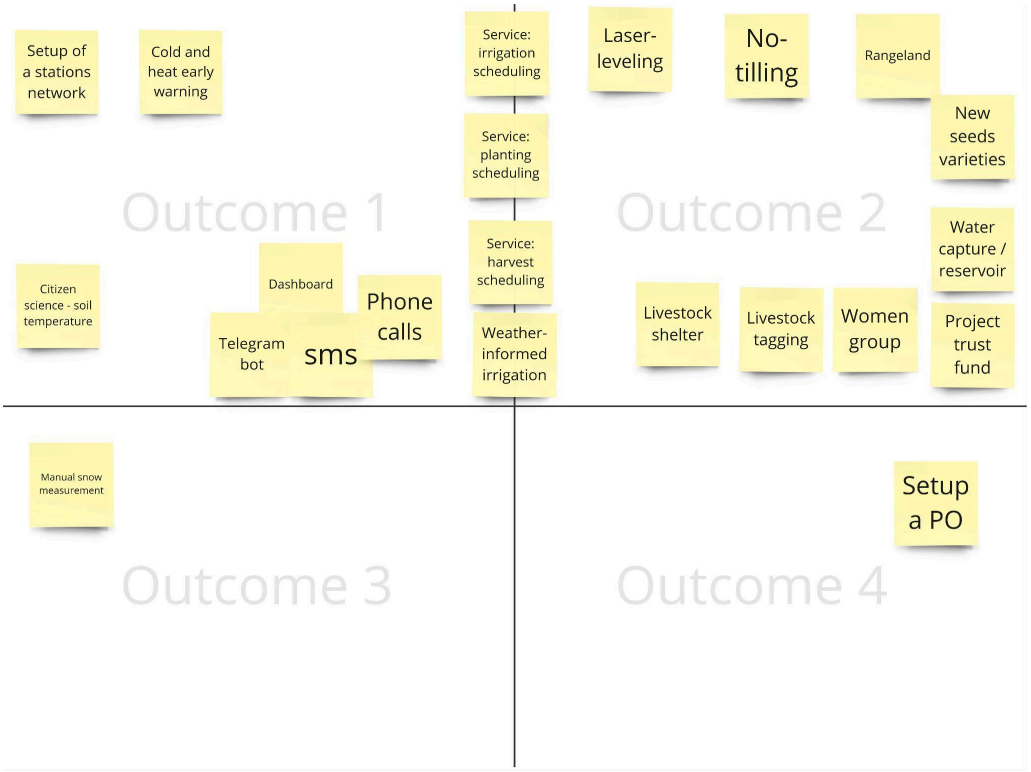
Therefore, the following elements can be taken into account for the project's second phase:

- Further increase the density of the stations network and, in particular, increase the amount of stations equipped to measure precipitation
- Increase the cooperation with CoESCD (and provide them with technical support, where needed) for integrating *nowcasts* of precipitation, by leveraging their radar station
- Closely monitor and document the evolution of the forecasting accuracy

See *Annex 01: Detailed recommendations* for more details.

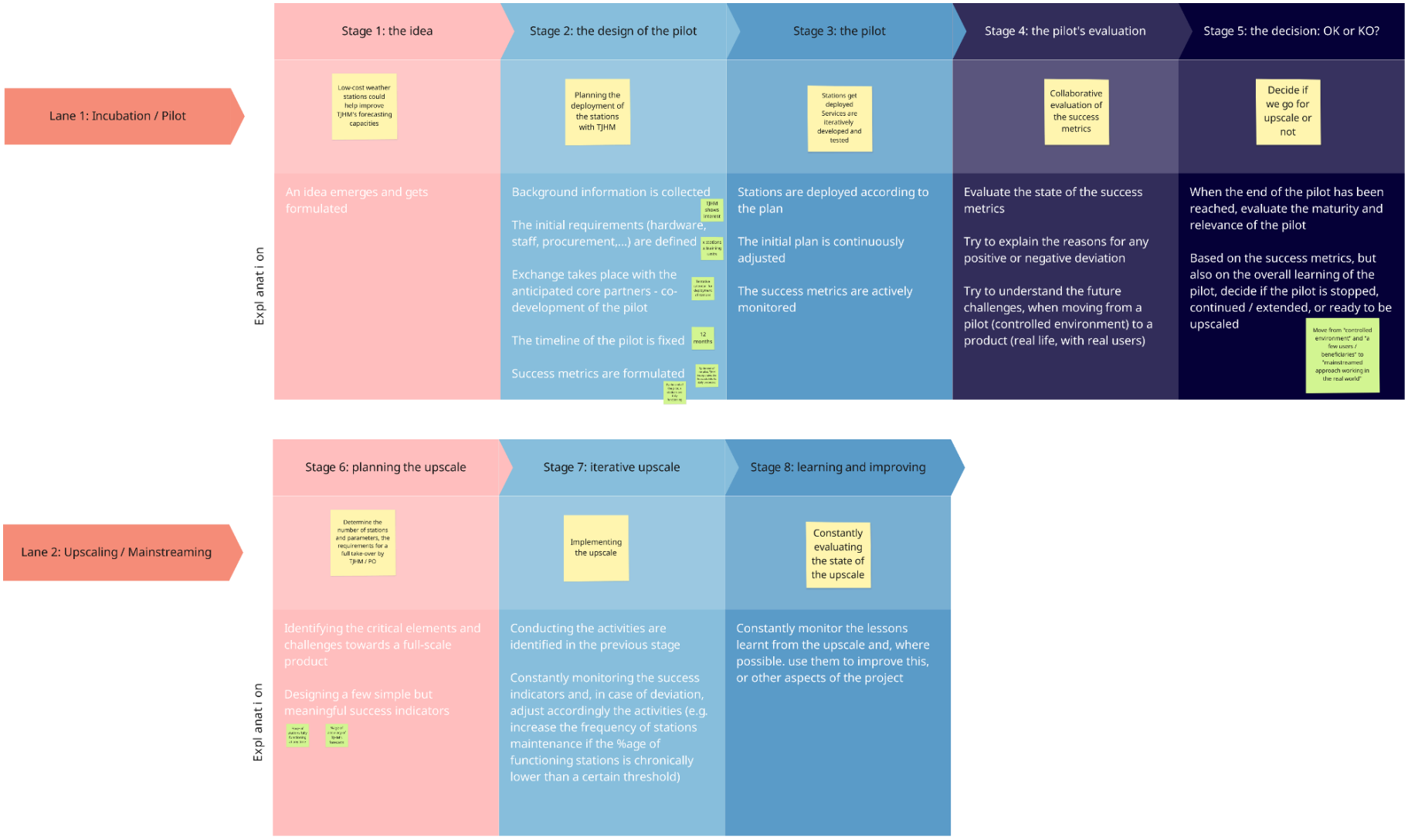
Annex 04: The 2-lanes approach

In the frame of the first phase, the WWCS project has testied and piloted many approaches and ideas, with varying levels of success and maturity.



While the second phase should be mostly aimed at fully upscaling the most mature and promising approaches, room must also be kept for additional pilots and “side activities”. **It is however important for the project and its partners to very consciously distinguish between the pilots and the upscale activities**. This is what we call **the 2 lanes approach**:

- **On the first lane**, an idea is developed, designed, piloted and evaluated. A pilot always has the following characteristics:
    - Clear timeline (we know for how long the pilot will last)
    - Clear success metrics (we know how we can evaluate its relevance)
    - Controlled environment: the pilot is run in an environment that is “simpler” than the real world
    - Limited amount of users / beneficiaries: we know who the users are, and can interact with them individually
- **On the second lane**, a pilot deemed sufficiently mature and promising after the first lane gets into an upscale phase. The upscale phase has the following characteristics:
    - No close-ended timeline (a scaled-up product will be here “for ever”)
    - Clear success metrics (we know how to evaluate if we are going into the right direction or not)
    - Uncontrolled environment: we are “in the real-world”
    - Possibly unlimited amount of users / beneficiaries



Template for the 2-lane approach, illustrated with the example of the product "Low-cost weather stations"

Annex 05: SWOT analysis for the setup of the Public Organization

Introduction

Maintaining the weather stations network on the long term is an endeavor currently deemed possibly too ambitious for Tajik Hydromet (TJHM). The lack of human and technical capacities, the high staff turn-over, the low salaries, as well as the doubts regarding the sustainability of such a governance model, have led to the idea of setting up a Public Organization (PO), which shall ultimately be in charge of maintaining and expanding the stations network, and of self-sustaining itself through the provision of paid services to a wide range of users.

The core assumption is that the PO will be set up as an institution independent from TJHM, and that there won't be any hierarchical relationships between them. At most, TJHM will sit on the PO's board, along with other national (and international?) institutions. To fully embody this reality, it is mandatory that the PO will not be physically located within TJHM's premises. It is also assumed that TJHM will fully support the process, by granting a *license* to the PO, as required by the national laws.

This SWOT analysis must be understood side-by-side with the raw business model drafted in the *Annex 06: Raw business model for the PO*.

Below are the relative strengths, weaknesses, opportunities and threats of setting up a PO, against relying exclusively on TJHM for the maintenance and provision of the weather, water and climate services.

Strengths [helpful / internal origin]

- Unlike TJHM (whose income flows directly back into the State budget), the PO could theoretically generate income to self-sustain itself, or even become profitable
- The governance model over the WWCS network and system can be shared between several State Institutions (e.g. through an inter-Ministries board), thus avoiding a too strong monopoly of TJHM over the governance of weather data and services in Tajikistan

Weaknesses [harmful / internal origin]

- The envisioned business model is currently not anchored in any evidence (see also below): there are no guarantees that there exists a sufficient market for paid weather services in Tajikistan
- Setting up the PO (developing the governance model and mechanisms, acquiring a license from TJHM, institutionalizing the interactions with TJHM, hiring and training

staff, identifying and acquiring a suitable location for the PO's office, procuring the initial equipment,...) will undoubtedly cause delay in the conduction of the activities. If the WWCS network and system were handed over to TJHM, the project activities (expansion of the stations network, development of full-scale services, etc.) could start immediately

- The governance of the WWCS network and stations between TJHM and the PO will be very intricate: even if the WWCS network and system are owned by the PO, it is assumed that TJHM, as the only official institution in charge of meteorological data in Tajikistan, will still have unrestricted rights to access and use the raw data from the stations. It is also rather probable that TJHM will still see themselves as the primary owners of this data. Which institution will then have the right to sell the raw data? Since the PO will be responsible for the network, but TJHM will still remain in charge of providing the data to the WMO, who shall ultimately be in charge of the data's quality and coherence? If some stations are down, can TJHM require the PO to repair them? Or can the PO be exclusively guided by its business interests?
- The setting up of the PO might divert financial support away from TJHM, which already struggles with limited financial resources. In the future, those 2 institutions might end up fighting over grants or support from projects, possibly jeopardizing their collaboration
- If the PO is governed by a board consisting of State Institutions, this could, in some cases, conflict with the PO's business-orientation (e.g. when a requirement from the board jeopardizes the financial sustainability of the PO, or when business priorities prevent the PO from providing critical services to the State Institutions)

Opportunities [helpful / external origin]

- Setting up such a PO could generate a very healthy concurrence to TJHM, eventually encouraging them to widen and improve their offer of services

Threats [harmful / external origin]

- In SDC's and CACH's current vision, the PO should act as a commercial provider, able to financially self-sustain itself. What would therefore happen to the WWCS network and system (and to all the expertise and knowledge accumulated), if the PO was to go bankrupt? TJHM is the only official institution for meteorology in Tajikistan and, as such, will be here "for ever"
- The concurrence between TJHM and the PO will not necessary be healthy, and could end up in power games and significant tensions
- Both SDC and CACH aim in the first place at improving the living conditions of the most marginalized groups. Those will be the first ones to fall through the cracks if the PO's survival requires the basic services to be provided against a fee

Final thoughts

As explained above, there are arguments both in favor and against the setting up of a PO, and both options can be seen as valid.

There is however one key message regarding the sustainability: at the time of writing, we could not find any tangible indication that there exists a sufficient market in Tajikistan for the PO to self-sustain its running costs (let alone making profit). In other words, the assumption that the PO could be financially self-sufficient is absolutely not anchored in any demonstrable evidence.

From our perspective, it is too early to even consider self-sustainability as a realistic mid-term option, because we don't have yet any evidence that the services are actually sought for by potential paying clients. Therefore, our recommendation is to accept, during a (probably long) transition period, that the maintenance and further development of the WWCS system will be subsidized by projects and donors. Only after a critical mass of users has been achieved (in terms of satisfied users and in terms of users growth), can the monetization of the service be seriously addressed.

As explained in *Annex 01: Detailed recommendations*, **our central recommendation is to freeze the setup of the PO for now**, and to focus on the actual upscale of the WWCS (increasing the density of stations, further improving the quality of the forecasts, developing and productively deploying a few selected services, etc.). Once the WWCS has become a productive, broadly used and well recognised product, CACH and SDC will have more tangible elements in their hands to decide on the future optimal governance model.

Finally, SDC would like to investigate the usage of drones for various tasks that could be added to the list of (paid) services provided by the PO, through a franchising model. Beside the fact that the usage of drones doesn't seem to be a purpose-oriented addition to the WWCS project (see *Annex 12: SWOT analysis for the testing of drones*), it would seem over-ambitious to guarantee that the PO will be able, on the mid-term, to master two vastly different technologies, and to be able to profitably market both of them.

Annex 06: Rough business model for the PO

The WWCS project envisions to set up a public organization aimed at providing weather, water and climate services. This annex provides an early and very raw estimation of the running costs of the PO. **It doesn't aim to be completely accurate, but it provides an order of magnitude for evaluating the soundness of the business model**.

It is assumed that the PO will initially consist of 5 staff members:

- Head of the PO
- 1 meteorologist
- 1 IT developer
- 1 technician
- 1 administrator / accountant

This scenario must be seen as **the minimum viable option**, with no extras (e.g. the technician shall travel alone to the field, without an assistant or a driver). It is also relatively risky because it does not provide any backup option if a staff member is missing (e.g. in case of sickness or staff turn-over). Since the PO is envisioned as an independent spin-off from TJHM, it cannot rely on the staff from the local TJHM offices, and the PO's technician will therefore need to travel to all the stations to perform regular maintenance and repairs.

This scenario assumes that the server hosting the WWCS system will be installed physically in the PO's premices. This assumption is based on the fact that international cloud services cannot be considered, and that the hosting options within Tajikistan, although existing, are not extremely common. From a purely technical perspective, a professional hosting service (cloud or not) would probably be cheaper in the long run, and would avoid many complications for the PO.

It is assumed that seed funding will be provided by CACH to kick-off the PO. Therefore, the PO will not need to "earn" (or otherwise acquire) the money necessary to purchase the technical equipment. However, the annual depreciation of the goods is considered.

It is also assumed that seed funding will be provided by CACH to support the running costs of the PO, for a transition period (whose duration is not known yet). However, if the PO aims at financial sustainability, those monthly expenses will need to be covered by regular income.

Taxes and other administrative costs (bank fees, e.g.) are also not included in this scenario, and must be clarified later, depending on the exact legal status of the PO. Inflation is also not accounted for.

Finally, this scenario assumes (as a starting point), the provision of one single service (geolocalized weather forecasts and extreme weather alerts) to a very broad user base (virtually the whole population of Tajikistan). The PO's sources of income can get more diverse in the future, if new needs and opportunities are unveiled.

Initial investments, covered by CACH	**Somoni**	**EUR**	**Annual depreciation**
4x4 car - Lada Niva	171 494TJS	15 000 €	20%
5 laptops	85 747TJS	7 500 €	20%
Office equipment (chairs and tables, printer, scanner, etc.)	57 165TJS	5 000 €	15%
1 server (incl. storage, screen and backup)	57 165TJS	5 000 €	20%
Various tools for the maintenance of the stations	11 433TJS	1 000 €	15%
500 Low-cost weather stations (230€ each)	1 314 789TJS	115 000 €	15%
10 mid-range weather stations (2500€ each)	285 824TJS	25 000 €	15%
TOTAL	**1 983 616TJS**	**173 500 €**	
Monthly expenses, to be covered by the PO	**Somoni**	**EUR**	**Notes**
Salary head of PO	20 579TJS	1 800 €	Comfortable salaries, in order to attract and retain competent specialists
Salary meteorologist	17 149TJS	1 500 €	
Salary IT developer	17 149TJS	1 500 €	
Salary technician	17 149TJS	1 500 €	
Salary administrator / finance specialist	17 149TJS	1 500 €	
Office rent, incl. electricity	13 720TJS	1 200 €	3 rooms + 1 workbench + enough storage for the stations and spare parts + access to a server room
Internet connection	3 000TJS	262 €	This is a completely random value, because the internet providers do not openly disclose their tariffs for business clients. The connection must however be broad enough to accommodate the UL and DL requirements of the services
Travels - per-diems and accommodation	3 000TJS	262 €	Assumptions: - 400 stations need to be checked twice per year. - Around 65 stations / month on average - Around 10 days / month

			- 300 somoni / day
Travels - petrol	30 000TJS	2 624 €	Assumption: - 300km on average for each field day. - Average of 10 liters / km. - 10 somoni / liter
Depreciation car	2 858TJS	250 €	
Depreciation laptops	1 429TJS	125 €	
Depreciation office equipment	715TJS	63 €	
Depreciation server	953TJS	83 €	
Depreciation tools	143TJS	13 €	
Depreciation low-cost weather stations	16 435TJS	1 438 €	
Depreciation mid-range weather stations	3 573TJS	313 €	
TOTAL	**165 002TJS**	**14 432 €**	
Absolute minimum amount of monthly paying users necessary to cover the PO's running costs	**16 500 users**		Assumption: the services target a wide array of end-users, who would agree to pay a monthly fee of 10 somoni

Annex 07: WWCS business model as a global international initiative and digital public good

In this annex, we present a possible direction to make the WWCS approach and technology sustainable in the future.

WWCS as a global international initiative

The core assumption is that there is no demonstrable market-oriented business model for the Public Organization (PO) to generate sufficient revenue independently (see *Annex 05: SWOT analysis for the setup of the Public Organization* and *Annex 06: Raw business model for the PO*). Consequently, the system will need to be subsidized by projects and donors until the system is widely recognized as a trusted provider of services, and a demonstrable source of profit is identified (e.g. big companies expressing a need for more specific services, providing a potential revenue stream).

However, as long as the WWCS system is only deployed in Tajikistan, it will struggle to gain significant traction. Therefore, it is crucial to promote the system in other regions and countries, lobbying for wider adoption. Expanding its use beyond Tajikistan will not only increase its visibility but also attract more stakeholders and potential funding sources.

This expansion and improvement are feasible because the WWCS system is OpenSource. An OpenSource approach allows any interested party to access the design and source code freely, fostering collaboration and innovation. By making the system's code and design publicly available, it encourages global participation and contribution, leading to continuous enhancements and adaptation to various regional needs. This open-source nature is key to its scalability and sustainability, as it leverages a wide pool of expertise and resources without the constraints of proprietary limitations.

Therefore, if, for example, the World Bank wanted to replicate the WWCS in Nepal, they could simply take the existing design and source code, procure stations (according to the WWCS OpenDesign specifications), and deploy them throughout the country. They could then build on this foundation by, e.g., improving the model, creating new services and dashboards, and adding support for additional sensors and parameters. Importantly, they should integrate their enhancements into the main codebase, allowing TJHM to benefit from these improvements without incurring additional costs.

However, to ensure the quality and relevance of contributions to the codebase, as well as a consistent strategy over the steering of the WWCS initiative, there needs to be a facilitator or broker overseeing the entire process. This role could be undertaken by CACH, ensuring that all improvements are beneficial and of high quality, thus maintaining the system's integrity and efficacy.

Study case: OpenIMIS

A similar concept is applied to the OpenSource tool OpenIMIS, which is also supported and promoted by SDC - https://openimis.org/

OpenIMIS Organization and Governance

openIMIS is a versatile open-source software that supports the administration of health financing and social protection schemes. **The governance structure of openIMIS is designed to foster a collaborative community of diverse stakeholders, ensuring the continuous improvement and effective implementation of the software across various regions**.

Governance Structure

The governance of openIMIS is organized into several key components:

1. **Steering Group**: This group includes development partners, scheme operators, implementers, and other relevant organizations. It defines the overall strategic direction of the openIMIS initiative and allocates resources for software development and implementations.
2. **Coordination Desk**: Responsible for operationalizing the strategic direction set by the Steering Group, this desk administers budgets and oversees committee activities.
3. **Regional Hubs**: There are two main hubs, in Asia and Africa, which support the community at a regional level. These hubs facilitate training, capacity development, and act as a bridge between local and global efforts.
4. **Implementers Committee**: This committee provides analysis and advice to scheme operators and policymakers, produces training materials, and submits functional requirements for the software.
5. **Developers Committee**: Focused on developing, maintaining, and supporting the core source code of openIMIS on a global level.
6. **Country Teams**: Comprising local stakeholders such as scheme operators, implementing partners, and IT partners, these teams manage the implementation of openIMIS in their respective countries.

Open-Source Community and Modular Design

openIMIS operates as an open-source platform, which means that its source code is freely available for anyone to use, modify, and distribute. This open-source nature enables a broad community of users, developers, and implementers to collaborate on improving the software. The system is modular and fully customizable, allowing users to pick and choose which modules to implement based on their specific needs.

Similarities with WWCS

The WWCS system we are proposing shares several similarities with openIMIS in terms of organization and governance:

1. **OpenSource Model**: Like openIMIS, WWCS is envisioned as an OpenSource technology. This allows for global collaboration, where different regions can adopt, modify, and enhance the system, contributing back to the main codebase.

2. **Community-Driven Development**: openIMIS relies on a community-driven approach for continuous improvement, meaning that users, developers, and implementers from around the world can provide feedback, suggest new features, and help fix issues. This is the future that we are suggesting here for WWCS.
3. **Regional and Global Support**: Similar to the regional hubs in openIMIS, WWCS could benefit from regional support structures that facilitate training, capacity building, and the dissemination of best practices.
4. **Need for a Facilitator/Broker**: Just as openIMIS has a coordination desk (hosted at, and financed by GIZ) and a structured governance model to ensure quality and relevance, WWCS would need a facilitator or broker to oversee the integration of contributions, maintain standards, and ensure the system's ongoing relevance and quality. Logically, this role could be undertaken by CACH.

In summary, adopting an OpenSource, community-driven approach for WWCS, similar to openIMIS, will not only enhance collaboration and innovation but also ensure the system's scalability and sustainability across different regions and contexts.

A first concrete step towards this approach could be the replication of WWCS in another CACH project, in a different country.

Annex 08: List of functioning stations

The WWCS API has been used several times to evaluate the health of the network. The below table and map highlight the current situation [02.07.2024]. It must be noted that a “non-responding” station can have many different causes, ranging from full hardware failure to the need for a simple software update. It can also simply be caused by a temporarily weak mobile network. It is actually expected that most of these stations can be reactivated easily, if a competent technician is sent on-site.

Table of stations (02.07.2024)

Status of stations:	2024-07-02
ASHT001	['Responding', 'Asht-Hydro', 40.682, 70.7248, 366.0, 'WWCS']
ASHT002	['Responding', 'Asht-Gulshan Hydromet', 40.6246, 70.4702, 472.0, 'WWCS']
ASHT003	['Responding', 'Asht-Mehrobod', 40.5731, 70.3697, 498.0, 'WWCS']
ASHT004	['Responding', 'Asht-Jamoat', 40.8007, 70.624, 750.0, 'WWCS']
AYNI001	['Responding', 'Ayni-Pete', 39.2479, 68.5447, 1607.0, 'WWCS']
AYNI002	['Responding', 'Ayni-Sangiston', 39.392, 68.5864, 1508.0, 'WWCS']
AYNI003	['Responding', 'Ayni-Iskandarkul', 39.0849, 68.3711, 2210.0, 'WWCS']
AYNI004	['Responding', 'Ayni Urmetan', 39.4422, 68.2606, 1270.0, 'WWCS']
AYNI005	['Responding', 'Ayni-Chore School N65', 39.3053, 68.5091, 2030.0, 'WWCS']
AYNI006	['Responding', 'Ayni-Dar Dar jamoat- Zerobod', 39.4363, 68.4646, 1370.0, 'WWCS']
AYNI007	['Responding', 'Ayni-Zoosun-Oromgohi Tughral', 39.388, 68.6192, 1530.0, 'WWCS']
AYNI008	['Not responding', 'DF Asliddinov Mullorahim Ayni', 39.1616, 68.8139, 2100.0, 'WWCS']
AYNI009	['Responding', 'Margheb Firdavs house Ayni', 39.1746, 68.8895, 2170.0, 'WWCS']
BOKH001	['Responding', 'Khatlon Hydromet', 37.8536, 68.7719, 428.0, 'WWCS']
BOKH002	['Responding', 'ECHO-Hydromet', 37.8316, 68.7729, 427.0, 'WWCS']
BUS001	['Responding', 'Buston-Hydromet', 40.5311, 69.3258, 319.0, 'WWCS']
CLIMDYU001	['Responding', 'CaCH Dushanbe Clima', 38.6003, 68.784, 700.0, 'WWCS']

CLIMDYU006	['Responding', 'Tajik Hydromet office-Dushanbe', 38.5695, 68.7428, 799.0, 'WWCS']
CLIMNUR002	['Responding', 'Nurobod Hydromet', 38.9103, 70.1222, 1389.0, 'WWCS']
CLIMPENJ001	['Responding', 'Penjekent-Hydromet', 39.4899, 67.6019, 1017.0, 'WWCS']
CLIMTEST	['Responding', 'Academy Land', 39.276, 71.5103, 2001.0, 'WWCS']
DAN001	['Responding', 'Hydromet', 38.0614, 69.2747, 656.0, 'WWCS']
DAR001	['Responding', 'Kevron-Hydromet', 38.4617, 70.8608, 1288.0, 'WWCS']
DAR002	['Not responding', 'Darvoz, Saghirdasht', 38.64, 70.6609, 2490.0, 'WWCS']
DAR003	['Responding', 'Darvoz, Shkev', 38.3423, 70.61, 1151.0, 'WWCS']
DYU006	['Responding', 'Tajik Hydromet office', 38.5698, 68.7428, 799.0, 'WWCS']
DYU007	['Responding', 'Park Ayni-Dushanbe', 38.6273, 68.7778, 927.0, 'WWCS']
DYU008	['Responding', 'School No77-Dushanbe', 38.5158, 68.7509, 749.0, 'WWCS']
DYU009	['Responding', 'Airport-Dushanbe', 38.5685, 68.8139, 830.0, 'WWCS']
DYU01	['Responding', 'CaCH Dushanbe', 38.6002, 68.7837, 700.0, 'WWCS']
DYU01-S	['Responding', 'CaCH Dushanbe', 38.6004, 68.7837, 700.0, 'WWCS']
DYU010	['Responding', 'Prezident Liceum-Dushanbe', 38.5931, 68.7518, 864.0, 'WWCS']
DYU02	['Responding', 'Dushanbe Sadbarg', 38.5606, 68.8008, 816.0, 'WWCS']
DYU03	['Not responding', 'Agrarian University', 38.6119, 68.7881, 897.0, 'WWCS']
FAR001	['Not responding', 'Istiklol jamoat,Fayzobod village, Leskhoz office', 37.4672, 69.3831, 500.0, 'WWCS']
FAR002	['Responding', 'Hydromet', 37.505, 69.4063, 497.0, 'WWCS']
FAYZ001	['Responding', 'Fayzobod-Hydromet', 38.5419, 69.3325, 1205.0, 'WWCS']
FAYZ002	['Responding', 'Fayzobod-Bustonobod', 38.6761, 69.6182, 1975.0, 'WWCS']
GHON001	['Responding', 'Ghonchi-Echo', 39.9618, 69.1349, 912.0, 'WWCS']
GP Schuchand-Bartang	['Not responding', 'GP Schuchand-Bartang', 37.9687, 71.6345, 0.0, 'TJHM']
HAM001	['Responding', 'Hydromet', 37.624, 69.6528, 497.0, 'WWCS']
HIS001	['Responding', 'Hydromet-Hisor', 38.4968, 68.6506, 742.0, 'WWCS']
HIS002	['Responding', 'Khonako- Hydro', 38.6265, 68.5675, 1009.0, 'WWCS']

HP Hirmanjo-Pyanj	['Not responding', 'HP Hirmanjo-Pyanj', 37.9, 70.1833, 0.0, 'TJHM']
ISF001	['Responding', 'Isfara-Airport', 40.1209, 70.6545, 870.0, 'WWCS']
ISH001	['Responding', 'Ishkoshim Hydromet', 36.7245, 71.6125, 2532.0, 'WWCS']
ISH002	['Responding', 'Ishkashim', 37.0167, 71.4739, 2500.0, 'WWCS']
IST001	['Responding', 'Istaravshan-Hydromet', 39.9013, 68.9991, 1010.0, 'WWCS']
JAY001	['Responding', 'Panji poyon Hydromet', 37.1943, 68.5787, 329.0, 'WWCS']
JOMI001	['Responding', 'Hukumat', 37.9494, 68.8088, 426.0, 'WWCS']
KAB001	['Responding', 'Besh-Palangon Hydro', 37.3545, 68.4608, 331.0, 'WWCS']
KAB002	['Responding', 'Kabodiyon Echological office', 37.4034, 68.184, 400.0, 'WWCS']
KH001	['Not responding', 'Khovaling Hukumat', 38.3454, 69.974, 1417.0, 'WWCS']
KH002	['Not responding', 'Khovaling Hazrati Sulton', 38.4693, 70.0668, 1837.0, 'WWCS']
KH003	['Responding', 'Jamakhon house', 38.2766, 69.9143, 1431.0, 'WWCS']
KH004	['Responding', 'Safar house', 38.409, 70.0328, 1667.0, 'WWCS']
KH005-S	['Not responding', 'Nabiev Hikmatullo land', 38.3553, 69.9482, 1432.0, 'WWCS']
KH006-S	['Not responding', 'Khojaev Amonullo land', 38.3127, 69.9381, 1312.0, 'WWCS']
KH007	['Responding', 'Hydromet', 38.3534, 69.9809, 1439.0, 'WWCS']
Khorog-Gunt	['Not responding', 'Khorog-Gunt', 37.4883, 71.5527, 0.0, 'TJHM']
KHRG001	['Not responding', 'Khorog-Hydromet', 37.5056, 71.5141, 2083.0, 'WWCS']
KHRG002	['Responding', 'Khorog Hydromet office ', 37.4907, 71.543, 2084.0, 'WWCS']
KHRG003	['Responding', 'Khorog Orbita Botsad', 37.4827, 71.6008, 2250.0, 'WWCS']
KHUJ001	['Responding', 'Khujand Eco', 40.2826, 69.6238, 340.0, 'WWCS']
KHUR001	['Responding', 'Ganjina Hydromet', 37.9635, 68.5564, 775.0, 'WWCS']
KHUR002	['Responding', 'Agro-Fakhrobod', 38.3032, 68.711, 1132.0, 'WWCS']
KON001	['Responding', 'Konibodom-Agro', 40.2918, 70.4183, 390.0, 'WWCS']
KULOB001	['Responding', 'Bakhtiyor house', 38.018, 69.8414, 746.0, 'WWCS']
KULOB002	['Not responding', 'Mahmadrasul house', 37.9377, 69.811, 675.0, 'WWCS']

KULOB003-S	['Responding', 'Kulob', 38.106, 69.8481, 880.0, 'WWCS']
KULOB004-S	['Not responding', 'Emomov Jahongir (Bakhtiyors fazer)', 38.0182, 69.8414, 746.0, 'WWCS']
KULOB005	['Responding', 'Hydromet Airport', 38.0045, 69.8127, 705.0, 'WWCS']
LAKH001	['Not responding', 'Lakhsh Hukumat', 39.2237, 71.2038, 1791.0, 'WWCS']
LAKH002	['Responding', 'Muksu Sarikenja', 39.2445, 71.5269, 2139.0, 'WWCS']
LAKH003	['Responding', 'Lakhsh Duvana', 39.3473, 71.5543, 2015.0, 'WWCS']
LAKH004	['Responding', 'Hydromet Lakhsh', 39.2995, 71.5257, 2003.0, 'WWCS']
LAKH005	['Responding', 'Beekeeper', 39.2175, 71.1819, 1870.0, 'WWCS']
LAKH006	['Responding', 'AAS centre', 39.2613, 71.5343, 2068.0, 'WWCS']
LAKH007	['Responding', 'Kashot jamoat', 39.3074, 71.4515, 1904.0, 'WWCS']
LAKH008	['Responding', 'Sartalo jamoat', 39.2448, 71.4252, 1913.0, 'WWCS']
LAKH009	['Responding', 'Yangishahr jamoat', 39.2445, 71.236, 1853.0, 'WWCS']
LAKH010	['Responding', 'Surkhob Jamoat', 39.1888, 71.2701, 1800.0, 'WWCS']
LAKH011	['Not responding', 'Pildon Jamoat', 39.1619, 71.0421, 1657.0, 'WWCS']
LAKH012	['Responding', 'Academy Land', 39.278, 71.5103, 2001.0, 'WWCS']
LAKH012-1	['Not responding', 'Academy Land', 39.278, 71.5103, 2001.0, 'WWCS']
LAKH012-10	['Not responding', 'Academy Land', 39.2724, 71.5164, 2013.3, 'WWCS']
LAKH012-11	['Not responding', 'Academy Land', 39.2725, 71.5167, 2010.7, 'WWCS']
LAKH012-2	['Not responding', 'Academy Land', 39.2782, 71.51, 2001.0, 'WWCS']
LAKH012-3	['Not responding', 'Academy Land', 39.2787, 71.5095, 2001.0, 'WWCS']
LAKH012-4	['Not responding', 'Academy Land', 39.2774, 71.5112, 2007.6, 'WWCS']
LAKH012-5	['Not responding', 'Academy Land', 39.2754, 71.5183, 2011.6, 'WWCS']
LAKH012-6	['Not responding', 'Academy Land', 39.2754, 71.5155, 2006.1, 'WWCS']
LAKH012-7	['Not responding', 'Academy Land', 39.2787, 71.5127, 2003.1, 'WWCS']
LAKH012-8	['Not responding', 'Academy Land', 39.2766, 71.5159, 2006.2, 'WWCS']
LAKH012-9	['Not responding', 'Academy Land', 39.2753, 71.5152, 2005.2, 'WWCS']
LAKH013	['Not responding', 'Near SLF station ', 39.1221, 71.3965, 3465.0, 'WWCS']

MACH001	['Responding', 'Maschoh-Hydromet', 39.4466, 69.6644, 2241.0, 'WWCS']
MACH002	['Responding', 'Maschph- Forest Agency ', 39.4127, 69.3154, 2050.0, 'WWCS']
MC Rohat	['Not responding', 'MC Rohat', 38.5667, 68.7667, 650.0, 'TJHM']
MC Shaymak	['Not responding', 'MC Shaymak', 37.5333, 74.8167, 3835.0, 'TJHM']
MS Anzob-Pass	['Not responding', 'MS Anzob-Pass', 39.0833, 68.8667, 3373.0, 'TJHM']
MS Ayvaj	['Not responding', 'MS Ayvaj', 36.9833, 68.0333, 319.0, 'TJHM']
MS Bulunkul	['Not responding', 'MS Bulunkul', 37.7, 72.95, 3746.0, 'TJHM']
MS Buston	['Not responding', 'MS Buston', 40.5167, 69.35, 318.0, 'TJHM']
MS Bustonobod	['Not responding', 'MS Bustonobod', 38.6667, 694.333, 1964.0, 'TJHM']
MS Chormagzak	['Not responding', 'MS Chormagzak', 38.4667, 69.2, 1730.0, 'TJHM']
MS Chorog	['Not responding', 'MS Chorog', 37.5, 71.5, 2075.0, 'TJHM']
MS Dangara	['Not responding', 'MS Dangara', 38.1, 69.3167, 668.0, 'TJHM']
MS Darband	['Not responding', 'MS Darband', 38.8667, 69.9833, 1258.0, 'TJHM']
MS Darvoz	['Not responding', 'MS Darvoz', 38.4667, 70.8833, 1288.0, 'TJHM']
MS Dehavz	['Not responding', 'MS Dehavz', 39.45, 70.2, 2564.0, 'TJHM']
MS Durakhshon-1	['Not responding', 'MS Durakhshon-1', 34.8833, 69.35, 700.0, 'TJHM']
MS Duschanbe	['Not responding', 'MS Duschanbe', 38.5833, 68.7333, 803.0, 'TJHM']
MS Faizabad	['Not responding', 'MS Faizabad', 38.5333, 69.3167, 1215.0, 'TJHM']
MS Farkhor	['Not responding', 'MS Farkhor', 37.4833, 69.3833, 447.0, 'TJHM']
MS Ganzhina	['Not responding', 'MS Ganzhina', 37.95, 68.5667, 752.0, 'TJHM']
MS Gorbunov	['Not responding', 'MS Gorbunov ', 38.8333, 72.2167, 4169.0, 'TJHM']
MS Gulshan	['Not responding', 'MS Gulshan', 40.65, 70.5, 550.0, 'TJHM']
MS Hamadoni	['Not responding', 'MS Hamadoni', 37.6167, 69.65, 488.0, 'TJHM']
MS Hawaling	['Not responding', 'MS Hawaling', 38.35, 69.9833, 1468.0, 'TJHM']
MS Hirmancho	['Not responding', 'MS Hirmancho', 37.9057, 70.1817, 870.0, 'TJHM']
MS Hissar	['Not responding', 'MS Hissar', 38.5, 68.65, 768.0, 'TJHM']
MS Humrogi	['Not responding', 'MS Humrogi', 38.2833, 71.3333, 1610.0, 'TJHM']

MS Irht	['Not responding', 'MS Irht', 38.1667, 72.6333, 3275.0, 'TJHM']
MS Isanbai	['Not responding', 'MS Isanbai', 38.05, 68.35, 563.0, 'TJHM']
MS Isfara	['Not responding', 'MS Isfara', 40.1333, 70.6, 870.0, 'TJHM']
MS Ishkashim	['Not responding', 'MS Ishkashim', 36.05, 71.6, 2523.0, 'TJHM']
MS Iskanderkul	['Not responding', 'MS Iskanderkul', 39.1, 68.3833, 2204.0, 'TJHM']
MS Istaravshan	['Not responding', 'MS Istaravshan', 39.9, 69.0, 1004.0, 'TJHM']
MS Javshangoz	['Not responding', 'MS Javshangoz', 37.35, 72.45, 3436.0, 'TJHM']
MS Kairakkum-Stausee	['Not responding', 'MS Kairakkum-Stausee', 40.2667, 69.8167, 347.0, 'TJHM']
MS Kalailabiob	['Not responding', 'MS Kalailabiob', 39.1167, 70.8333, 1598.0, 'TJHM']
MS Karakul	['Not responding', 'MS Karakul', 39.0167, 73.55, 3930.0, 'TJHM']
MS Khujand-Oburdon	['Not responding', 'MS Khujand-Oburdon', 40.2167, 69.7167, 425.0, 'TJHM']
MS Khushyori	['Not responding', 'MS Khushyori', 38.0, 68.0, 1361.0, 'TJHM']
MS Kulob	['Not responding', 'MS Kulob', 37.9167, 69.7833, 688.0, 'TJHM']
MS Kurgan-Tjube	['Not responding', 'MS Kurgan-Tjube', 37.8333, 68.7833, 427.0, 'TJHM']
MS Kushtepa	['Not responding', 'MS Kushtepa', 38.25, 69.5333, 931.0, 'TJHM']
MS Lyakhsh	['Not responding', 'MS Lyakhsh', 39.0, 71.0, 1998.0, 'TJHM']
MS Madruskat	['Not responding', 'MS Madruskat', 39.4333, 69.6667, 2254.0, 'TJHM']
MS Mayhura	['Not responding', 'MS Mayhura', 39.0167, 68.7833, 1922.0, 'TJHM']
MS Muminobod	['Not responding', 'MS Muminobod', 38.1167, 70.0333, 1232.0, 'TJHM']
MS Murgab	['Not responding', 'MS Murgab', 38.1667, 73.9667, 3576.0, 'TJHM']
MS Navobod	['Not responding', 'MS Navobod', 37.1667, 71.3667, 2566.0, 'TJHM']
MS Nischni Panj	['Not responding', 'MS Nischni Panj', 37.2, 68.5833, 329.0, 'TJHM']
MS Palos Proletarier	['Not responding', 'MS Palos Proletarier', 40.1333, 69.5833, 0.0, 'TJHM']
MS Pandsch	['Not responding', 'MS Pandsch', 37.25, 69.1, 326.0, 'TJHM']
MS Panjikent	['Not responding', 'MS Panjikent', 39.5, 67.6, 1015.0, 'TJHM']
MS Rasht	['Not responding', 'MS Rasht', 390.0, 70.3, 1316.0, 'TJHM']
MS Rogun	['Not responding', 'MS Rogun', 38.5682, 68.775, 1800.0, 'TJHM']

MS Rohat	['Not responding', 'MS Rohat', 32.4693, 68.1893, 650.0, 'TJHM']
MS Rushan	['Not responding', 'MS Rushan', 37.95, 71.55, 1981.0, 'TJHM']
MS Safed-dara	['Not responding', 'MS Safed-dara', 38.8333, 69.0, 2600.0, 'TJHM']
MS Sagirdasht	['Not responding', 'MS Sagirdasht', 38.588, 70.7537, 2600.0, 'TJHM']
MS Sangiston	['Not responding', 'MS Sangiston', 39.3833, 68.5833, 1522.0, 'TJHM']
MS Sanglok	['Not responding', 'MS Sanglok', 38.25, 69.2333, 2239.0, 'TJHM']
MS Sawnob	['Not responding', 'MS Sawnob', 38.3, 72.4667, 2800.0, 'TJHM']
MS Shakhristan	['Not responding', 'MS Shakhristan', 39.5667, 68.5833, 3143.0, 'TJHM']
MS Tavildara	['Not responding', 'MS Tavildara', 38.7, 70.4833, 1616.0, 'TJHM']
MS Yavan	['Not responding', 'MS Yavan', 38.3167, 69.05, 639.0, 'TJHM']
MUM001	['Responding', 'Muminabad Hukumat', 38.1083, 70.0311, 1245.0, 'WWCS']
MUM002	['Responding', 'Hydromet Muminabad', 38.086, 70.0173, 1232.0, 'WWCS']
MUM003	['Responding', 'Beekeeper', 38.0975, 70.0403, 1305.0, 'WWCS']
MUM004	['Not responding', 'Sunnat land', 38.1144, 70.0759, 1700.0, 'WWCS']
MUM005	['Responding', 'AAS centre', 38.1588, 70.0085, 1181.0, 'WWCS']
MUM006	['Not responding', 'Childukhtaron', 38.3008, 70.1452, 1810.0, 'WWCS']
MUM007	['Not responding', 'Balkhobi Jamoat Test', 37.9087, 69.8737, 870.0, 'WWCS']
MUM008	['Not responding', 'Dehibaland jamoat', 38.0556, 70.0089, 1279.0, 'WWCS']
MUM009	['Responding', 'Boghgai Jamoat', 38.0646, 69.9604, 1139.0, 'WWCS']
MUM010	['Responding', 'Sh Shohin Jamoat', 37.9862, 69.9103, 1000.0, 'WWCS']
MUM011	['Not responding', 'Balkhobi Jamoat, Olimtoi Village, school #40', 37.8201, 69.3498, 755.0, 'WWCS']
MUM012	['Responding', 'Academy land', 38.1494, 69.9922, 1218.0, 'WWCS']
MUM013-S	['Responding', 'Academy land', 38.1492, 69.9922, 1218.0, 'WWCS']
MUM014-S	['Responding', 'Odinaev Ghafor', 38.1123, 70.0242, 1214.0, 'WWCS']
MURG001	['Responding', 'Murghob Hydromet', 38.1464, 73.9589, 3600.0, 'WWCS']
MURG002	['Not responding', 'Murghob Burunkul', 37.7043, 72.9461, 3770.0, 'WWCS']
MURG003	['Not responding', 'Shughnon Dzhelonda', 37.5751, 72.583, 3559.0, 'WWCS']

MURG004	['Responding', 'Karakul', 39.0142, 73.5574, 3940.0, 'WWCS']
MURG005	['Responding', 'Murgob, Tokhtamysh', 38.0613, 74.4061, 3730.0, 'WWCS']
MURG006	['Responding', 'Murgob, SHaymak', 37.5371, 74.8201, 3850.0, 'WWCS']
NORAK001	['Responding', 'Norar Ecological dep ', 38.385, 69.3157, 646.0, 'WWCS']
NUR001	['Responding', 'Nurobod Women Group House', 38.9676, 70.1532, 1262.0, 'WWCS']
PANJ001	['Responding', 'Airport Hydromet', 37.255, 69.0909, 363.0, 'WWCS']
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RASHT002	['Responding', 'Rasht Navobod Jamoat', 39.0074, 70.1564, 1274.0, 'WWCS']
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RUSH004	['Responding', 'Rushon Ravmeddara Khijez', 37.9998, 71.8308, 2121.0, 'WWCS']
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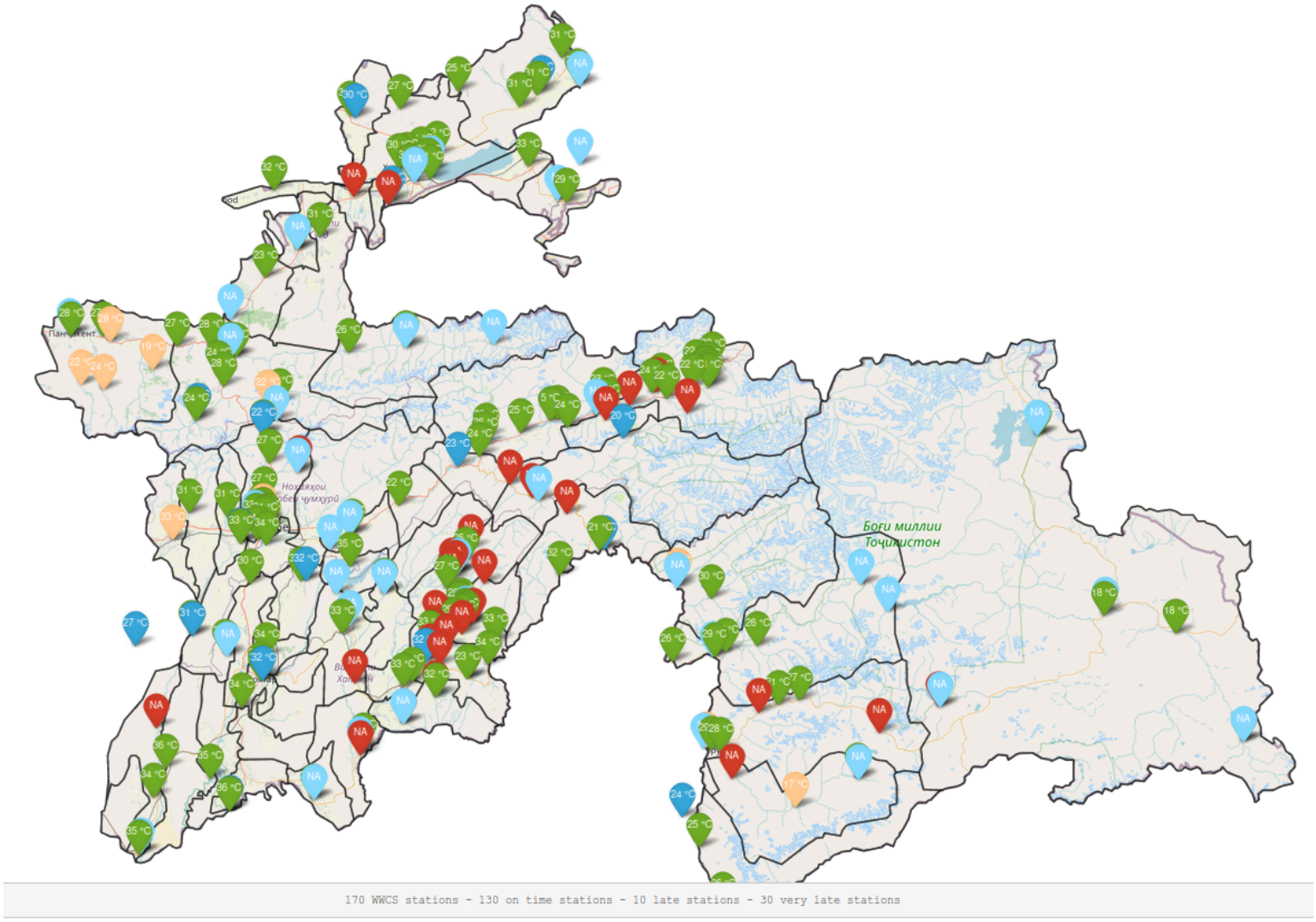
YOVON001	['Responding', 'Hydromet', 38.3148, 69.0205, 639.0, 'WWCS']
ZAF001	['Responding', 'Zafarobod-Eco', 40.1799, 68.8529, 407.0, 'WWCS']

Number of stations:	249
Stations responding:	132
Stations non responding:	117
Stations responding %:	53
Stations non responding %:	47
Stations WWCS:	180
Stations TJHM:	69
Stations WWCS responding:	132
Stations WWCS non responding:	48
Stations TJHM responding:	0
Stations TJHM non responding:	69

Map of stations (02.07.2024)

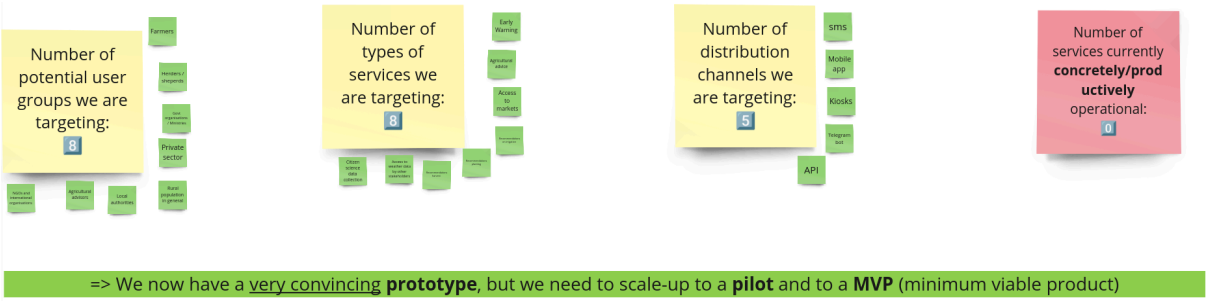


Annex 09: Identify the right weather services for broader upscale

During the 1st phase, the WWCS project has tested and piloted several types of weather services (early warning system, agricultural advice, etc.) through various channels (sms, Telegram bot, kiosks, API, etc.), aimed at a few restricted users. As a direct consequence, up to now, no service has been upscaled to a fully productive level. For the 2nd phase, it will be necessary to identify a few promising services, and to focus the project's energy on their upscale.
This annex provides some methodological and tactical help to strategically identify the most promising services.

The current situation

As illustrated here, at the current stage, the WWCS approach and system can be seen as a very promising prototype: several approaches have been tested with various user groups, some of which shall now be turned into a MVP (minimum valuable product).



***Prototype**: A prototype is an early model or sample of a product used to test and demonstrate its features and design. It's usually created to explore ideas and gather feedback before the final version is developed. Think of it as a rough draft.*

***MVP (Minimum Viable Product)**: An MVP is a simplified version of a product that includes only the most essential features. It's launched to see if there's interest and demand from users, allowing for real-world feedback and improvements. Think of it as the first basic version ready for use.*

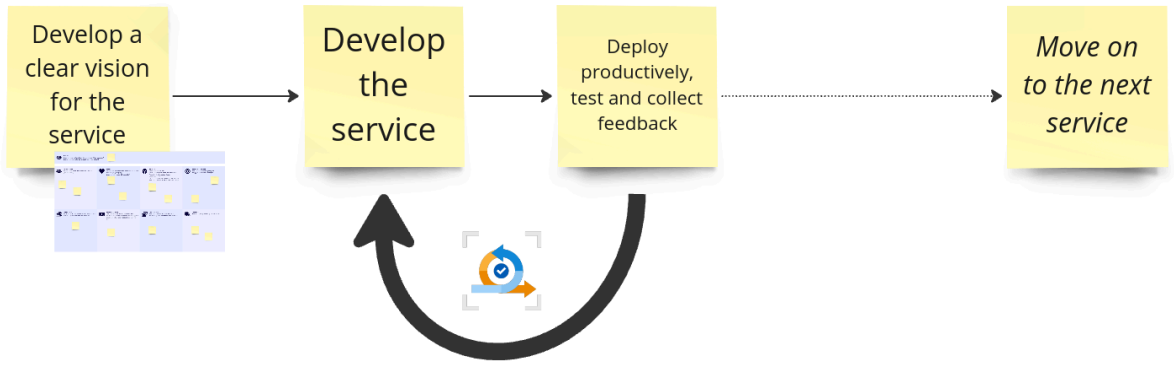
***In short, a prototype tests ideas, while an MVP tests the market**.*

A successful service shall fulfill the law of the 3 "U", meaning that the service must be:

- **Useful**: it must address a real-life issue for which CACH and its partners share a common understanding
- **Usable**: it must be provided in a format (medium, language, type of information,...) that is easy for the intended user to comprehend
- **Used**: usage statistics, or dedicated surveys, must unambiguously indicate that the intended users actually use the service on a regular basis

How to identify which service(s) shall be turned into an MVP?

The development of successful products and services often starts with clarifying the **product vision**. The product vision board (see below) is a very effective tool to ensure that all stakeholders have the same understanding of the problems to be solved by the service, and of how it will solve them.
In order to ensure the relevance of the service, the development phase itself shall happen in an **agile / iterative** way, frequently delivering new versions to the users, collecting their feedback and integrating this feedback into the development loop.
Another key success factor is the **focus**: once it has been determined that a specific service shall be upscaled, CACH and its direct partners shall focus (as much as possible) their efforts exclusively to the iterative development of this service, during a given period of time (typically from a few weeks to a few months).Trying to "do a bit of everything in parallel", without a clear vision, typically leads to much longer development times, and to a lower quality of the service.



The process of **developing the product vision board**[1] should be very participatory, involving the key stakeholders, and should entail in priority the following steps:

1. Clearly **identify the end users** that need to be reached in priority with the service (random farmers? OR agricultural advisors? OR bigger agricultural companies? OR other Ministries / National Institutions? OR etc.) and ensure that representatives of those end-users are interested and willing to commit time to the development (to test and provide regular feedback)
2. Together with those representatives, identify (in a series of workshops) which ones of their **key problems** can be (at least partially) solved with the service. For each use case, start identifying relevant ways to convey the information to the designated end user, taking into account their capacities and limitations (e.g. internet connectivity)
3. Conduct a **simple market research** to identify possible concurrent products
4. Formulate as precisely as possible the **behavioral change** that this service should support
5. Start identifying expected **cost factors** for developing and maintaining the service on the long-term

[1] The process of developing the product vision board should however not be over-stretched: it will be impossible to find definitive answers to all the questions and topics. Therefore, the board should focus on "what we know now", and on reaching a common understanding, between all stakeholders, of "where we are going with the service". This board can, and should be updated in the future, once CACH will know more about the uptake, and actual impact of the service

Once the product vision has reached a sufficient level of completeness, the agile, iterative and participatory development of the service can start:

1. Develop a **simple prototype** which addresses the core of the user case (e.g.forecast data are served by the API in a condensed way, so that external mobile app can easily interpret them)
2. **Present and test the prototype** with the users' representatives, collect their feedback (e.g. "is this information sufficient and clear?", "do they know how to interpret the information and how to act on it?", "will they be able to receive the information, or do they live outside of sufficient network coverage?", "what should be improved to make the service even more useful?", "was the use case initially correctly described, or does it need to be refined?", "what should be done to increase the outreach of the service?", etc.)
3. **Use feedback to further develop the prototype** (e.g. "personalize the service based on the user's location", “allow simple automated registration for new users”, "personalize the weather warning based on the crops cultivated by the user", "allow the user to personalize the threshold that will trigger an alert", etc.). Most importantly, the features / aspects that will be further developed need to explicitly address needs expressed by the users. The priority of the development is informed by what the users consider "more useful / important / urgent
4. **Repeat the whole loop**. Ideally, each loop "development-feedback" should not last more than one month

The key elements of this approach are:

1. Re-focus the prioritization of the service’s development on the **actual needs** of the users ("what actual problem will this feature solve?"), taking into account that those needs might (and will) change during the development cycle
2. Use **very short development cycles**, to receive very early feedback from the users. This allows to ensure that we are on the right track
3. Once the prototype is working and providing useful information, it should be put into **production**, even if it doesn't propose all features yet

The project vision board

Using a Product Vision Board before starting to develop a digital product is crucial for several reasons:

1. **Clarity and Alignment**: The Product Vision Board helps ensure that all team members and stakeholders share a clear and unified understanding of the product's purpose, target audience, and key features. This alignment is essential for guiding development efforts and making cohesive decisions throughout the project.
2. **Identifying Assumptions**: The board captures critical assumptions about the product, its users, and its market. By documenting these assumptions early, teams can test and validate them, reducing the risk of developing a product based on incorrect or untested hypotheses.
3. **Focused Development**: By clearly outlining the target group, user needs, and standout features, the Product Vision Board helps prioritize development tasks. This focus ensures that the most important aspects of the product are addressed first,

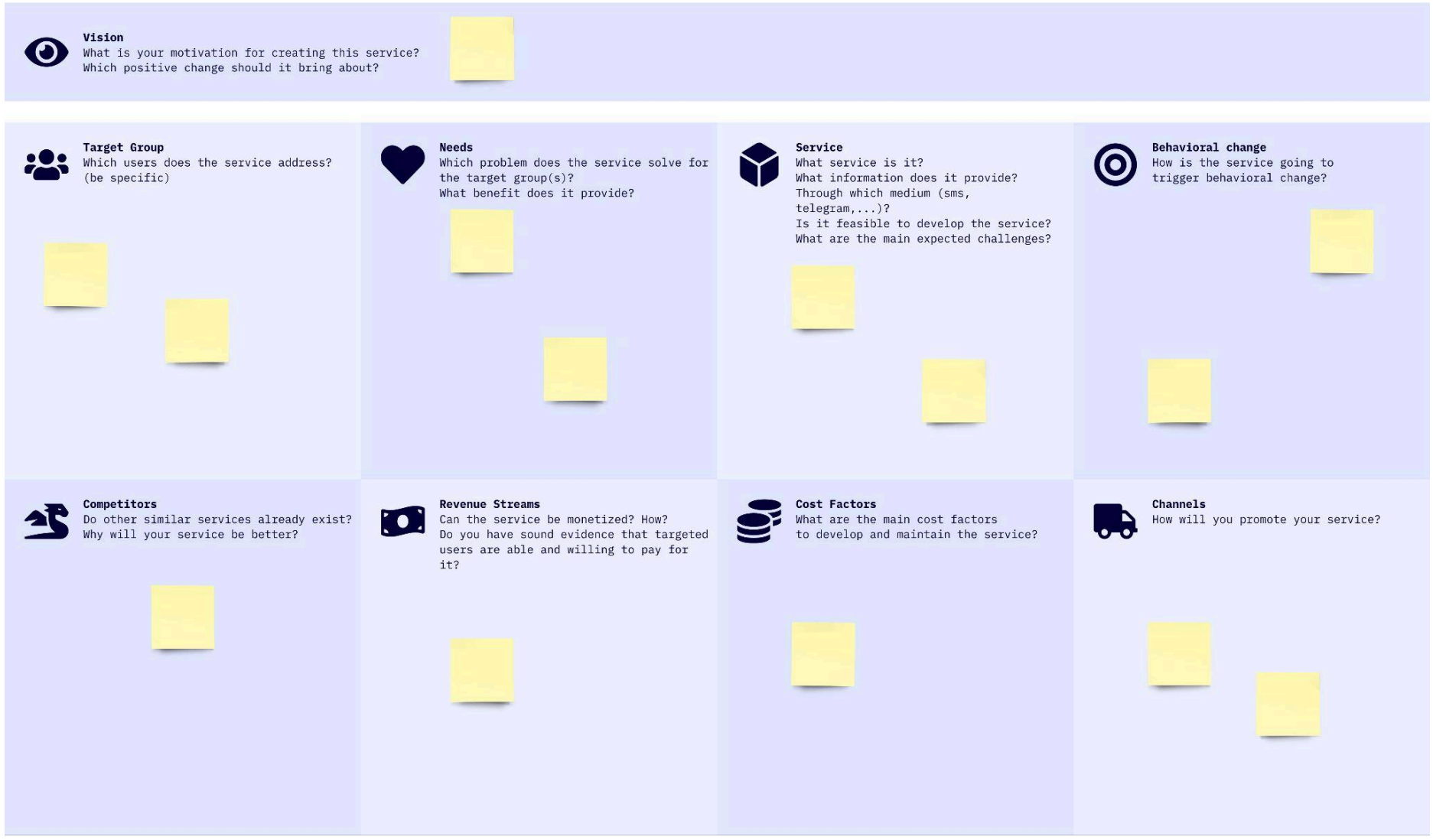
improving the chances of delivering a product that meets user needs and achieves business goals.

4. **Enhanced Communication**: A well-structured Product Vision Board serves as a communication tool that can be easily shared with stakeholders, investors, and team members. It provides a concise and visual summary of the product vision, making it easier to communicate complex ideas and gain buy-in from various parties.

Using the Product Vision Board effectively sets a solid foundation for product development by promoting a shared vision, validating assumptions, and aligning efforts with strategic business goals. This approach reduces risks and increases the likelihood of creating a successful and impactful product.

Source of the Product vision board: Roman Pichler - https://www.romanpichler.com/blog/the-product-vision-board/

The product vision board template on the next page has been adapted to better fit the context of the WWCS project.


Vision
What is your motivation for creating this service?
Which positive change should it bring about?
Target Group
Which users does the service address?
(be specific)
Needs
Which problem does the service solve for the target group(s)?
What benefit does it provide?
Service
What service is it?
What information does it provide?
Through which medium (sms, telegram,...)?
Is it feasible to develop the service?
What are the main expected challenges?
Behavioral change
How is the service going to trigger behavioral change?
Competitors
Do other similar services already exist?
Why will your service be better?
Revenue Streams
Can the service be monetized? How?
Do you have sound evidence that targeted users are able and willing to pay for it?
Cost Factors
What are the main cost factors to develop and maintain the service?
Channels
How will you promote your service?

Annex 10: Notes from the partners meetings

This annex summarizes in a few short bullet points the key information collected during the interviews with the project's partners. Those bullet points are the raw information, and do not imply endorsement from the evaluators. Some of the evaluators' recommendations are also provided, but please refer to *Annex 01: Detailed recommendations* for the full details.

Hydromet

- In general, TJHM is very happy about the collaboration with CACH, and wishes to further expand the density of the network, throughout the territory of Tajikistan. The fact that CACH listens to their needs and requests is particularly appreciated
- After having been very doubtful at the beginning, TJHM is now very happy with the low-cost weather stations :
    - They already see a clear improvement in the accuracy of the forecast provided by the low-cost weather stations
    - Their maintenance is much cheaper, and easier, than their heavy manual stations
- For the future, TJHM would like to further work on landslide risk assessment, and to provide dedicated services to, e.g. the Ministry of Transports, or the Ministry of Agriculture
- TJHM would like to strengthen the cooperation with CoESCD
- Regarding the creation of the PO :
    - All interviewees welcome the idea, but there are different views on the PO's structure : some consider it must absolutely be located under TJHM, while others highlighted that they must be completely independent from each other (administratively, hierarchically, and geographically)
    - It was also suggested to use an existing PO («Ekoloiha»), rather than creating a new one
- At the moment, TJHM is not equipped to maintain and assemble the stations. A «laboratory» would need to be installed (in fact, a workbench, incl. the necessary tools and storage space for the stations and the spare parts)

Evaluators' thoughts and recommendations:

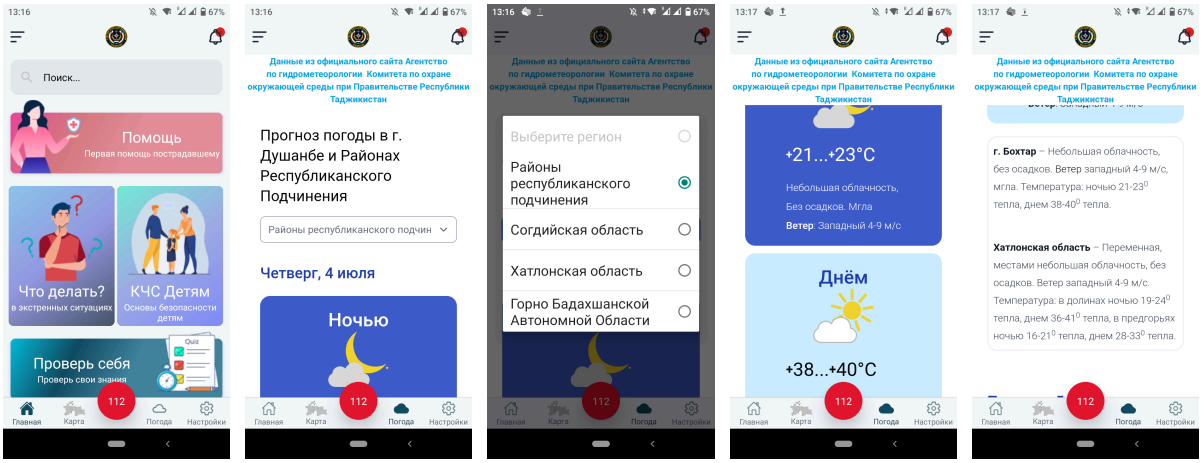
- Regardless of whether or not the PO will be established, TJHM will always remain the central institution in charge of meteorological data in Tajikistan (unlike the PO, which can disappear at some point, if they don't succeed at becoming economically profitable). Therefore :
    - Great attention must be paid to ensure that funding the PO does not divert too many resources away from TJHM. Specifically, capacity development measures for the PO should also include TJHM staff whenever possible, to ensure they do not fall behind in terms of capabilities.
    - In particular, TJHM's capacities in IT and digital technologies need to be further developed. Even if TJHM is not ultimately responsible for maintaining and developing the WWCS, it is crucial that they fully understand the system's

intricacies. Additionally, if the PO is established but fails to operate for any reason, TJHM will serve as the fallback option.
    - Even if the stations' network falls under the responsibility of the PO, it must be ensured that TJHM will have direct access to the raw data, and unlimited right to use it
    - A strong governance model and clear Standard Operating Procedures (SOPs) need to be established to ensure that TJHM's need to access the WWCS raw data is not overridden by the business imperatives of the PO.
- The reasons behind the suggestion to use an existing PO rather than creating a new one are not fully clear to the evaluators. If this option was to be pursued, a deeper analysis would be necessary (e.g. to guarantee the absence of any conflicts of interest)
- If the wish to strengthen the cooperation with CoESCD is genuine, several of the detailed recommendations provided in *Annex 01: Detailed recommendations* can support it (e.g. integration of the WWCS weather forecasts in CoESCD's «SOS» mobile application, Rehabilitate and sustain the Hissor hail radar, etc.)
- TJHM's request for a laboratory/workbench is valid, but CACH should not make a significant investment until it is formally decided whether TJHM or the PO will be responsible in the future. However, minimal support can be provided to TJHM in the meantime to ensure they can build and repair the stations.
- Currently, there is no credible evidence that the PO can become financially sustainable in the mid-term, let alone profitable (see *Annex 06: Raw business model for the PO*). If CACH and their partners ultimately decide to establish this PO, the decision should be driven by expected gains in efficiency, flexibility, transparency, and quality, rather than the vague hope of self-financing. The service provider (whether TJHM or PO) will likely need subsidies from CACH and/or other projects for several years before it can (maybe) offer timely, relevant, and potentially monetizable services.

CoESCD

- CoESCD has started an internal process of digitalization, but would like to go further. For example:
    - The kiosk provided by CACH allows CoESCD staff to check the weather forecasts, and, when necessary, to inform the district offices about upcoming weather events. Ideally, CoESCD would like to automate and streamline this process (forecasts coming directly to their phone or computer, and available also to the district officers).
- The main interest of CoESCD in the project is the automated provision of operative data. In particular:
    - Localized weather forecasts, up to 5 days in advance
    - Precipitation
    - Snow levels
    - Water levels in the water bodies
    - Avalanche forecast

- The hail radar in Hissor is fully functioning[1], but only between February and June, when the hail risk is higher. CoESCD would like a second radar, to be installed in the Sughd region, since the one in Hissor cannot cover the whole territory of the Republic.
- CoESCD is aware that data from the hail radar could be very useful for TJHM and for the WWCS system, and is fully ready to grant access to the data[2].
- On July, 25th, 2024, a training on the use of radar data will be organized, with the support of the World Bank. CoESCD and TJHM representatives will take part.
- With the support of the World Bank, CoESCD has launched a mobile application “SOS” in February 2024. This application provides information on the correct behavior in case of a disaster, but also displays the TJHM weather forecasts, at oblast level. Replacing these general forecasts by the localized ones provided by WWCS would be a very strong added value for CoESCD



- The interview took place with CoESCD focal point Tojiddin Mahmadov, who is apparently switching to a new position. Someone else might take over the role of focal point
- Despite being the chair of the project’s steering committee (NSC), CoESCD was not aware of the existence of working groups under the NSC

Evaluators’ thoughts and recommendations:

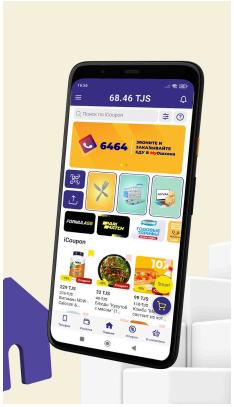
- Integrating WWCS forecasts into the SOS app can be seen as a low-hanging fruit: with relatively minor efforts, the WWCS data could directly impact more than 500 users throughout the country. This is also a perfect opportunity to collect feedback from a wide user base (e.g. with a simple popup asking the users from time to time how accurate the forecasts are), which can in turn help further improve the model and the service. A few key elements must however be considered:
    - The technical infrastructure providing the services will have to support a load that is bigger than now.
    - The API backend must offer a 99% level of availability. If the interruptions are too frequent, the SOS app will quickly lose its attractivity. The current

[1] This quote from the CoESCD contradicts reports and observations from various experts and consultants, and would need to be validated on-site again.
[2] This also contradicts reports and observations from other stakeholders, and would need to be validated again, and eventually formally endorsed by CoESCD and TJHM higher management.

situation, with Omar being the only person monitoring and maintaining the system, cannot guarantee this level of availability.
    - The stations must be frequently serviced (by CACH and / or by TJHM). The current situation (~25% of the WWCS stations not responding) can be seen as a warning flag.
    - TJHM must fully understand the approach and agree that the forecasts will be provided for free to Tajik citizens
- The Hissor radar can provide very valuable data to improve the accuracy of the WWCS forecasts, especially for heavy precipitation events (see *Annex 03: Study case on the weather forecast*). It might therefore be valuable to try again and help CoESCD make this radar fully operational again
- Some of the information collected during the interview might not be fully accurate. For example, the interviewee pretended that the SOS app already has more than 2000 users, although the real figure is around 500, according to the Google Play store. Similarly, the apparent openness towards collaborating and transparently sharing data with TJHM contradicts the previous experiences.
- However, a healthy, transparent, and efficient cooperation between TJHM and CoESCD is crucial to the success of the WWCS project. Despite previous challenges and frustrations, renewed efforts should be invested in fostering this cooperation. A promising approach could be a symmetric exchange: CoESCD provides TJHM with radar data necessary to improve forecast quality, while TJHM offers CoESCD highly operative and localized information, which will be far more useful for CoESCD's operations than the current rough and non-localized weathe

Babilon-M

- As a national company, Babilon-M considers it is one of their duties to work also for the good of the people of Tajikistan. For example, during the Covid-19 crisis, they made some specific numbers free of charge (e.g. for medical consultations).
- They are not actively involved in the project's steering. They do not participate in the National Steering Committee, and they are not interested to engage directly with the other national partners at this stage. They consider CACH as their only interface to the project.
- Their mobile application myBabilon, used by over 500.000 Babilon customers, could be adapted to integrate localized weather forecasts and warnings. But some technical and organizational questions must be cleared first. In particular, they need to be sure that the API will be providing data consistently in the future.
- They do not seem to be aware that CACH plans to transition away from the sms-based warnings to the telegram bot.



Evaluators' thoughts and recommendations:

- Babilon-M is not aware that CACH is currently transitioning from SMS to a Telegram bot for the delivery of WWCS information. To maintain good collaboration, Babilon-M should be kept updated about such project evolutions, as the provision of SMS has been a cornerstone of the cooperation between CACH and Babilon-M.
- Integrating WWCS forecasts into the myBabilon app can be seen as a low-hanging fruit: with relatively minor efforts, the WWCS data could directly impact more than 500.000 people throughout the country. This is also a perfect opportunity to collect feedback from a wide user base (e.g. with a simple popup asking the users from time to time how accurate the forecasts are, or through anonymous tracking, to understand the habits and needs of the users), which can in turn help further improve the model and the service. A few key elements must however be considered:
    - The technical infrastructure providing the services will have to support a load that is massively bigger than now. It must be carefully studied, what part of the services can run on the WWCS project's own infrastructure, and what part needs to run on Babilon-M's.
    - The API backend must offer a 99% level of availability. If the interruptions are too frequent, Babilon will quickly lose interest. The current situation, with Omar being the only person monitoring and maintaining the system, cannot guarantee this level of availability.
    - The stations must be frequently serviced (by CACH and / or by TJHM). The current situation (~25% of the WWCS stations not responding) would probably look like a red flag to Babilon
    - TJHM must fully understand the approach and agree that the forecasts will be provided for free to Tajik citizens
    - Babilon has its own team of developers. If an agreement is reached, and if CACH and TJHM can provide sound evidence that they are able to guarantee the permanent availability of the service, Babilon will most probably be able to develop the "weather forecasts" widget in their app fully on their own.
- However, Babilon-M is not interested in long and endless discussions, agreements and hypothetical plans. They should only be approached again when CACH will have a very concrete plan to propose, and the resources available to implement this plan

ALRI

- Although ALRI wants to move towards a billing system, several limitations of using water-meters to monitor the consumption were highlighted:
    - the difficulty to install water meters on non-concrete channels (water-meters need clear water, and need to be regularly cleaned)
    - the procurement cost of such water-meters
- Therefore, the water consumption shall be monitored by the mirob, 3 times a day, at the “magistral” (main channel) level
- Accurate weather forecasts are very important for ALRI. In case of heavy rains, they will ask the mirob to open the gates of the channel. It was however not clear from the interview whether they received the forecasts from CACH or from the local TJHM office. Other parameters that are important for them:
    - Heat (for planning the irrigation needs)
    - Natural disasters
- For the 2nd phase, they expressed the need for:
    - heavy machinery to clean the channels
    - training for local ALRI staff and farmers on water usage, crop planting methods, etc.

Evaluators’ thoughts and recommendations:

- ALRI’s future plans for a transparent billing system were not very clear and did not fully align with the project's objectives. Specifically, ALRI envisions monitoring water usage at the channel level rather than at the field or household level. This means it would be possible to know the total water consumption for a group of fields or households, but not for each individual field or household. While this approach is understandable from a pragmatic perspective, it could become a significant bottleneck. If neighboring plots or households use different irrigation practices (traditional vs. weather-based), the incentive to use less water will be reduced if the water bill does not reflect actual consumption.

Food Security Committee

- According to them, the FSC is responsible for “everything” that has to do with animals in TJK (livestock, stray dogs, wildlife, beekeeping, etc.), but also with the provision of authorizations for the introduction of new crops, e.g.
- One of the main objective of the FSC is its internal digitalization (e.g. through a digital unique id system for all livestock in Tajikistan)
- CACH provided them with tablets and computers, but not yet the amount originally agreed upon
- The application that shall run on those tablets still needs to be developed by CACH. It was not clear from the interview what this application would entail
- The weather services should enable the FSC to inform their district inspectors, who will then relay this information to the shepherds, advising them on whether or not they should move to the higher pastures.

Evaluators’ thoughts and recommendations:

- During the discussion it became quickly very clear that the perimeter of responsibilities between the FSC, the rest of the MoA, the CEP, the Pasture Committee, the Ministry of Health, and others, is a little bit blurry. This could possibly

lead to tensions or misunderstandings during the implementation of activities, if other institutions feel they are being bypassed.
- The needs and requests from the FSC are understandable but fall far outside the project's scope. It is crucial to clearly define the objectives, scope, and limitations of the cooperation with them to avoid unrealistic expectations.

Lakhsh – trial fields

- The farmers involved in the field trials are very convinced of the weather-based irrigation approach (higher yield (up to 50% increase) and lower water consumption). They however also highlighted the critical role played by the reservoir from which the intervention plot gets its water ("*The reservoir is the main advantage of this approach, and we want to build them for our fields as well*").
- The concept of leveling is not new to the farmers, as they used to perform this task during Soviet times using mechanical levelers. However, the laser leveler appears to deliver much better results compared to its predecessors.
- The provision of weather services to the farmers seemed to be rather confusing. No single farmer was able to show a sms or message containing information or advice:
    - The Telegram bot currently only sends messages to the farmers asking them to indicate how many m3 of water have been applied to their field on that particular day
    - Information on the amount of irrigation to apply to the intervention plot was provided through phone calls from CACH
    - No one indicated having been warned about upcoming severe weather events
- Most, if not all community members have access to smartphones, and the area is decently covered by 3G/4G network. There are therefore no major obstacles in using a Telegram bot rather than sms.

Evaluators' thoughts and recommendations:

- While the weather-based irrigation approach has demonstrated promising results (bigger yield and lesser water consumption), it needs to be upscaled in order to be properly assessed, because the pilot induced 2 main bias :
    - The intervention field relies on a water reservoir, allowing for systematic irrigation at optimal times. In reality, the community only has access to water once every 14 days. This means that, in the worst case, up to two weeks could pass between the optimal moment to apply irrigation and the moment when water is actually available. Although the WWCS model compensates for this, the real impact of this hydric stress on future yields must be evaluated. The key question is whether the intervention field provided better results primarily due to the weather-based approach or mainly because of the reservoir.
    - Most farmers grow potatoes, and all their fields share similar geomorphological characteristics and are subject to identical meteorological phenomena. Consequently, it is very likely that, according to the weather-based irrigation approach, most (if not all) fields will require irrigation at the same time. Only a gradual upscale of the approach can determine if the available water supply can meet these simultaneous demands.

- There currently seems to be several open questions regarding the services that the WWCS system should provide: what information? To whom? Through which channel? After several approaches have been tested in the first phase, it is now necessary to reduce the scope, and identify the most relevant / promising services that can be upscaled to “the real world”. See *Annex 09: Identify the right weather services for broader upscale*.

Lakhsh – women’s group

- The women’s group expressed gratitude for the opportunity to cultivate this land and communicated some specific requests (more land to accommodate other women who would like to join the group, instruments, umbrellas to protect from the sun, etc.)
- The women indicated that “our men have smartphones”, meaning that the WWCS services could not necessarily reach them directly

Evaluators’ thoughts and recommendations:

- Most of the requests could be fulfilled through the project trust fund. Additional information on the fund’s modalities should be provided to the women group
- Once WWCS services specifically targeting farmers' needs are deployed, special attention must be given to ensuring that women's groups receive the relevant information and understand how to act on it.

Rasht – Deputy Head of District

- The Deputy Head of District highlighted the burning necessity to have access to reliable and localized weather forecasts (protection against disasters, agriculture, construction, etc.)
- His favorite activity from CACH was the restoration of water pipes. This has however taken place in the frame of another CACH project
- He values the cooperation with CACH

Evaluators’ thoughts and recommendations:

- This interview seems to indicate a rather open and cooperative attitude towards CACH, but didn’t raise new, or unexpected insights

Rasht – Pasture Users Union

- The central activity is the construction of the livestock shelter, which shall be finished later this year. Through this shelter, the PUU will be able to provide veterinary services (disinfection of incoming sheep), to sell hay and medicine, etc.
- Some experiments have been made with a LoRA antenna and 11 livestock chips to monitor the location of the livestock. So far, the PUU does not have access to the live data, but CACH provided them with static maps showing where the livestock had been going
- The PUU fully acknowledges that the increasing amount of livestock and the limited amount of available pastures causes serious degradation problems

Evaluators’ thoughts and recommendations:

- The livestock shelter seems like a promising and useful endeavor, but its actual impact cannot be assessed yet.

- The experiment with the LoRA antenna shows potential, but no significant impact has been observed so far. It is unclear how to best integrate the rough livestock location data (with only a few chips per herd) with the Committee for Food Security's plan to build a nationwide livestock database (requiring one chip per animal with a unique ID). A full-scale experiment with one chip per animal might exceed the project's financial capacities, while a minimal experiment, as it stands, may not fully test the approach's potential (e.g., finding lost animals). Additionally, it is not clear how to make this information operational for the Pasture User Unions (PUUs), as they cannot realistically rely on CACH to prepare, print, and deliver physical maps each time an animal goes missing.

Muminobod– Experiments

- Several experiments have been, or are being, conducted, among which: measure water run-off and soil erosion by comparing different crops, laser leveler, seed cleaner.
    - The laser leveler has just been delivered and has not been used yet
    - The seed cleaner is being used for the first time this season. They therefore don't have evidence about higher and better yields yet
- Climate change is very visible for the farmers, and impacts their lives directly (more frequent sand storms, higher temperatures, more erratic precipitation,…)
- All experiments are still in a very early phase, and their real impact can therefore not be assessed yet. However, the farmers expressed a strong opinion that those experiments are promising ("we have seen in a neighboring village how the seed cleaner improves the wheat yield", "the new wheat sort "Moskovski 56" provides higher yields"
- Although happy with the new crops tested (esparcette and wheat "Moskovski 56"), they wish additional training to improve their knowledge on how to plant and use them
- Some people (only the agronomists) have received sms from CACH to warn them about the cold wave and the heavy rains. This has allowed them to react accordingly (protect the trees against cold, and postpone the planting period). It would be good if all community members could receive those sms. Both sms and Telegram are realistic options in this area (weak internet connectivity, but sufficient for simple messages)

Evaluators' thoughts and recommendations:

- The experiments seem promising, but it is not possible to measure their actual impact / efficiency until they have been upscaled. Only the new wheat sort "Moskovski 56" has been already planted on other fields, seeming (before the 1st harvest) to indeed provide a higher yield
- Most of their additional requests (e.g. providing fences to protect crops from wild boars) could be fulfilled through the project trust fund. Additional information on the fund's modalities should be provided to the community

Muminobod – Women's groups

- 2 women groups have been formed, in 2 villages, with respectively 6 and 10 participants
- Each group rents a field (2 ha each), which is paid by CACH. CACH also provided them with trainings, e.g. on chickpeas
- The groups were created because the women don't have access to irrigated fields
- Due to a lack of water and resources, the women groups would require a pump, pipes, seeds and tools. A reservoir from which water could be pumped is available 200m away. Also, one of the groups works on a field very far away from the village. They would ideally want another one, closer, or have a mean of transportation
- More women would like to join the group, but the fields are not big enough to accommodate more workers. If other fields could be rented, other women could join

Evaluators' thoughts and recommendations:

- Most of the requests could be fulfilled through the project trust fund. Additional information on the fund's modalities should be provided to the women group
- Once WWCS services specifically aiming at the farmers' needs will be deployed, a particular attention must be put on ways to ensure that the women groups receive the relevant information, and know how to react on it

Muminobod – Rural Advisory Services

- The 7 advisors used to work with SAROB before the WWCS project. Now, they are no longer employed by SAROB, and their main source of income is provided by the farmers they support (in cash or in-kind, e.g. with a share of the harvest)
- Every year, more farmers are requesting their services. The payment mechanisms are very diverse (basic / initial advice for free, advice against payment, advice against a share of the harvest, etc.)
- The advisors have received sms informing them of upcoming cold wave, and of heavy rains, with recommendations on how to react. Those warnings have probably saved their harvest
- The WWCS project contributed the following:
    - Several technical trainings (much more efficient than those from SAROB)
    - Minor financial contribution (e.g. to cover their telecommunication costs)
    - Seeds, that the advisors provided to the farmers (in exchange of a share of their harvest)
- Additional support is needed, in particular:
    - Seeds that are more adapted to the local (changing) climate, e.g. seeds that can be planted in the spring, or "alfalfa from Germany". The increasing number of requests from farmers also means that CACH should increase the amount of seeds that they provide
    - A motorcycle, in order to be more efficient when visiting the farmers (the advisory services cannot be realised exclusively on the phone). The advisors would be able to pay themselves for the fuel.
    - Training focused on the impact of climate change (what crops and practices are adapted to climate change). In particular, those trainings should take place during winter, when their agricultural works require less attention.

Providing some kind of certification after attending the training would allow them to increase their credibility against farmers and other organizations.
    - The local market only provides low-quality seeds. CACH should help to find companies that can provide “elite” seeds on the local market. Since the increase of yield is clear, farmers would agree to pay the higher cost of those seeds, compared to the low-quality ones.
- The sms-based early warning system is extremely useful. In particular the following events should be integrated:
    - Cold / heat waves
    - Droughts
    - Strong winds
    - Heavy precipitations
    - Sandstorm
    - Landslides
    - Recommendations on optimal time to plant the seeds

Evaluators’ thoughts and recommendations:

- Some advisors seem to have the impression that CACH is their new employer (“SAROB paid our salaries and sent us once a year to the sanatorium for resting and getting training, but CACH doesn’t provide this”). It might be helpful to remind them regularly that the project’s role cannot be compared with that of SAROB.
- The EWS (based on sms and Telegram) should be upscaled to integrate (gradually) several types of warnings
- CACH can mediate between the advisors / farmers and private companies to ensure that “elite” seeds can be made available on the local market. Ideally, the first seeds to be provided in this way should be the ones that have been tested, and positively validated in the frame of the project

BOKU

- BOKU has integrated the project recently (agreement signed in May 2023)
- The initial idea was to organize students exchange between Tajikistan and Austria. So far, no Tajik students could go to Austria, apparently because of reluctance from the Tajik Universities’ side. Several BOKU students have however spent several months in the field in Lakhsh and Muminobod, to collect data and conduct various experiments
- Through its activities, BOKU contributes to better understand the possible positive and negative impacts of alternative agronomic practices, at small (field level) and large (watershed level) scale
- One of the main challenges so far is the lack of access to data, such as historical precipitation and river discharge
- BOKU appreciates a lot that the project proposal and approach have been formulated in rather generic terms, allowing to more flexibly test approaches

Evaluators’ thoughts and recommendations:

- TJHM needs to demonstrate its genuine will to contribute to the project, and to develop a sense of ownership. In this sense, CACH, SDC and their partners should work together on convincing TJHM to provide the necessary historical data

Annex 11: Study case: drip irrigation

Situation

In the village of Tut-Kawul, in Deh-i-Baland jamoat, 20 minutes away from Muminobod center, Sobitron Saidov (local farmer) has started experimenting with drip irrigation on his tomato field. He became interested in the approach through internet research, purchased the necessary equipment (pipes, filter, container) on the local market, and is experimenting for the first time during this season. The agricultural advisors provide him also with punctual support.

Before the first harvest, he can already see several tangible benefits:

- Up to 60% reduction of water usage
- Visually healthier plants and expectedly higher yield
- The soil remains loose, which is better for the crop's growth (as opposed to the traditional way, which leaves the soil much harder, and cracked).
- As a direct consequence of the previous point: less soil erosion. The extremity of his plot was not covered by the drip irrigation system, and was irrigated in the traditional way. The impact on soil erosion is obvious:

Left: "normal" irrigation approach // Right: drip irrigation

According to Sobitron, "*All the neighbors are interested in this system, and also want to use it*".
It must be noted that, in this village, farmers pay for water usage according to the area of their field, regardless of their actual water consumption. When the vodkhoze will switch to a billing system based on effective consumption, lower expenses for water usage will add up to the other advantages listed above. This village is however in the comfortable position that the farmers do not suffer from a lack of water, due to the proximity of the Muminobod reservoir. It should therefore still be tested if drip irrigation remains so beneficial in a situation where water users have to follow a grafika, as is the case in Lakhsh's project site.

Integrate into the WWCS approach

This is by far not the first time that drip irrigation is being tested in Tajikistan, but it could be a very valuable addition to the WWCS approach. Indeed, one of the main challenges with drip irrigation is to know exactly when, and how much water must be applied to the field. Sobitron Saidov's pragmatic approach is to stop the water when the upper layer of the soil is wet. Combining soil moisture sensors with localized weather forecasts can adequately inform the farmers on the amount of irrigation to put, thus adding to the water-saving and yield-increasing potential of drip irrigation.
Why it would it be a good idea for the WWCS project to combine drip-irrigation to its other approaches:

- Very simple technology, widely available on the local market, for a decent price (4000 somoni for the "highest-quality" pipes for a 0.5 hectares field)
- The upscale of the weather-based irrigation might run into bottlenecks if many farmers need to irrigate at the same time. Any additional water-saving measure will further contribute to a broader upscale

- The optimal use of drip-irrigation is an additional reason / motivation to enforce a more transparent, and usage-based billing system by ALRI
- CACH could already build upon Sobitron Saidov's experience after his first harvest, and use this as a demonstration and lessons learnt for further replication

During the visit, some ideas have been discussed to marginally further improve the efficiency:

- Use white pipes (or paint the black pipes in a light color) to reduce the temperature of the water
- Use soil moisture sensors to determine the optimal amount of water to apply

Annex 12: SWOT analysis for the testing of drones

Introduction

SDC seems particularly interested in testing and piloting the usage of various types of drones in the frame of the project, such as:

- Meteodrones: high-altitude drones developed by the ETH Zürich and the company Meteomatics(typically used to replace traditional radiosondes)
- Drones for monitoring of glaciers, snow cover and crop yields

Below are the relative strengths, weaknesses, opportunities and threats of introducing various sorts of drones within the activities of the WWCS project.

Strengths [helpful / internal origin]

- Meteodrones:
  - Could increase the accuracy of the WWCS meteorological model, especially for storm detection
- Drones for monitoring of glaciers, snow cover and crop yields:
  - Collect and compute environmental data that is relevant to better apprehend the impacts of climate change on water availability

Weaknesses [harmful / internal origin]

- Meteodrones:
  - Given the current challenges experienced by TJHM to autonomously maintain a network of low-tech weather stations, and their current inability to manage the server running the WWCS infrastructure, it seems very unlikely that they would be able to use, manage and maintain a very high-tech technology such as the meteodrones
  - The WWCS project has not yet exhausted all the simpler / quicker options available to improve the forecasts (augmenting the density of stations, integrating CoESCD's radar station, localizing the thresholds, etc.)
- Drones for monitoring of glaciers, snow cover and crop yields:
  - Most commercial imaging drones have an autonomy of a few kilometers, meaning that the operators must physically be on (or very close to) the observed location. For example, the very renowned eBee X can fly in a range of up to 8km. The organization operating it must therefore rely on solid logistic skills, and on dedicated human and financial resources to organize drone campaigns, which is not the case for TJHM
  - The processing of the drone images also requires specific skills, and equipment (powerful workstation to extract, process and analyze the images, large storage to keep an archive of the images, etc.)

    - Nowadays, commercial satellites provide multispectral images that can be used for this kind of applications. Even the freely available Sentinel-2 images can be used to monitor glacier extent and crop yields. The added value of drones over satellite images is not demonstrable for the WWCS project.

Opportunities [helpful / external origin]

- All sorts of drones:
    - If such experiments were demonstrably successful, they could contribute to increasing the Government's acceptance for drone technologies, thus simplifying their usage in the future

Threats [harmful / external origin]

- All sorts of drones:
    - The very restrictive legislation on drones in Tajikistan will make it extremely challenging for the project to get all necessary authorizations, even with backing from national partners. The amount of time and energy that the project would need to invest in the acquisition of all authorizations seems rather counter-productive, as it will divert resources away from the project's main objectives and activities
- Drones for monitoring of glaciers, snow cover and crop yields:
    - TJHM is not the institution in charge of monitoring glaciers in Tajikistan. Bringing new partners (Institute of Glaciology) into the project will require significant efforts, and further increase the project's institutional complexity, without clear gains towards the project's goals

Final thoughts

The usage of drones can be extremely beneficial for some use cases, in some contexts. But, in the framework of the WWCS project, we could not find conclusive evidence that the purchase, testing and operationalization of drone technologies would be an effective, cost-efficient, impact-oriented and sustainable approach.

The evaluators' main recommendations are to focus the 2nd phase of the project on the upscaling and operationalization of the already piloted approaches, in order to increase the project's real and demonstrable impacts. Testing drone technologies would require a level of time, resources and investments that contradicts this recommendation.

If the WWCS project however decided to test drones in the frame of the project (e.g. to create high-resolution maps of the fields and crops in the project area), it is highly recommended to first address the drone service providers in the country, rather than procuring equipment whose future anchoring within TJHM is highly questionable (technical capacities to operate the drone end-to-end, acquisition of authorizations for TJHM, actual interest from TJHM for drones, etc.). During previous projects, the evaluators have successfully cooperated with the FAZO Institute and with AKAH in this respect.

Annex 13: List of interviews

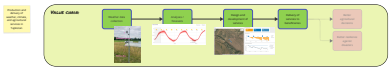
Date / time / location	With whom	Comments
06.06.2024 - 14:00 CET - MS Teams	Caritas (Shinan, Afzalsho, Boris)	Kick-Off call
12.06.2024 - 12:00 CET - MS Teams	MeteoSwiss	
19.06.2024 - 14:00 CET - Zoom	SLF	
19.06.2024 - 16:00 CET - Zoom	ICARDA Akramkhanov Akmal -	presentation of ICARDA's work in the project areas
20.06.2024 - 12:30 CET - MS Teams 20.06.2024 - 14:30 Caritas office	Caritas (Boris) Afzalsho Nasibov	discussion of travel plans to the regions
27.06.2024 - 10:00 - Caritas Office	Caritas Afzalsho Nasibov	Introduction to the mission
28.06.2024 - 09:30 - SDC Office	SDC Shodiboy Djabborov - National Program Officer Climate change and DRR	Presentation / introduction
28.06.2024 - 13:15-15:30 -	Hydromet	We meet with the focal point, with the

Date / time / location	With whom	Comments
Hydromet Office	Nurali Mirakhov - Chief Engineer Sunatullo Pirov - Head of Communications Center Sheralizoda Nazrialloh Sherali - Deputy Director	technicians and the Deputy Director
30.06.2024 Lakhsh	Ilhomiddin Jamshedov - Tractor driver, operator of laser land leveler Farmers involved in the field trials and other experiments Women group	
01.07.2024 Gharm	Deputy Head of the Rasht District Pasture User Union (livestock shelter)	
03.07.2024 - 09:00 - ALRI Office	ALRI Saidov Saiqurbon - Focal point - representative of the steering committee Yokubov Qiyomiddin - Senior specialist at a water users association	
03.07.2024 - 11:00 - CACH Office	CoESCD Tojidin Mahmadov - Head of the methodological center	
03.07.2024 - 14:00 - CFS Office	Committee for Food Security Karimzoda Rano Alidzhan - Vice-chairwoman	
03.07.2024 - 15:30 - Babilon Office	Babilon Islom Islomov - Marketing and Analytics Department Manager	
04.07.2024 Muminobod	Farmers involved in the experiments (runoff, innovative wheat sort, seed cleaner, women group	
05.07.2024	Rural Advisor Services (group discussions + visits of fields)	

Date / time / location	With whom	Comments
Muminobod	Drip irrigation experiment (not from the project) Recipients of subsidies from thePTF 2 Women groups	
06.07.2024 Dangara	Experimental plots (innovative fodder crops)	
07.07.2024 - 20:00 - Zoom	Boku	
10.07.2024 - 14:00 - SDC Office	SDC / CACH	Debrief of the mission

Annex 14: Board "Prioritization of services"

Context

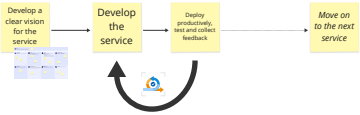


Problems

The situation in numbers

Objectives for the second phase

Counter-measures



Other suggestions?

Expected results

Evaluation of the WWCS project in TJK: quick debrief

10.07.2024 - Dushanbe, Tajikistan

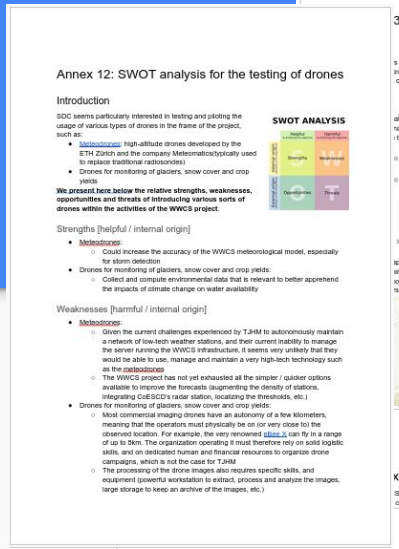
Anton Timoshenko
Stéphane Henriod

Warning

We will not go into the details in this presentation

Present main outcomes

Open discussion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SWOT ANALYSIS

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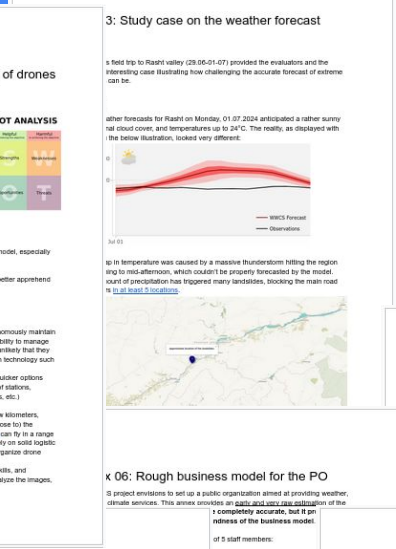

3: Study case on the weather forecast

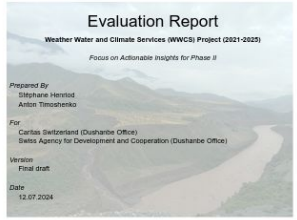
s field trip to Rasht valley (29.06-01.07) provided the evaluators and the interesting case illustrating how challenging the accurate forecast of extreme can be.

ather forecasts for Rasht on Monday, 01.07.2024 anticipated a rather sunny al cloud cover, and temperatures up to 24°C. The reality, as displayed with the below illustration, looked very different:

WWCS Forecast
Observations

Jul 01

p in temperature was caused by a massive thunderstorm hitting the region ing to mid-afternoon, which couldn't be properly forecasted by the model. ount of precipitation has triggered many landslides, blocking the main road s in at least 5 locations.


Evaluation Report

Weather Water and Climate Services (WWCS) Project (2021-2025)

Focus on Actionable Insights for Phase II

Prepared By
Stéphane Henriod
Anton Timoshenko

For
Caritas Switzerland (Dushanbe Office)
Swiss Agency for Development and Cooperation (Dushanbe Office)

Version
Final draft

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Annex 05: SWOT analysis for the setup of the Public Organization

Introduction

SWOT ANALYSIS

Maintaining the weather stations network on the long term is an endeavour currently deemed possibly too ambitious for Tajik Hydromet (TJHM). The lack of human and technical capacities, the high staff turn-over, the low salaries, as well as the doubts regarding the sustainability of such a governance model, have led to the idea of setting up a Public Organization (PO), which shall ultimately be in charge of maintaining and expanding the stations network, and of self-sustaining itself through the

x 06: Rough business model for the PO

S project envisions to set up a public organization aimed at providing weather, climate services. This annex provides an early and very raw estimation of the

completely accurate, but it pr
ndness of the business model.

of 5 staff members:

Annex 11: Study case: drip irrigation

Situation

In the village of Tul-Kawul, in Deh-i-Baland jamoat, 20 minutes away from Muminobod center, Sobitron Saidov (local farmer) has started experimenting drip irrigation on his tomato field. He became interested in the approach through Internet research, purchased the necessary equipment (pipes, filter, container) on the local market, and is experimenting for the first time during this season. The agricultural advisors provide him also with punctual support.

Before the first harvest, he can already see several tangible benefits:

- Up to 60% reduction of water usage
- Visually healthier plants and expectedly higher yield
- The soil remains loose, which is better for the crop's growth (as opposed to the traditional way, which leaves the soil much harder, and cracked).
- As a direct consequence of the previous point: less soil erosion. The extremity of his plot was not covered by the drip irrigation system, and was irrigated in the traditional way. The impact on soil erosion is obvious:

viable option, with no extras (e
ut an assistant or a driver). It is a
option if a staff member is missi
s envisioned as an independent
ll TJHM offices, and the PO's tec
erform regular maintenance and

g the WWCS system will be insta
ed on the fact that international o
ptions within Tajikistan, although
cal perspective, a professional ho
he long run, and would avoid mar

led by CACH to kick-off the PO. T
ire) the money necessary to purc
preciation of the goods is consid

rovided by CACH to support the
tion is not known yet). However,
ses will need to be covered by

es, e.g.) are also not included in
exact legal status of the PO. Infla

oint), the provision of one single
weather alerts) to a very broad u
The PO's sources of income can
unities are unveiled.

Annex 07: WWCS business model as a global international initiative and digital public good

In this annex, we present a possible direction to make the WWCS approach and technology sustainable in the future.

WWCS as a global international initiative

The core assumption is that there is no demonstrable market-oriented business model for the Public Organization (PO) to generate sufficient revenue independently (see *Annex 05: SWOT analysis for the setup of the Public Organization* and *Annex 06: Raw business model for the PO*). Consequently, the system will need to be subsidized by projects and donors until the system is widely recognized as a trusted provider of services, and a demonstrable source of profit is identified (e.g. big companies expressing a need for more specific services, providing a potential revenue stream).

However, as long as the WWCS system is only deployed in Tajikistan, it will struggle to gain significant traction. Therefore, it is crucial to promote the system in other regions and countries, lobbying for wider adoption. Expanding its use beyond Tajikistan will not only increase its visibility but also attract more stakeholders and potential funding sources.

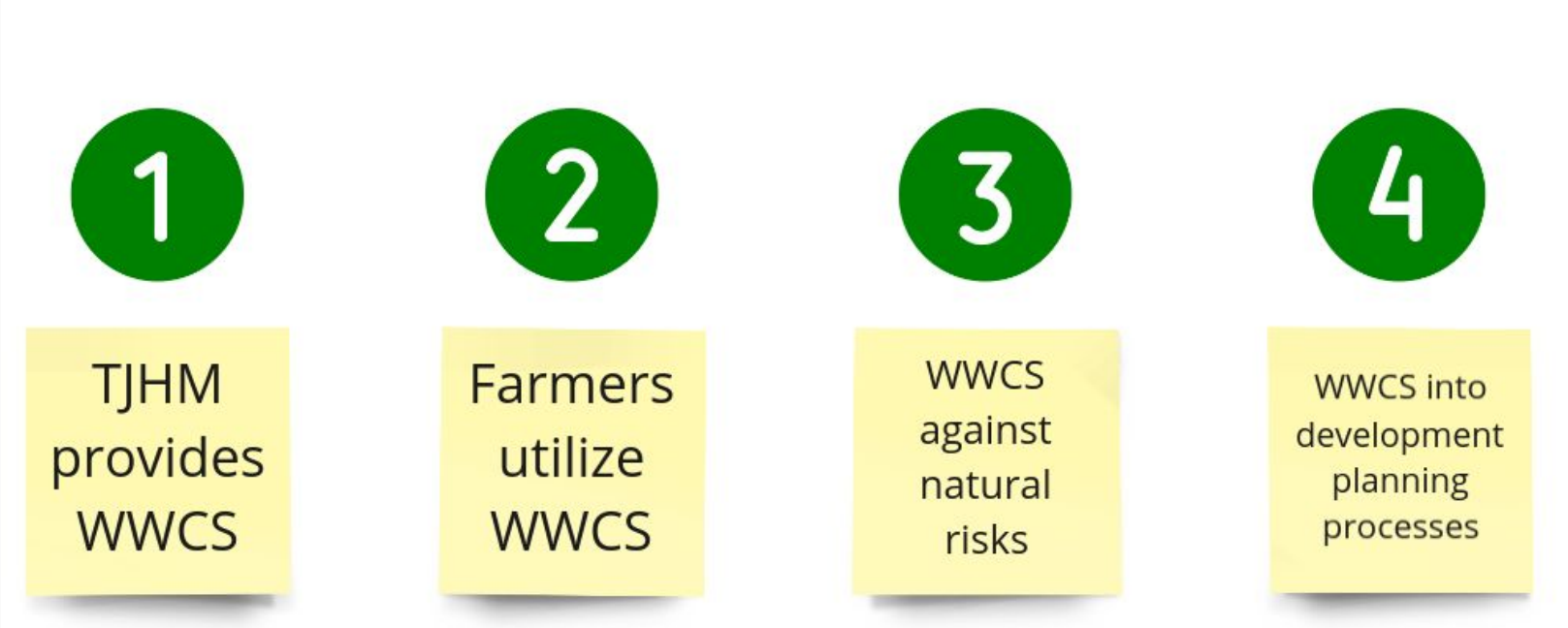
This expansion and improvement are feasible because the WWCS system is OpenSource. An OpenSource approach allows any interested party to access the design and source code freely, fostering collaboration and innovation. By making the system's code and design publicly available, it encourages global participation and contribution, leading to continuous enhancements and adaptation to various regional needs. This open-source nature is key to its scalability and sustainability, as it leverages a wide pool of expertise and resources without the constraints of proprietary limitations.

Therefore, if, for example, the World Bank wanted to replicate the WWCS in Nepal, they could simply take the existing design and source code, procure stations (according to the WWCS OpenDesign specifications), and deploy them throughout the country. They could then build on this foundation by, e.g., improving the model, creating new services and dashboards, and adding support for additional sensors and parameters. Importantly, they should integrate their enhancements into the main codebase, allowing TJHM to benefit from these improvements without incurring additional costs.

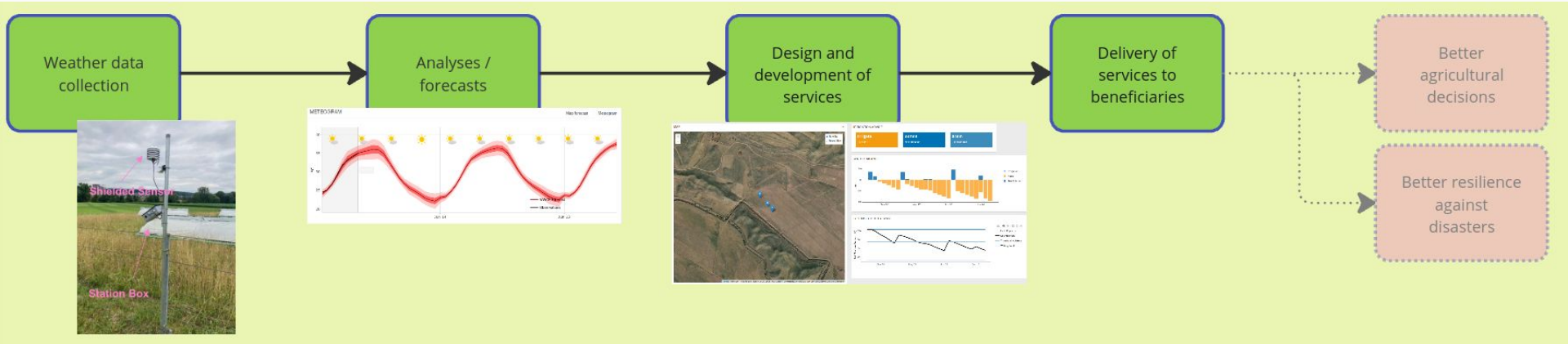
However, to ensure the quality and relevance of contributions to the codebase, as well as a consistent strategy over the steering of the WWCS initiative, there needs to be a facilitator or broker overseeing the entire process. This role could be undertaken by CACH, ensuring that all improvements are beneficial and of high quality, thus maintaining the system's integrity and efficacy.

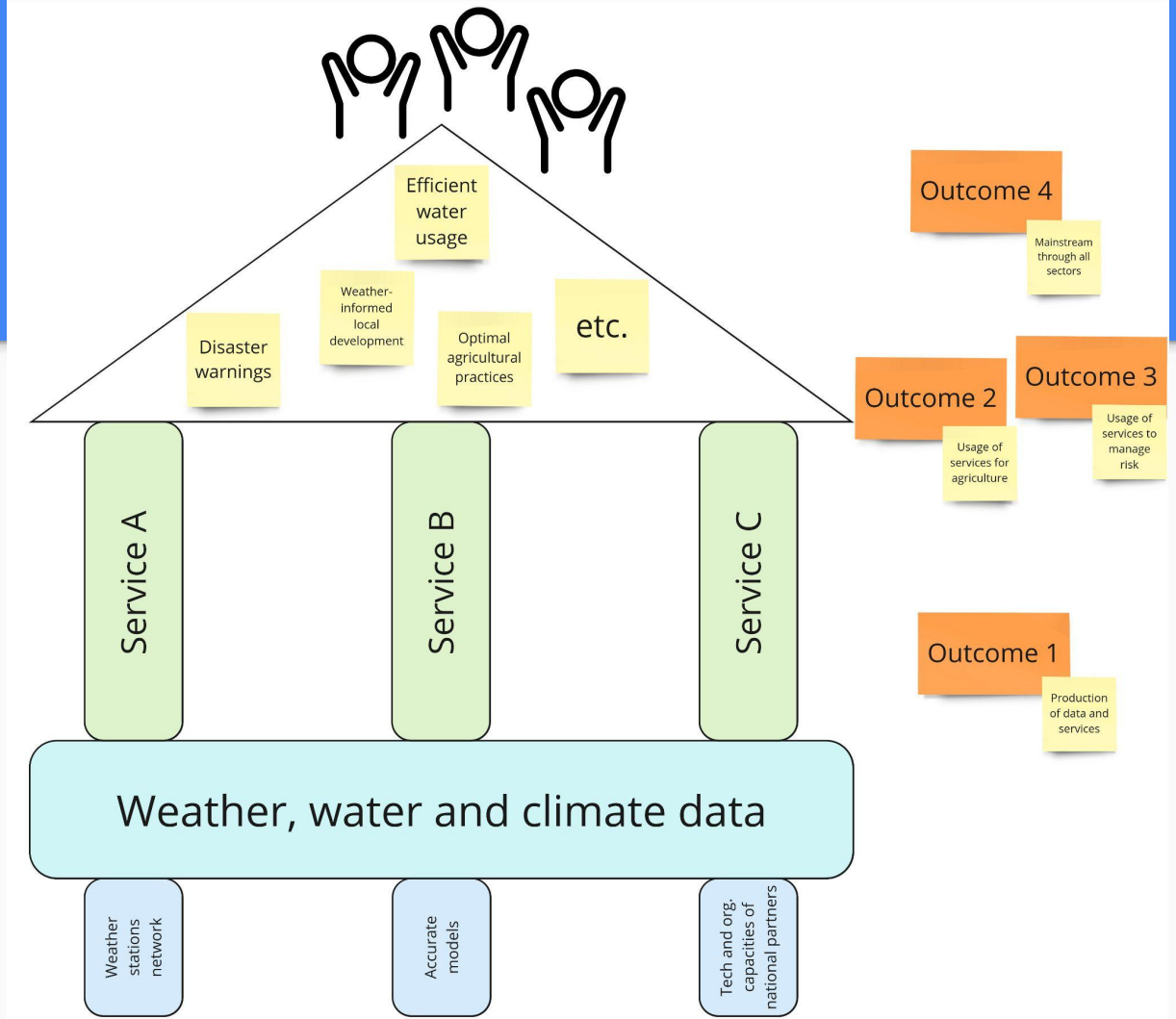
Project's logic:
Recap

Leveraging weather, water and climate services for sustainable rural livelihoods and well-being

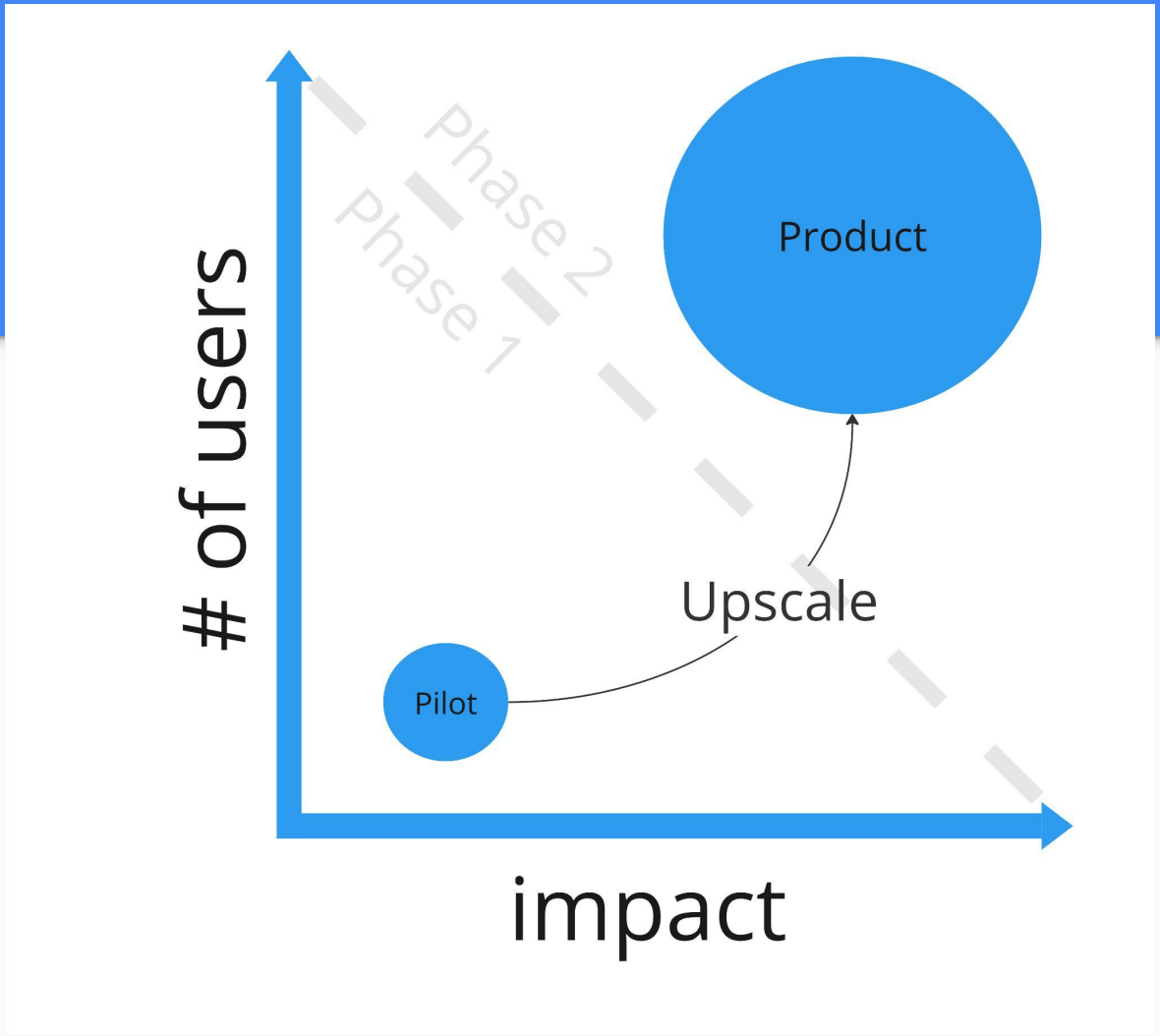


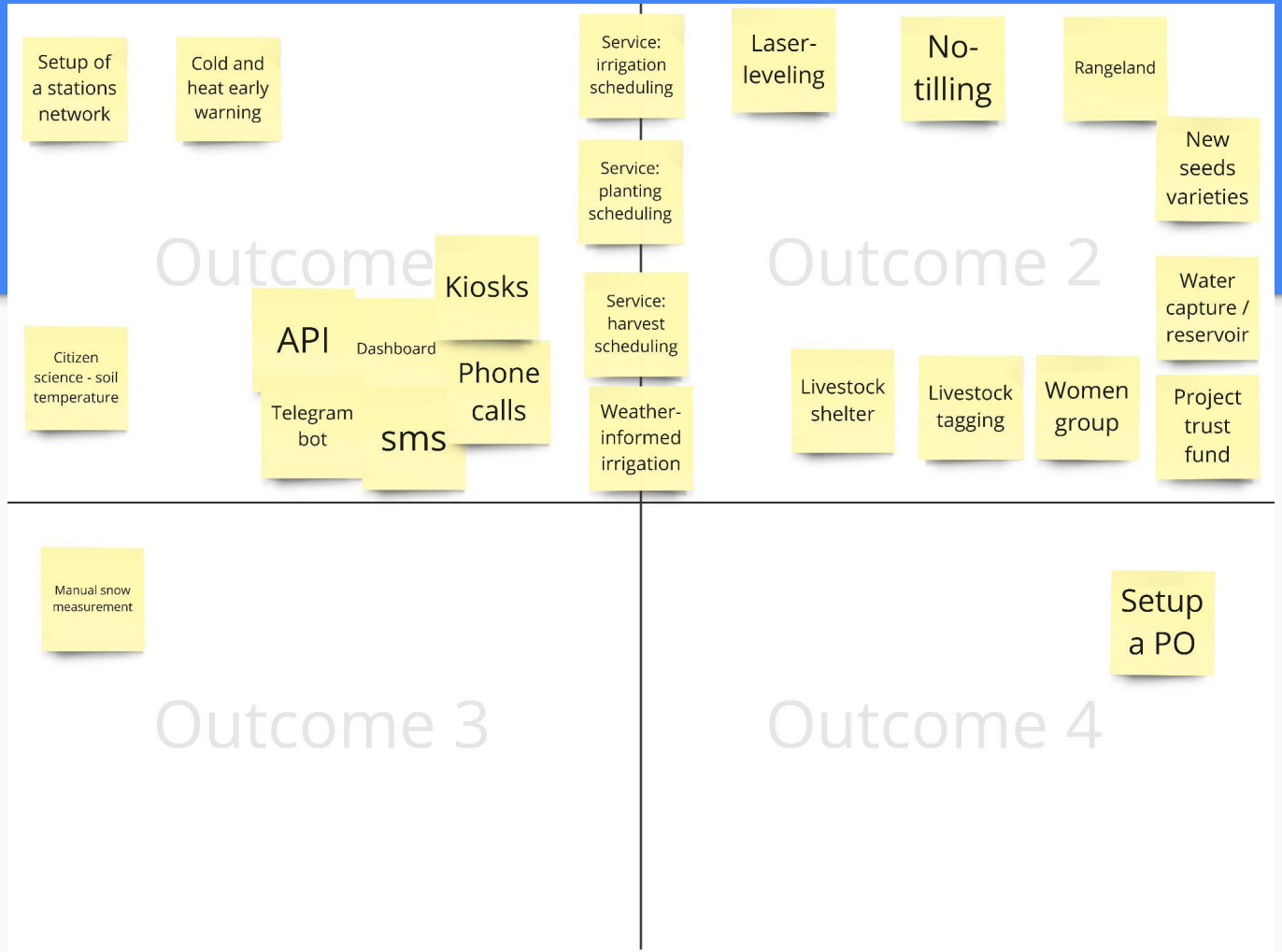
The project’s value chain




Efficient water usage
Weather-informed local development
Optimal agricultural practices
etc.
Disaster warnings
Outcome 4
Mainstream through all sectors
Outcome 2
Usage of services for agriculture
Outcome 3
Usage of services to manage risk
Service A
Service B
Service C
Outcome 1
Production of data and services
Weather, water and climate data
Weather stations network
Accurate models
Tech and org. capacities of national partners


Phase 1:
The pilot


Phase 2
Phase 1
Product
# of users
Upscale
Pilot
impact


Setup of a stations network
Cold and heat early warning
Service: irrigation scheduling
Laser-leveling
No-tilling
Rangeland
New seeds varieties
Service: planting scheduling
Outcome 1
Outcome 2
Kiosks
API
Dashboard
Service: harvest scheduling
Water capture / reservoir
Citizen science - soil temperature
Phone calls
Telegram bot
sms
Weather-informed irrigation
Livestock shelter
Livestock tagging
Women group
Project trust fund
Manual snow measurement
Setup a PO
Outcome 3
Outcome 4

Key observations: steering and PM

NSC passive => need to reactivate WGs and slowly hand over ownership

Implementation partners strongly committed and happy about the collaboration

But, need for an internal discussion platform (30min. monthly meetup?)

Key observations: Outcome 1

180 stations running - 75% responding - very accurate forecast

A few services successfully tested on a few dozens users

TJHM now convinced of the relevance of the approach

Fully functioning system and infrastructure - but need upscale for the next phase

1

Key observations: Outcome 2

Lakhsh: weather-informed irrigation provides better yields, but biases

Ad-hoc services (phone calls, sms) have saved harvests

New yields, machinery and practices create new harvest opportunities

Some (minimal) upscale of the new yields, through RSA

2

Key observations: Outcome 3

Limited engagement of CoESCD so far (despite chairing the NSC 2024)

Sharp interest for digitalization and “operational information” - Kiosk is a first step

Training on avalanche forecast (September) might increase interest

Contributing to their “SOS” mobile app as well

Key observations: Outcome 4

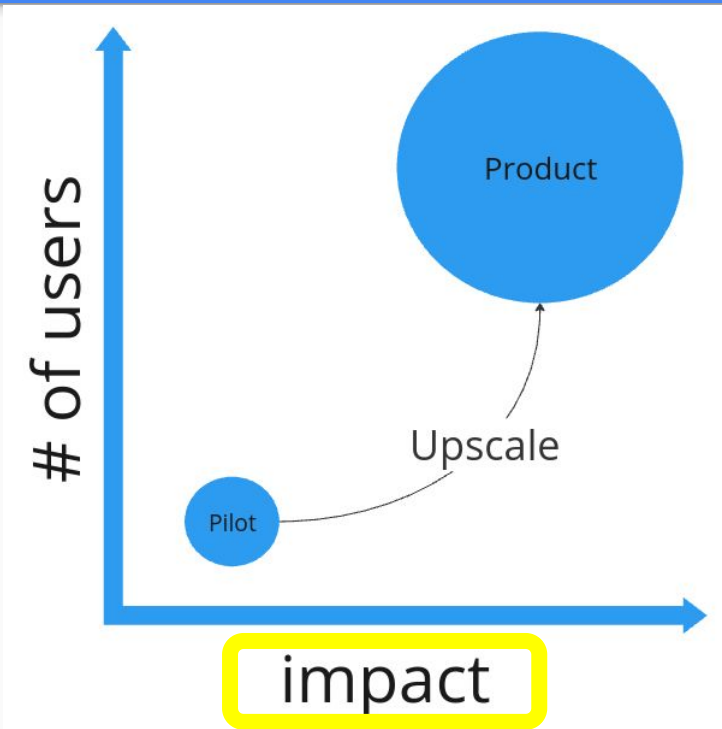
Can realistically only start once services are upscaled and rolled-out

Setup of the PO as one possible way to facilitate WWCS mainstreaming

Phase 2:
The upscale

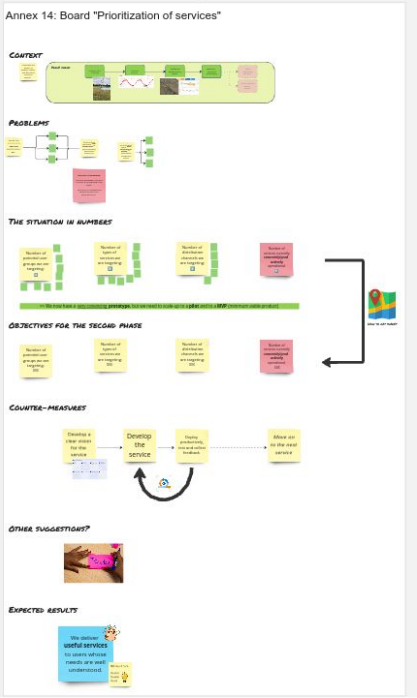
Why upscale?

From testing and learning in controlled environments to…

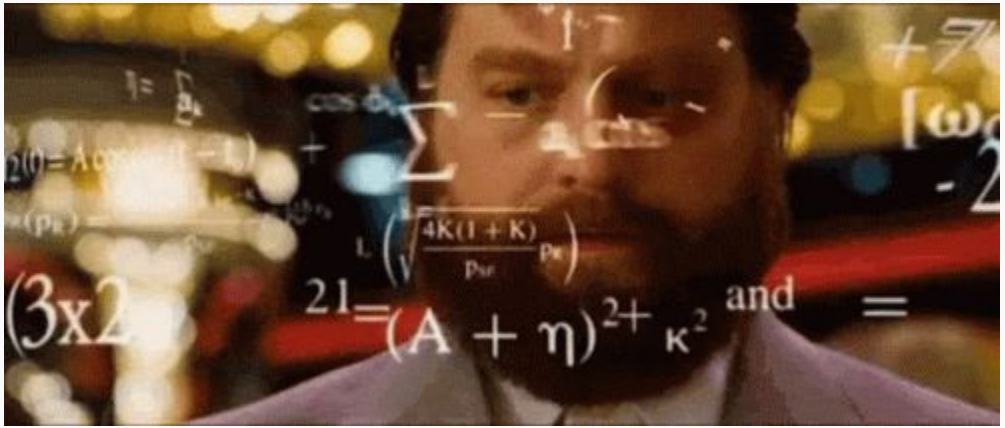


How to upscale?

Example: prioritizing the WWCS services to be upscaled

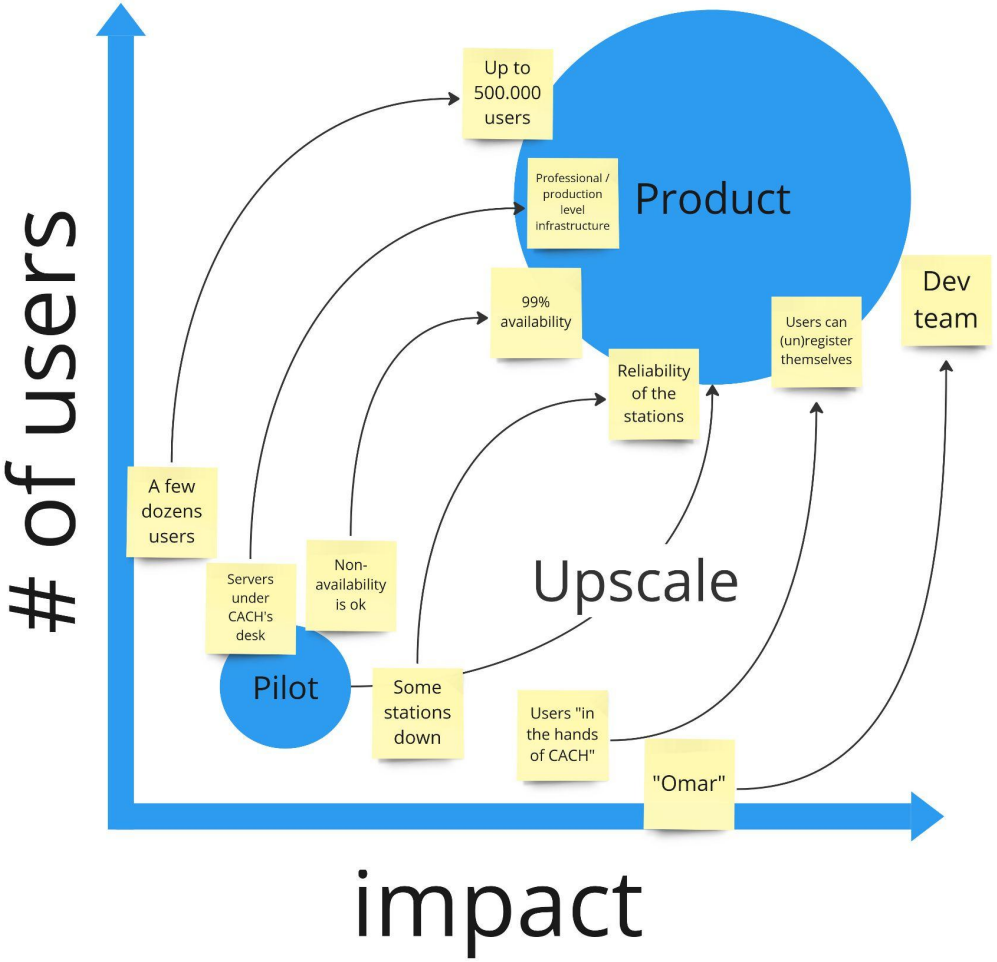


Upscale = completely new challenges



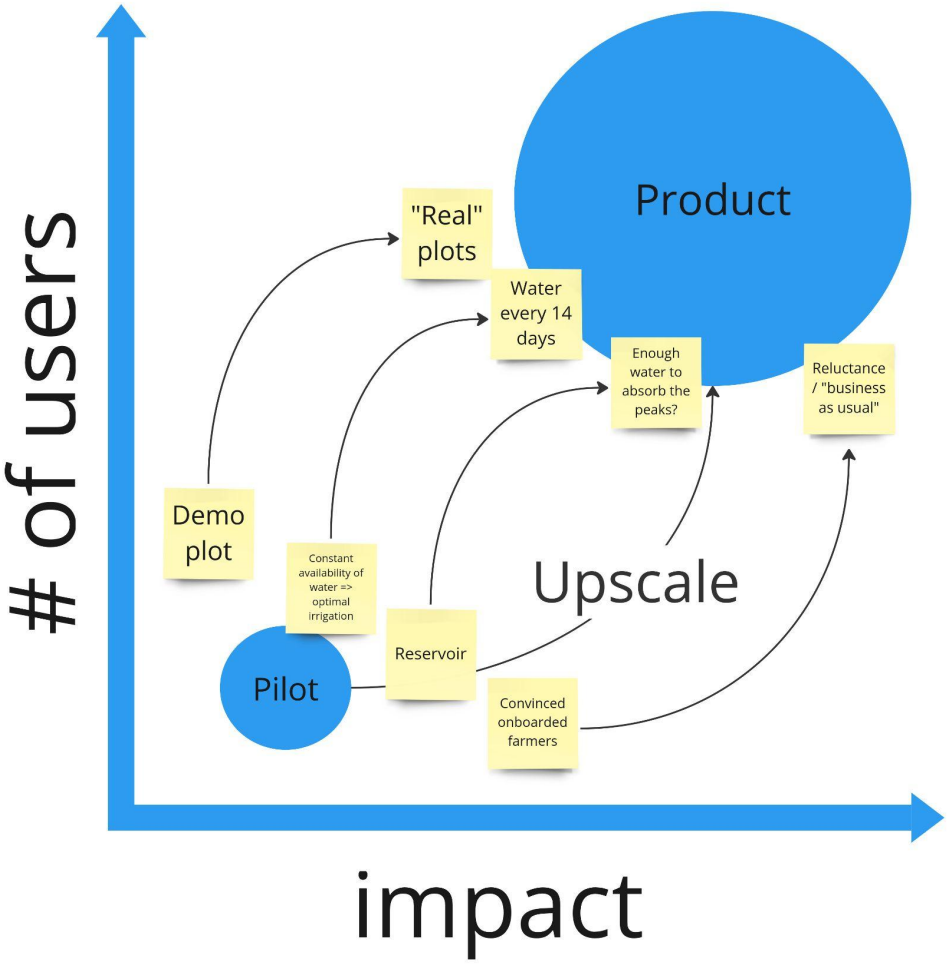
Upscale = from controlled environment to the real world

Example:
WWCS services



Upscale = from controlled environment to the real world

Example:
Lakhsh potatoes



Key recommendations for the 2nd phase

Annex 01: Detailed recommendations

The recommendations for the second phase are organized by thematic topics, but not by outcomes, since most of them will directly impact more than 1 outcome. The most directly impacted outcomes are indicated with the following code:

1

Outcome 1: Tajik Hydromet provides timely and effective WWCS.

2

Outcome 2: Farmers utilize WWCS to inform their decisions for effective agronomic practices, diversified crop mix associations and Sustainable Land Management practices.

3

Outcome 3: Communities and authorities in target areas employ WWCS to manage risks from natural hazards.

4

Outcome 4: Governmental structures at all levels (national, oblast, district, jamoat) incorporate WWCS into their development planning processes.

1. **Focus** on upscale

Many development cooperation projects never go beyond the pilot phase

A day has only 24 hours and the partners have limited resources to contribute

Some additional piloting is ok, BUT…

… upscale, operationalization and replication is what will create impact

1.1 **Get ready** for upscale

Upgrade and professionalize the technical infrastructure (scalability + flexibility)

Development team: Omar + local developers + TJHM

Create the environment that will support upscale of the services

2. Identify the (few) **most impactful** WWCS services to upscale

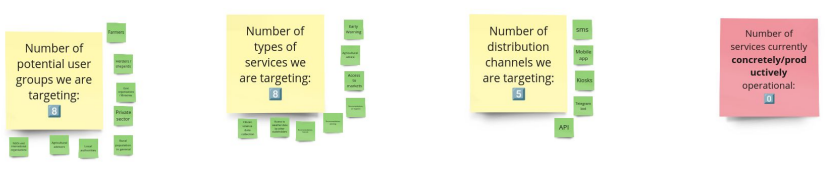
Reach more people? Low-hanging fruits? Most requested?

Objective: reach a critical mass of users: create evidence, generate feedback

Basic services delivered for free, to make a case for future advanced paying services

Focus first on a few services. Don’t do everything at once

Once the services are widely used, we can start thinking *business model*



2.1 Simple EWS through Telegram / sms

Very positive feedback from early recipients “We really need that”

User-centricity

Accompanied by capacity development measures (how to react?)

2.2 The myBabilon App

Low-hanging fruit - 500.000 users

Radical change of scale => professional provision of services

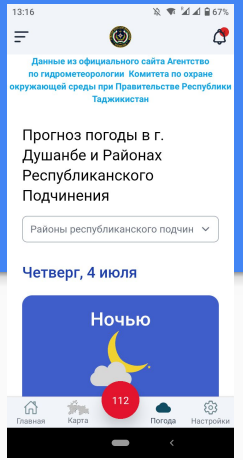
Leverage Babilon’s infrastructure and expertise

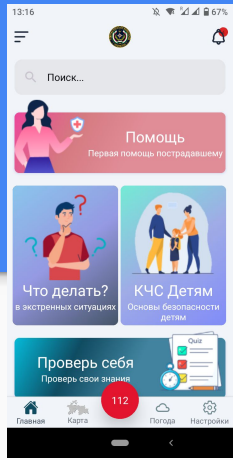
And possibly deploy later to other apps (myTcell, etc.)

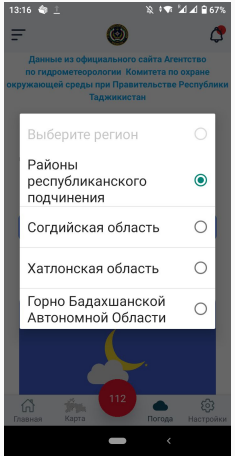
2.3 CoESCD's SOS app

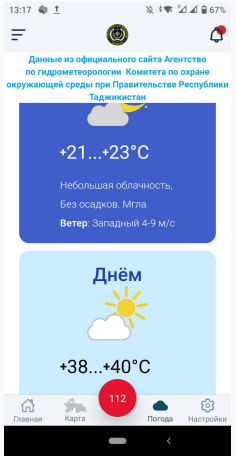
Low-hanging fruit - 500 users

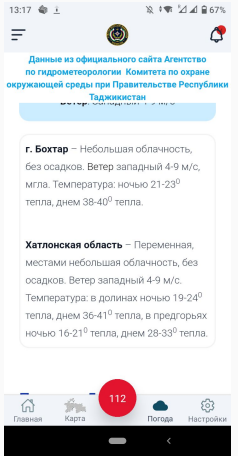
Raise interest of CoESCD through "1 service for CoESCD"









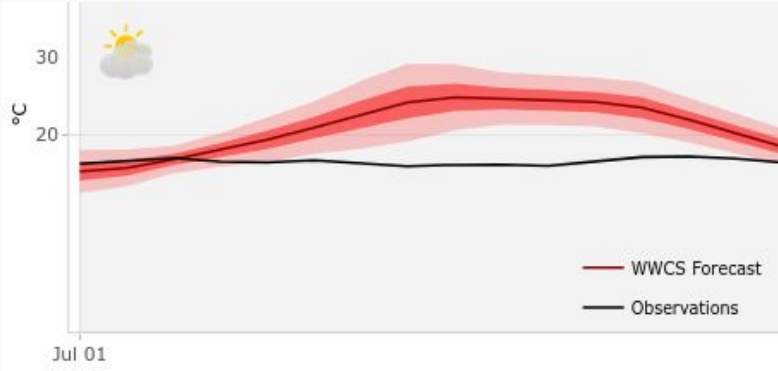


3. Further **improve the forecast** accuracy

The forecast accuracy is estimated by TJHM at 90% - comparable to their forecast

But still challenging to capture some extreme events (esp. rain, thunderstorms)

Several directions can be envisioned

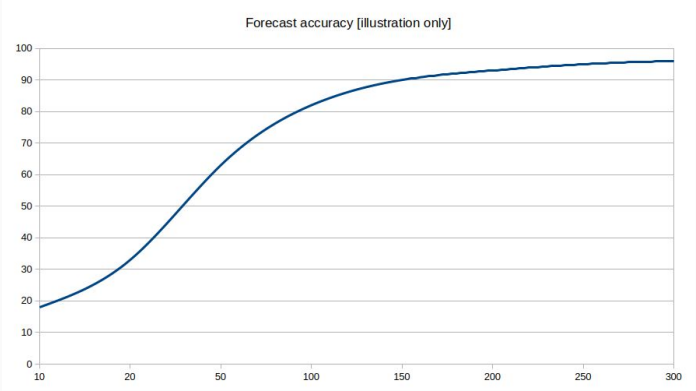


3.1 Increase the **density of stations**

A higher density will improve the forecast, and make the network more robust

BUT there is a limit (“*How many stations is optimal?*”)

Closely monitor the impact on forecast accuracy



3.2 Closely **monitor** the forecast accuracy

Ultimate goal = accurate forecast

XXX stations is only a means to this end

Close monitoring to understand how “more stations”, “other stations”, “stations on other places” impact the accuracy

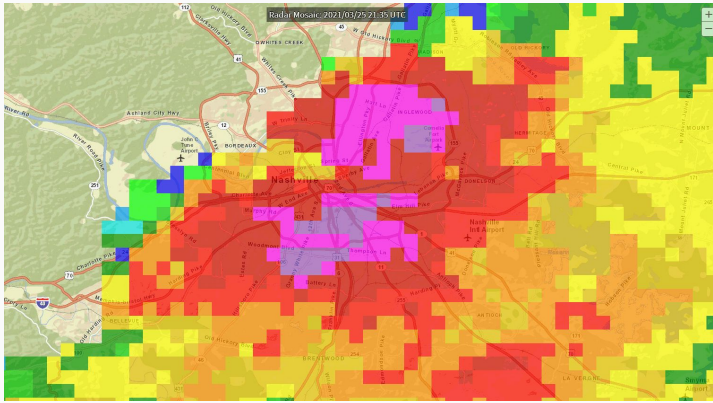
Dedicated dashboard

3.3 Reactivate the **CoESCD radar**

Nowcast will increase the accuracy of the forecast

Active cooperation with TJHM (“*radar data against operational services*”)

Probable need for operational support



4. Freeze the setup of the PO

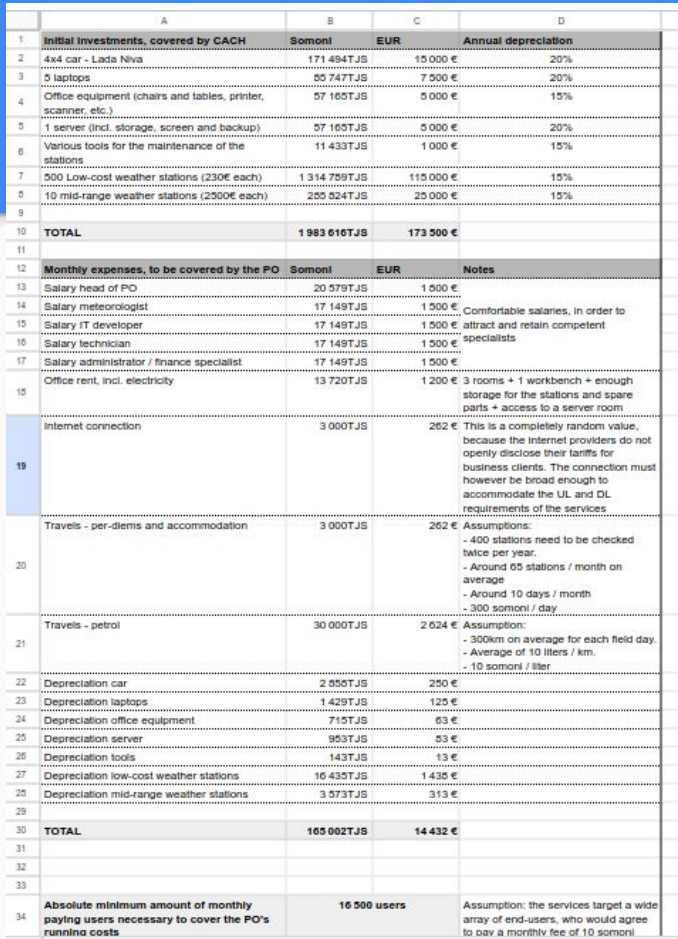
Unrealistic business model on the short- to mid-term

First need evidence that there is a market for services

How to dimension the PO if we have no idea about

- type of services?
- number of users?

The time / resources spent now on setting up the PO are not spent on provision of real-life services



	A	B	C	D
1	**Initial investments, covered by CACH**	**Somoni**	**EUR**	**Annual depreciation**
2	4x4 car - Lada Niva	171 494TJS	15 000 €	20%
3	5 laptops	55 747TJS	7 500 €	20%
4	Office equipment (chairs and tables, printer, scanner, etc.)	57 165TJS	5 000 €	15%
5	1 server (incl. storage, screen and backup)	57 165TJS	5 000 €	20%
6	Various tools for the maintenance of the stations	11 433TJS	1 000 €	15%
7	500 Low-cost weather stations (230€ each)	1 314 759TJS	115 000 €	15%
8	10 mid-range weather stations (2500€ each)	285 524TJS	25 000 €	15%
9				
10	**TOTAL**	**1 983 616TJS**	**173 500 €**	
11				
12	**Monthly expenses, to be covered by the PO**	**Somoni**	**EUR**	**Notes**
13	Salary head of PO	20 579TJS	1 800 €	
14	Salary meteorologist	17 149TJS	1 500 €	Comfortable salaries, in order to attract and retain competent specialists
15	Salary IT developer	17 149TJS	1 500 €	
16	Salary technician	17 149TJS	1 500 €	
17	Salary administrator / finance specialist	17 149TJS	1 500 €	
18	Office rent, incl. electricity	13 720TJS	1 200 €	3 rooms + 1 workbench + enough storage for the stations and spare parts + access to a server room
19	Internet connection	3 000TJS	262 €	This is a completely random value, because the internet providers do not openly disclose their tariffs for business clients. The connection must however be broad enough to accommodate the UL and DL requirements of the services
20	Travels - per-diems and accommodation	3 000TJS	262 €	Assumptions: - 400 stations need to be checked twice per year. - Around 65 stations / month on average - Around 10 days / month - 300 somoni / day
21	Travels - petrol	30 000TJS	2 624 €	Assumption: - 300km on average for each field day. - Average of 10 liters / km. - 10 somoni / liter
22	Depreciation car	2 855TJS	250 €	
23	Depreciation laptops	1 429TJS	125 €	
24	Depreciation office equipment	715TJS	63 €	
25	Depreciation server	953TJS	83 €	
26	Depreciation tools	143TJS	13 €	
27	Depreciation low-cost weather stations	16 435TJS	1 435 €	
28	Depreciation mid-range weather stations	3 573TJS	313 €	
29				
30	**TOTAL**	**165 002TJS**	**14 432 €**	
31				
32				
33				
34	**Absolute minimum amount of monthly paying users necessary to cover the PO's running costs**	**16 500 users**		Assumption: the services target a wide array of end-users, who would agree to pay a monthly fee of 10 somoni

5. Reactivate the **Project Trust Fund**

Very flexible way to provide small-scale, and impactful support

Great asset to incentivize people AND to support them with concrete outcomes

6. Bring the new **seeds to the local markets**

Successful experiments with innovative seeds, but cannot recycle them for ever

Partnership with private companies to ensure availability

But anticipate the risk of monoculture / monovariety

7. Upscale the “**Lakhsh potato experiment**”

Build evidence that the approach also works at full scale

(and / or identify what needs to be adjusted)

Combine with drip irrigation

8. WWCS as a **global international initiative** and **digital public good**

WWCS needs continuous improvement (new services, new parameters, new models)

Market is too small in TJK (both private sector and international dev cooperation)

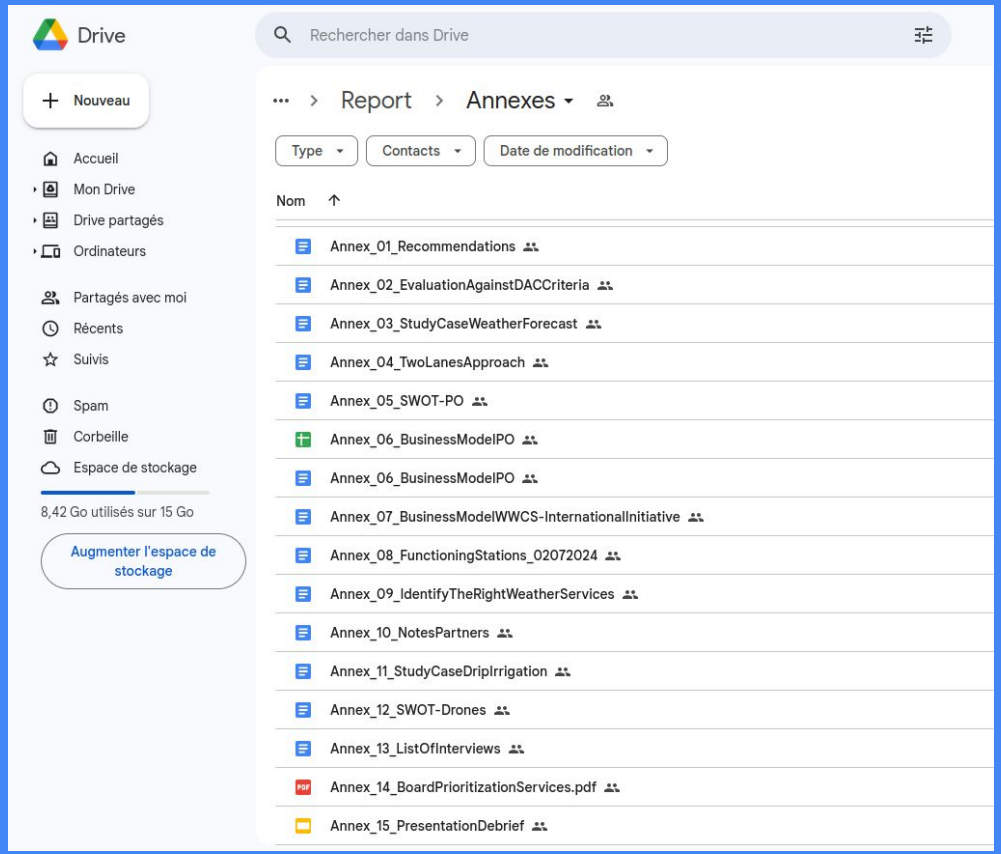
Needs a critical mass of users, developers, supporters => lower costs for all

Leverage OpenSource and OpenDesign

Similar to openIMIS

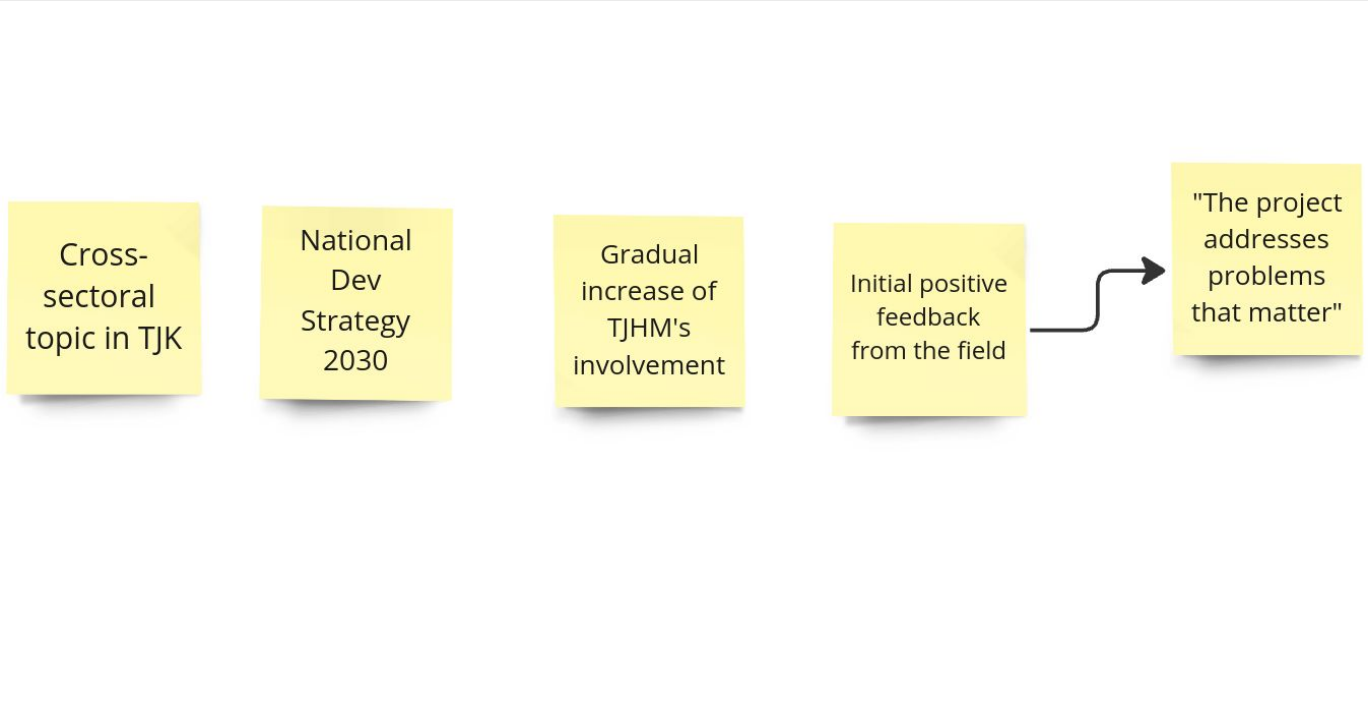
openIMIS

Open Discussion

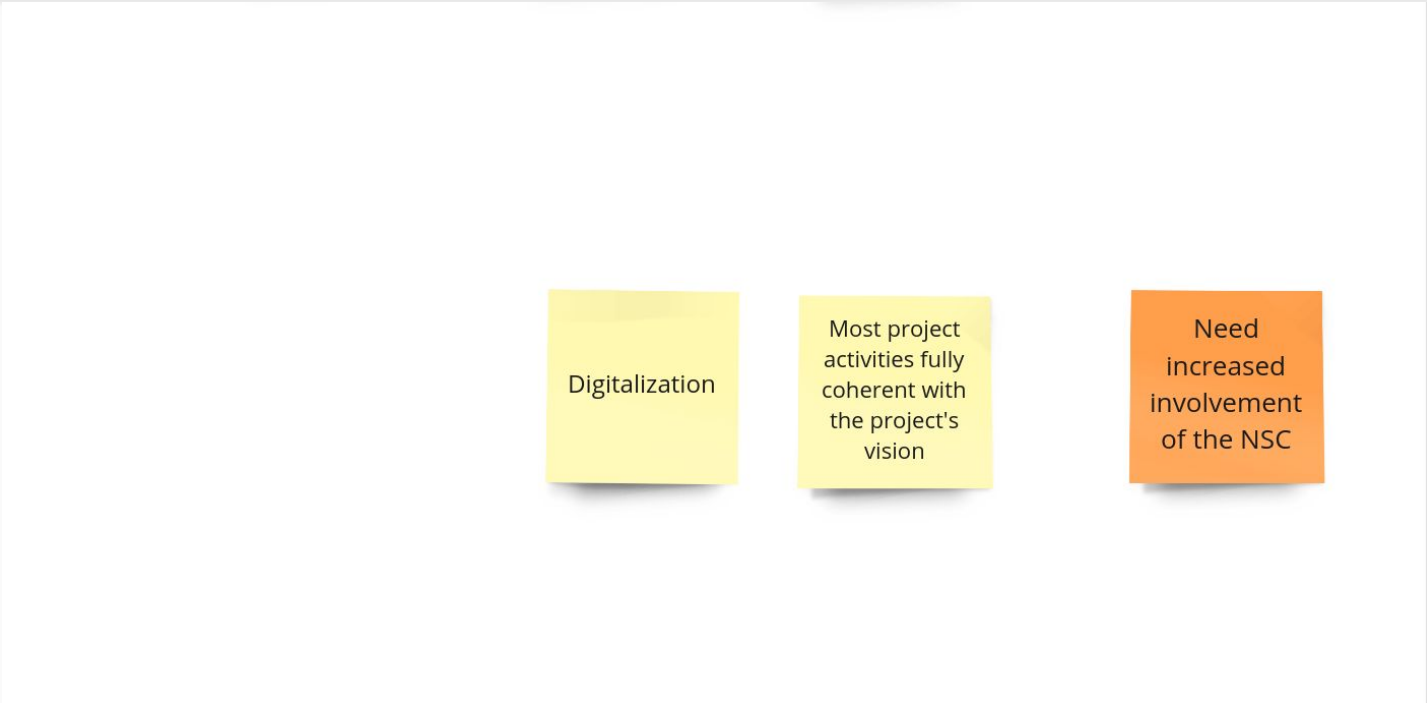


DAC criteria

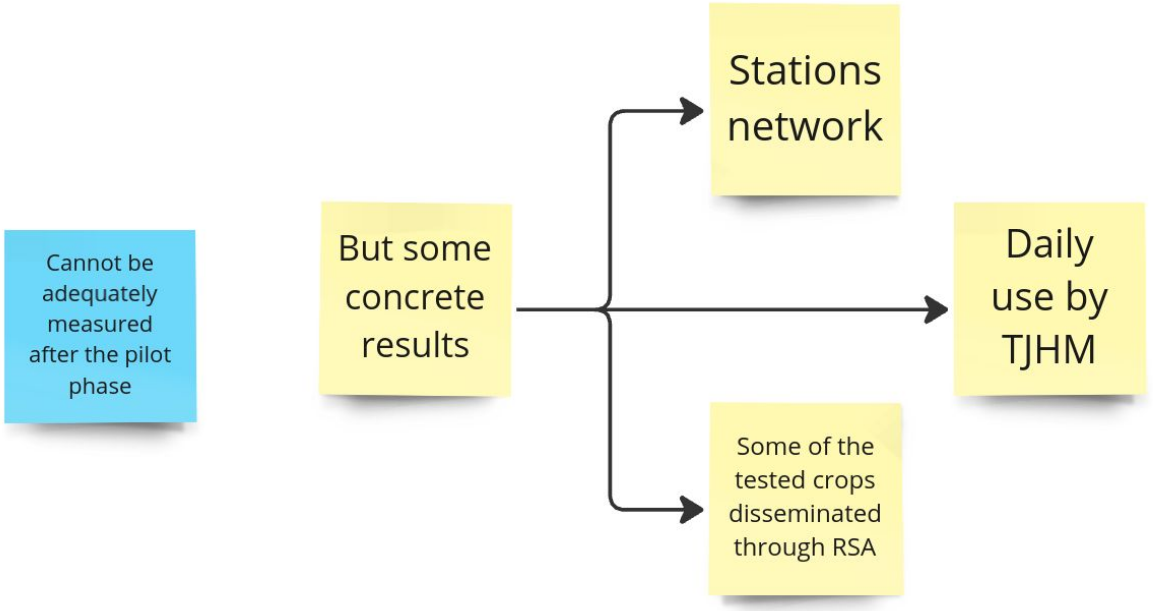
DAC - Relevance



DAC - Coherence



DAC - Effectiveness

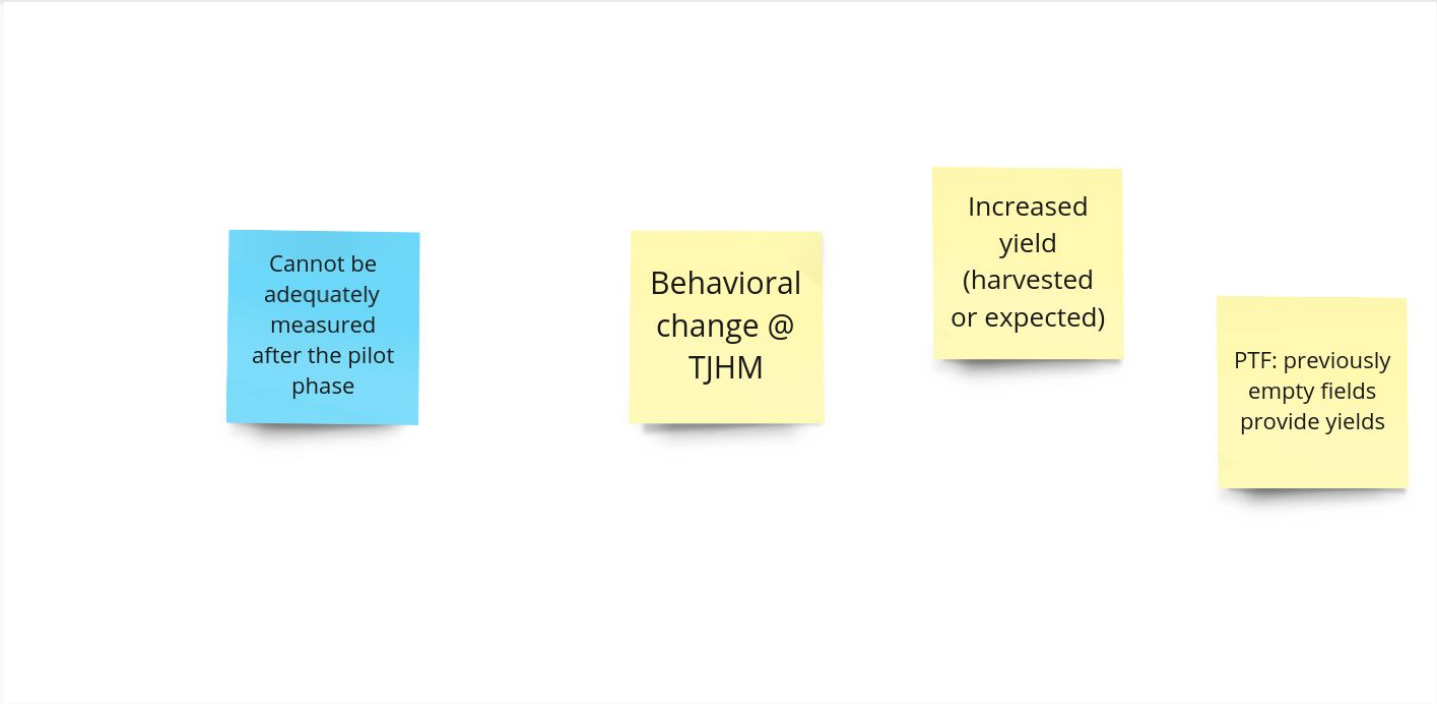


DAC - Efficiency

Cannot be adequately measured after the pilot phase

Low-cost approach => efficient procurement and maintenance

DAC - Impact


Cannot be adequately measured after the pilot phase
Behavioral change @ TJHM
Increased yield (harvested or expected)
PTF: previously empty fields provide yields

DAC - Sustainability

Assessment grid for project/programme evaluations of the SDC interventions (October 2023)

This assessment grid is a mandatory annex to external evaluations (and internal assessments in the case of SECO) of SDC and SECO financed projects and programs (hereinafter referred to as an 'intervention'), be they commissioned by SDC, SECO or external partners. It is based on the OECD Development Assistance Committee evaluation criteria and guidance.[1] Its purpose it to help make results of evaluations more transparent and quantify them (transform the qualitative information in the evaluation reports into quantitative scores) in a standardized manner. This serves accountability purposes and helps for the aggregate reporting, steering and learning.

How to use this assessment grid:

- Evaluators should provide the filled assessment grid in ***Word***.
- All *applicable* sub-criteria should be scored and a short explanation provided. If the evaluation ToRs explicitly exclude some DAC criteria, they should not be filled in the assessment grid. To guarantee coherence, it is advised to match each evaluation question in the ToRs to a sub-criterion in the assessment grid.
- The 20 sub-criteria shall not be modified, however additional sub-criteria may be added to reflect specific objectives and learning interests of the commissioner.
- If specific results are not yet measurable at the time of the assessment, it requires analysing the likelihood of achieving those results (in particular for the criteria effectiveness, impact and sustainability). Please mention this in the dedicated section (evaluability assessment on p. 2).
- There are hyperlinks on each evaluation criterion in the assessment grid, which lead to the OECD guidance on each specific criterion. The guidance also includes information on the interlinkages and differences between the DAC criteria.
- When applying a gender and climate lens, evaluators are expected to use the relevant guidance.[2]
- To rate each sub-criterion, select your rating (0-4, kindly only use integers) in the column “score”:

	Relevance / coherence / efficiency	Effectiveness	Impact	Sustainability
1= Highly satisfactory	There were **no shortcomings** in relation to the intervention’s relevance/ coherence/ efficiency.	Objectives at outcome level were (or are likely to be) **fully** achieved or exceeded.	The intervention had (or is likely to have) a **significant positive** impact.	**All** of the intervention’s benefits (will) last. *Note: for this rating, clear evidence is required (not only assumptions).*
2= Satisfactory	There were **moderate shortcomings** in relation to the intervention’s relevance/ coherence/ efficiency.	Objectives at outcome level were (or are likely to be) **largely** achieved.	The intervention had (or is likely to have) an **overall positive** impact.	**A majority** of the intervention’s benefits (will) last.
3= Unsatisfactory	There were **important shortcomings** in relation to the intervention’s relevance/ coherence/ efficiency.	Objectives at outcome level were (or are likely to be) only **partially** achieved (at a rather low level). *Note: if outputs are achieved, but do not result in the expected outcomes, consider rating effectiveness as unsatisfactory.*	The intervention had (or is likely to have) **no** impact.	**A minority** of the intervention’s benefits (will) last.
4= Highly unsatisfactory	There were **very severe shortcomings** in relation to the intervention’s relevance/ coherence/ efficiency.	Objectives at outcome level were **not** achieved (or are **un**likely to be achieved).	The intervention had (or is likely to have) an unexpected **negative** impact.	**None** of the intervention’s benefits (will) last.
0= Not assessed	The criteria statement cannot be assessed. Please explain in the justifications section.			

[1] Two guiding principles were set out by the OECD DAC Network on Development Evaluation alongside the definitions of the six criteria. These are:
a. Principle One: The criteria should be applied thoughtfully to support high-quality, useful evaluation.
b. Principle Two: Use of the criteria depends on the purpose of the evaluation.
The OECD guidance Applying Evaluation Criteria Thoughtfully (2021) explains these principles and provides advice as well as examples for the use of the criteria.

[2] See for instance Applying a Human Rights and Gender Equality Lens to the OECD Evaluation Criteria

Along with the assessment grid, please also fill in this table with data on the evaluation, on the evaluated intervention and on the evaluability of the intervention.

Evaluation data			
Title of the evaluation report	Evaluation Report - Weather Water and Climate Services (WWCS) Project (2021-2025)		
Evaluation mandated by	SDC and Caritas Switzerland	Evaluation dates (start – end)	11.06.2024 30.08.2024
Evaluation carried out by Name of lead evaluator (if relevant) Name of company	Stephane Henriod Anton Timoshenko Company name	For external evaluations: Total evaluation budget (including all fees and costs) and currency	21240 CHF
Has any member of the evaluation team been involved in the intervention?	No	If yes, how?	Briefly explain the type of involvement here
Evaluated intervention data			
Intervention title (including phase number)	Weather, Water and Climate Services (2021–2025)		
Intervention internal number (if available) (e.g. 7F-…, UR_...)	Click here to enter text.	Dates of the evaluated phase (start – end)	01.01.2021 01.07.2024
Is it the final phase?	No	Total budget for the evaluated phase; SDC/SECO contribution if applicable	CHF 5657964 CHF 2593234
Evaluability[3] assessment by evaluator			
To which extent do you consider that the intervention can be evaluated in a reliable and credible fashion?	2 - reliable		
If applicable, please select the type of limitation(s) to the evaluation and provide a brief explanation *Note: when assessing evaluability also consider the representativeness and participation of specific stakeholders/groups involved in the evaluation as well as the influence of conflict/fragile context on the quality and validity of the data and access to target groups (if applicable)*	☐ Objectives are not adequately defined (e.g. weaknesses in intervention design, lack of baselines and targets) ☒ Results are not verifiable (e.g. too early to tell, lack of sufficiently robust data and evidence) ☐ Other limitation(s) The first phase of the project (the one being evaluated here) exclusively focused on piloting innovative approaches, methods and technologies. This has led to the identification of a few relevant and mature approaches, that shall now be upscaled within the second phase. However, it is not possible to evaluate the actual impact, effectiveness of efficiency of a pilot project. The evaluation provides deep insights into the DAC criteria, but a conclusive analysis can only be conducted during / after the second phase.		

[3] See definition of evaluability in OECD (2023), Glossary of Key Terms in Evaluation and Results Based Management for Sustainable Development (Second edition), OECD Publishing, Paris https://www.oecd-ilibrary.org/docserver/632da462-en-fr-es.pdf?expires=1690787009&id=id&accname=guest&checksum=ED10CC16AE8370653438B9C7A52688E0

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
1 Relevance: Is the intervention doing the right things? Summary: The extent to which the intervention's objectives and design (at the time of design and at time of evaluation) respond to beneficiaries' and involved stakeholders' needs and priorities, and continue to do so if circumstances change. *Note: Understanding gendered power dynamics and reflecting on the SDG commitment to "leave no one behind" are crucial in understanding relevance.*	*Please do not write anything here. The DAC criteria score will automatically be calculated as the arithmetic mean of sub-criteria.*	The thematic focus of the project (better weather, water and climate data for more informed decision making) is extremely relevant for many sectors in Tajikistan. This has been confirmed by all interviews, at local, district and national levels, and is emphasized in several sections of the National Development Strategy 2030 ("Prevention or prediction (reduction) of vulnerability" as one of the Strategy's 3 basic principles; "Ensuring food security" as one of the Strategy's core objectives for the next 15 years; "Integrated water resource management" and "Diversify agricultural production, as well as introduce innovations with minimum impact on the environment and quality of land" as two of the main activities identified to reach the strategic goals).
1.1 ***Responsiveness to needs, policies and priorities***: the extent to which the objectives (at output, outcome and impact levels) of the intervention respond to the needs and priorities of the beneficiaries (target group), involved stakeholders (involved in funding, implementing and/or overseeing the intervention) and, when relevant, to indirectly affected stakeholders (e.g. civil society, etc.). *Note: A particular emphasis should be placed on beneficiaries. If there are trade-offs, please describe them in the justification.*	1 - highly satisfactory	As explained above – The objectives are fully in-line with several govt and sectoral strategies. In particular, several govt institutions undergo a (slow) digitalization process, to which the project can actively contribute.

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
1.2 ***Sensitiveness and responsiveness to the context and capacities of the beneficiaries and involved stakeholders****:* the extent to which the context was considered in the design of the intervention (e.g. economic, environmental, equity, social, cultural, political economy and last but not least capacity considerations). *Note: Evaluators are encouraged to describe which contextual factors are most pertinent to the intervention.*	1 - highly satisfactory	One of the central challenges for a successful implementation lies in the systemic under-staffing of Tajik Hydromet, and their low technical capacities. This challenge was fully acknowledged by the project, both during the conception (capacity development measures for Hydromet) and during the implementation itself (identification of alternative measures)
1.3 ***Quality of design****:* the extent to which core design elements of the intervention (such as objectives and their related indicators, logframe, theory of change including related assumptions, choice of services and intervention partners, exit strategy) reflect the needs and priorities of the target group, are appropriate, realistic, clearly defined, measurable and feasible (technical, organisational and financial feasibility). *Note: the exit strategy should be planed from the outset of the intervention to ensure the continuation of positive effects as intended, whilst allowing for changes in contextual conditions.*	2 - satisfactory	Most of the elements of the intervention reflect the needs and priorities of the stakeholders, partners and beneficiaries. One hypothesis however is based on non-demonstrable assumptions: the fact that TJHM, or the Public Organization, can become financially self-sustainable by selling services. At the time of the evaluation, there is no evidence that a sufficient market for weather, water and climate services exists in Tajikistan
1.4 ***Adaptation over time****:* the extent to which the intervention has meaningfully adapted to changes over the course of its lifespan (e.g. evolving policy and economic contexts, change of funding, new opportunities, outbreaks of conflict or pandemic, etc.).	1 - highly satisfactory	Despite the numerous changes and unforeseeable events (Covid, disturbance of the global procurement, initial reluctance of Hydromet to sign the cooperation agreement, etc.), the project's approach has continuously evolved.
If an additional sub-criteria is relevant please formulate it here	0 - not determined	Click here to enter text.
2 Coherence: How well does the intervention fit? Summary: The compatibility of the evaluated intervention with other interventions in a country, sector or institution, i.e., the extent to which other interventions (in particular policies) support or undermine the intervention and vice versa.	*Please do not write anything here. The DAC criteria score will automatically be calculated as the arithmetic mean of sub-criteria.*	As explained above, the project's logic is very coherent with the national development strategy, and with the core mission of the main national partner, Tajik Hydromet. Most national partners either have already started a process of digitalization of their activities (CoESCD, TJHM), or are strongly interested in this (Committee for Food Security). The project clearly supports this.

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
		The project's activities themselves are mostly very coherent, with the vision to mainstream weather services into several sectors (agriculture, DRR, local economy, etc.).
2.1 ***Internal policy alignment***: the extent to which the intervention aligns with the wider policy frameworks of the Swiss Development Cooperation, including the most recent Swiss international cooperation strategy overall and at country level, as well as to relevant international norms and standards to which Switzerland adheres (international law, international agreements, etc.).	0 - not determined	Specific information on the SDC strategies were not provided for evaluation
2.2 ***Internal compatibility***: the extent to which the intervention is compatible with other interventions of Swiss development cooperation in the same country/region and thematic field (consistency, complementarity, synergies, avoiding duplication of efforts, subsidiarity). *Note: if feasible, evaluators are encouraged to also take into account compatibility with the interventions of different levels / departments of the Swiss government in the same operating context (e.g.: development, diplomacy, trade, security, etc.)*	0 - not determined	Specific information on the SDC strategies were not provided for evaluation. It must however be highlighted that the intervention's objectives are highly cross-sectoral, and that a successful implementation will most likely trigger positive side-effects on other interventions and areas of work as well
2.3 ***External compatibility***: the extent to which the intervention is compatible with interventions of other actors in the country and thematic field (complementarity, synergies, overlaps and gaps, value-added, use of existing systems and structures for implementing activities, harmonization, coordination, etc.).	2 - satisfactory	Provision and access to weather services is a very recurring topic among the development community in Tajikistan. The intervention's results, if positive, can directly flow into many projects and activities of other actors in the country, and in the region. As usual, an optimal and effective coordination with other projects is very difficult to establish, but no obvious flaws can be attributed to the intervention itself.
If an additional sub-criteria is relevant please formulate it here	0 - not determined	Click here to enter text.
3 Effectiveness: Is the intervention achieving its objectives? Summary: The extent to which the intervention achieved, or is expected to achieve, its objectives and its results, including any differential results across groups.	*Please do not write anything here. The DAC criteria score will automatically be calculated as the arithmetic mean of sub-criteria.*	The project's first phase has been mostly exploratory, testing and piloting various approaches and ideas. Since none of them has been fully scaled-up yet, the evaluation of the concrete results is rather limited. However, a few very concrete outputs could be achieved (based on the indicators from the project's logframe): Impact level: The results at impact level cannot be adequately measured after the pilot phase. Only a broader upscale in phase 2 will allow for a meaningful assessment

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
		Outcome 1: Deployment of 180 low-cost weather stations, most of which send consistent data to the WWCS system Identification of a few key services that bear great potential for up-scale during phase 2. Their broader deployment will allow to monitor the rate of adoption among the population Outcome 2: Several new crops have been tested, and, for some of them, disseminated through the RAS. Most of them have been planted this year for the first time, thus not allowing to evaluate the yield increase Outcome 3: No systematic EWS could be established so far. Ad-hoc measures have however been taken to inform (per phone call) the local populations of upcoming cold wave or heavy precipitation Outcome 4: Due to the absence, so far, of fully deployed services, no development planning process has taken advantage of the WWCS services so far The capacity development measures have been spontaneously praised by the local communities.
3.1 ***Achievement of objectives**:* The extent to which the intervention achieved or is expected to achieve its intended objectives (outputs and outcomes) as originally planned (or as modified to cater for changes in the environment), including its transversal objectives (e.g. gender, climate) *Note: If some – but not all – of the objectives were achieved the evaluators will need to examine their **relative importance** to draw conclusions on the effectiveness.*	2 - satisfactory	Likelihood to achieve the wished outcomes can be properly evaluated only after the piloted activities have been upscaled.
3.2 ***Unintended effects***: The extent to which the intervention has responded adequately to the potential benefits/risks of the positive/negative unintended results.	2 - satisfactory	Very few possibly negative unintended effects have been identified during the evaluation. The possible risks associated with mono-cropping, although not explicitly addressed within the project, are counter-balanced by additional measures (rotation, agro-forestry,...), but must be explicitly addressed (or, at least, considered) during a broader upscale in the 2nd phase.

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
3.3 ***Differential results**:* the extent to which the intervention results (outcomes) were inclusive and equitable amongst beneficiary groups and the extent to which key principles such as non-discrimination, accountability and leave-no-one-behind were taken into account during the implementation.	0 - not determined	Cannot be assessed before upscale of the piloted activities. The support to women groups ensures however that some marginalized groups are also directly impacted by the intervention
If an additional sub-criteria is relevant please formulate it here	0 - not determined	Click here to enter text.
4 Efficiency: How well are resources being used? Summary: The extent to which the intervention delivers, or is likely to deliver, results in an economic and timely way.	*Please do not write anything here. The DAC criteria score will automatically be calculated.*	Evaluating the efficiency of the project (in terms of human and financial resources) at this stage is premature, as it has focused solely on piloting activities without yet scaling them up. This is akin to researching and engineering a new car; until the first car hits the market, all investments appear as "pure loss." The true measure of efficiency, in terms of human and financial resources, can only be assessed once the project has been fully implemented and its outcomes and impact realized. Therefore, only time will reveal whether the project has been efficient in its resource utilization. One element must however be highlighted here: while TJHM was very doubtful about the low-cost weather stations at the beginning of the project, their cost-efficiency (for the procurement and maintenance) has ultimately convinced them of the approach.
4.1 ***Economic efficiency*:** The extent to which the intervention delivered the results (inputs → outputs; inputs → outcomes) in the most cost-efficient way possible (including allocation of resources between target groups and time periods; available options for purchasing inputs according to market conditions, etc.).	2 - satisfactory	Evaluating the efficiency can only be carried out after an upscale phase. However, the very central principle of the evaluation (low-cost weather stations) addresses in itself the question of the cost-efficiency, which has been praised by Hydromet, especially for its potential to ensure a cost-efficient long-term maintenance of the stations
4.2 ***Timeliness*:** The extent to which the intervention delivered the results (outputs, outcomes) in a timely manner (within the intended timeframe or reasonably adjusted timeframe) and the extent to which efforts were made to mitigate delays. *Note: in case timeliness was unsatisfactory for reasons outside of the intervention's control, the rating should still be unsatisfactory and explanation provided in the justification field.*	2 - satisfactory	The delays (less than 500 stations deployed, etc.) are direct causes of 1) External factors (Covid, initial reluctance of Hydromet to sign the agreement,...) 2) The recognition that "500 stations" should not be a goal in itself. Rather, the accuracy of the forecasts, and the anchoring of the approach within the national

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
		systems are the actual measures of a successful delivery
4.3 ***Operational efficiency***: The extent to which management, monitoring and steering mechanisms supported efficient implementation (resource allocation, spending and redirection, risk management, logistics and procurement decisions, etc.)	0 - not determined	Could not be systematically evaluated. But no obvious flaws could be identified by the evaluators
If an additional sub-criteria is relevant please formulate it here	0 - not determined	Click here to enter text.
5 Impact: What difference does the intervention make? Summary: The extent to which the intervention has generated or is expected to generate significant positive or negative, intended or unintended, higher-level effects. Impact addresses the ultimate significance and potentially transformative effects of the intervention. It seeks to identify social, environmental and economic indirect, secondary and potential consequences of the intervention that are longer term or broader in scope than those already captured under the effectiveness criterion. It does so by examining the holistic and enduring changes in systems or norms, and potential effects on people's well-being, human rights, gender equality, and the environment. *Note: depending on the timing of the evaluation and the timescale of intended benefits, evaluators can assess for both actual impacts (i.e. already evident) and foreseeable impacts.*	*Please do not write anything here. The DAC criteria score will automatically be calculated as the arithmetic mean of sub-criteria.*	Similarly, the actual impact of the project can only be evaluated after a broader upscale of the piloted approaches. However, some observed marginal impacts could indicate that a scale-up could actually prove the impactfulness of the project: Behavioral change: Despite initial doubts TJHM uses the WWCS dashboard and really sees advantage of the low-cost approach (while also seeing the limitations) Impact on the communities: Some farmers have already seen a yield increase in some small-scale experiments (weather-based irrigation, new wheat sort,...) The realization of small projects through the Project Trust Fund has had a significant impact on individual farmers, e.g. allowing them to grow vegetables, chickpeas or wheat on previously non-usable fields
5.1 ***Intended impacts*:** The extent to which the intended (planed and, where applicable, revised) 'higher-level effects' (i.e. lasting changes in the lives of beneficiaries) of the intervention were (or are expected to be) achieved. *Note: also consider the extent to which the intervention contributed to "holistic and enduring changes in systems or norms" and transformational change (addressing root causes or systemic drivers of poverty, inequalities, exclusion and environmental damage).*	0 - not determined	Cannot be realistically assessed before a real upscale has taken place.
5.2 ***Contribution to intended impacts:*** The extent to which the intervention actually contributed (or is expected to contribute) to the intended higher-level effects. *Note: results of contribution analysis, etc.*	0 - not determined	Cannot be realistically assessed before a real upscale has taken place.

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
5.3 ***Unintended impacts***: Has the intervention brought about (or is it expected to bring about) any unintended (positive and/or negative) higher-level development results? If yes, to what extent have these higher-level effects been positive (or are likely to be positive)? *Note: consider here any kind of unintended effects such as escalating or deescalating effect on a conflict or context of fragility, effect on the legitimacy of the state or non-state actors, effect on the inclusion or exclusion of vulnerable groups, unintended pollution, etc.* *If there wasn't any noteworthy unintended impact (higher-level effect), mark this question as non-applicable (n/a) and do not give a rating.*	1 - highly satisfactory	Nothing indicates that major unintended impacts (positive or negative) will be triggered by the intervention
5.4 ***Differential impact***: the extent to which the intervention's intended and unintended higher-level results (impacts) were (or are expected to be) inclusive and equitable amongst beneficiary groups and the extent to which key principles such as non-discrimination, accountability and leave-no-one-behind were taken into account during the implementation. *Note: Keep in mind that positive impacts overall can hide significant negative distributional effects.*	0 - not determined	Cannot be realistically assessed before a real upscale has taken place.
If an additional sub-criteria is relevant please formulate it here	0 - not determined	Click here to enter text.
6 Sustainability: Will the benefits last? Summary: The extent to which the net benefits of the intervention continue or are likely to continue. Includes an examination of the enabling environment for sustainable development, i.e. financial, economic, social, environmental, and institutional capacities of the systems needed to sustain net benefits over time. Involves analysis of resilience, risks and potential trade-offs. *Note: depending on the timing of the evaluation and the timescale of intended benefits, evaluators can assess for both actual sustainability (i.e. the continuation of net benefits created by the intervention that are already evident) and prospective sustainability (i.e. the net benefits for key stakeholders that are likely to continue into the future)*	*Please do not write anything here. The DAC criteria score will automatically be calculated as the arithmetic mean of sub-criteria.*	A very visible evolution has been observed since the beginning of the project. While TJHM was very doubtful at the beginning, they have slowly taken some ownership, by integrating the WWCS dashboard in their own forecasts, and taking the lead on the maintenance of some stations. But due to a lack of internal capacities, they have not achieved a full level of ownership and leadership yet, which will be key in the long-term sustainability of the WWCS approach. Regarding CoESCD, the amount of activities concretely implemented with them is too scarce to really assess the extent to which they will really demonstrate ownership. Some of the evaluation's recommendations aim at increasing their interest, and ownership in the WWCS approach. The central question regarding the sustainability of the WWCS approach has to do with the long-term maintenance of the WWCS network and infrastructure. While the project initially envisioned

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
		anchoring the system at TJHM, the idea of setting up a Public Organization emerged during the 1st phase, moved by the vision that the PO would be allowed (unlike TJHM to sell services and to financially self-sustain itself). At the moment, there are no indications that such a business model is a realistic endeavor in Tajikistan. See Annex 05: SWOT analysis for the setup of the Public Organization and Annex 06: Raw business model for the PO.
6.1 ***Capacity and resilience development***: The extent to which the beneficiaries and development partners have strengthened their capacities (at the individual, community, or institutional level), have the resilience to overcome future risks and external shocks that could jeopardise the intervention's results and have improved their ownership or political will.	2 - satisfactory	Mostly at field level, many beneficiaries have highlighted the many benefits they gained from the various capacity development measures.
6.2 ***Financial sustainability***: The extent to which development partners have the financial resources to maintain the intervention's net benefits over time (e.g. increased national, and where applicable subnational, financial or budgetary commitments).	3 - unsatisfactory	There currently doesn't exist any demonstrable evidence that the WWCS approach can financially self-sustain itself. As strongly highlighted in the report and in the recommendations, pure financial sustainability should not be the central objective at this stage. Rather, a reliable provision or accurate, and useful services should guide the intervention's logic for the 2nd phase. It should not be overlooked that, even in Europe, meteorological services are subsidized by the State, and do not cover all their running costs through the provision of paid services. If the Tajik Government is not able / willing to finance the basic infrastructure, and to ensure a high level of expertise, those costs will need to be (at least partly) subsidized by the international development community.
6.3 ***Contextual factors***: The extent to which the context is conducive to maintain the intervention's net benefits over time (e.g. policy or strategy change; legislative reform; institutional reforms; governance reforms; increased accountability for public expenditures; improved processes for public consultation in development planning). *Note: It includes assessing the trade-offs associated between instant outcomes and potential longer-term effects as well as the trade-offs between financial, economic, social and environmental aspects.*	2 - satisfactory	The volatile institutional framework in Tajikistan makes it impossible to provide a conclusive answer. The very existence of a national steering committee however increases the chances of anchoring the intervention's benefits over time.
If an additional sub-criteria is relevant please formulate it here	0 - not determined	Click here to enter text.

DAC criteria and SDC/SECO sub-criteria	Score	Justification (Please provide a short explanation for your score or explain the reason why a criterion was not assessed)
7 General comments Summary: this section is only for free text (no score). The evaluator may provide an overall assessment of the evaluated intervention, explore and reflect on relationships and synergies between different criteria (this includes considering if and how they are causally related).		The intervention is fully online with many priorities and needs, from local to national levels. To achieve a demonstrable and lasting impact, the second phase of the intervention should focus exclusively on upscaling the successfully piloted approaches and avoid testing too many new ones. This emphasis on upscaling is essential for long-term impact and will keep the intervention team focused on activities that drive significant results.