Inception Report

(January 20, 2024)

Project Title: *Hyper-local medium-range weather forecasts to improve the climate resilience of smallholder coffee farmers in India*

Submitted By: *Precision Development (PxD)*

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ACRONYMS

ADPC	Asian Disaster Preparedness Center
PxD	Precision Development
CFAN	Climate Forecast Applications Network
CKT	Coffee Krishi Taranga
M&E	Monitoring and Evaluation
ECMWF	European Centre for Medium-Range Weather Forecasts
GEFS	Global Ensemble Forecast System

1. INTRODUCTION

1.1 Project Background:

Precision Development (PxD) in partnership with the Coffee Board of India, has developed an IVR–based digital extension service called "Coffee Krishi Taranga" (CKT). The CKT platform provides regular advisory services along with other critical information such as daily coffee prices, to coffee farmers in the South Indian states of Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu. Leveraging the success of CKT, PxD plans to incorporate crucial rainfall forecast information into the existing IVR service.

1.2 Project Objective:

As part of the project, PxD is committed to provide accurate, hyper-local and customized rainfall forecast information paired with actionable advisory to 50,000 coffee farmers in the state of Karnataka. The forecast information will be disseminated through voice-based push calls over the existing CKT service. The forecast information will be developed by our partner and weather forecast provider Climate Forecast Applications Network (CFAN). The forecasts will be paired with climate-adjusted agronomic advisory, curated by PxD's team of experts that will be monitoring forecasts and adjusting advisory as per the coffee crop calendar.

1.3 Expected Project Outcomes:

Provision of accurate rainfall forecasts and associated climate adjusted advisories is expected to allow farmers to take precautionary actions and minimize adverse consequences of weather shocks. The bundled service is expected to help farmers better manage weather-related risks, for example, making day to day decisions like timing of fertilizer application to prevent runoff, application of irrigation during dry spells and optimizing harvest timing around any unseasonal wet spells - potentially reducing losses, boosting farmers' productivity, consequently raising incomes, and building climate resilience.

1.4 Project Main Activities:

The main activities in the project involve the following:

- Finalization of coffee crop calendar
- Creation of voice-message library of static and variable information
- Development of audio-stitching technology to generate customized audio-messages
- Piloting the service with a sample of 1000 farmers
- Analyze quantitative and qualitative data from pilot survey, incorporate farmer feedback for service improvement
- Scaling of the service to 50,000 farmers
- Regular data monitoring and generation of bi-weekly engagement reports
- Post intervention analysis
- Final project report

1.5 Inception Report - Purpose and Scope:

The Inception Report aims to provide an overview of the project's anticipated trajectory in the coming months. Building on the progress achieved thus far and informed by discussions with our partner organizations, this report sheds light on the achievements so far, including finalization of the coffee crop calendar and creation of the library of audio files - the foundational elements crucial to the project's success. Furthermore, the report will also highlight a few changes made to the initial work plan. These adjustments are a result of certain activities being set in motion post the contract-signing phase. Despite these alterations, the project, on the whole, is moving in the right direction and PxD has made significant progress on key deliverables.

2. APPROACH AND METHODOLOGY

Within this project, PxD will develop a voice-based weather product for farmers, delivering 5-day cumulative rainfall forecasts via automated voice calls.

2.1 CFAN's method of weather forecasting

PxD will source forecast information from Climate Forecast Applications Network (CFAN), a private company founded by leading academic meteorologists. CFAN produces the probabilistic forecasts using the European Centre for Medium-Range Weather Forecasts (ECMWF) global ensemble forecast system. These forecasts are further calibrated by CFAN through comparison with 20-year "reforecasts" (i.e., retrospective forecasts) and applying various statistical post processing techniques. Historical observations for rainfall are drawn from the satellite-derived CHIRPS and IMERG datasets, and those for other weather phenomena are drawn from ECMWF's ERA5 and operational analysis datasets. CFAN's methods focus on correction of individual ensemble members through a logistic regression approach, with the comparison of model-produced values to satellite and observation-based data. This results in a forecast with significantly reduced bias and improved accuracy.

2.2 Comparative analysis of CFAN forecast with existing providers

CFAN has a track-record in researching and developing bespoke weather information services for public and private actors in South Asia for the past 15 years. CFAN's approach involves applying state-of-the-art calibration methods to weather forecast data from the ECMWF, consisting of 51 ensemble members. The accuracy of ECMWF forecasts has been shown to consistently outperform those of other producers. In contrast, IMD relies on the Global Ensemble Forecast System (GEFS), which has 30 ensemble members, to provide deterministic forecasts.

CFAN also supplements ECMWF with GEFS in cases where a larger ensemble is desired. CFAN has already carried out an initial investigation of the impact of calibration on rainfall forecasts in the region, focusing on Punjab (Pakistan) and Karnataka (India). Results show that the uncalibrated ECMWF forecast can anticipate rainfall across the region, demonstrating "skill" up to two weeks ahead. After calibration, forecast accuracy increases notably. Calibration also adds substantial value where terrain is more complex, such as in Karnataka.

Some advantages of using CFAN's calibrated forecasts over existing local providers include:

- Employment of forecast probabilities: CFAN provides probabilistic forecasts ("There is a 60% chance of heavy rain tomorrow.") rather than deterministic forecasts ("There will be heavy rain tomorrow."). The ability to estimate forecast probabilities is a significant advantage to using the CFAN system compared to widely available forecasts provided locally. These local forecasts indicate a single-value, deterministic estimate of upcoming weather, with no indication of uncertainty in each particular forecast. This increases the risk of false alarms, and prevents warning of low-probability, high-impact events. Moreover, probabilistic forecasts enable the provision of rich information for e.g. the cumulative probability that a weather quantity exceeds a certain threshold, and the margin of error associated with a prediction. Furthermore, surveys conducted by PxD last year revealed a high demand among farmers for better forecasts in general, and for multi-day cumulative probabilistic forecasts in particular.
- Resolution: The forecast information provided by CFAN is at a granularity of 18 × 18 square kilometers, which means that forecasts are provided at the level of a cluster of gram panchayats or that there are around 3 distinct forecasts within each block of a district. This is an improvement on forecasts provided by IMD, which are commonly disseminated at the district level, and in some cases at the block-level. This low

granularity limits the spatial precision of interventions. Even in the case of online forecasts (such as those provided by Weather Underground), while forecasts are labeled with a village's name, the actual forecast is sourced from the nearest weather station (and there are only 2 weather stations in the 3 coffee growing districts in Karnataka). As a result, CFAN's forecasts are an improvement on other commonly available forecasts in the region.

- Employment of multi-decade "reforecasting": A 20-year "reforecast" is associated with CFAN forecasts, which can be used to estimate forecast skill, this is generally not possible with local forecasts which do not create a concurrent "reforecast" or have a large archive of relevant forecasts from which to evaluate skill.
- High accuracy: The skill (hit rate or probability of detection) of CFAN's cumulative forecasts is 94% or more — i.e., out of all the rainfall events in the period considered, 94% of them were correctly predicted.[1]

Provider	Source	Level	Time range
IMD	IMD	District wise	5 day, 7 day
SkyMet	SkyMet	District, tehsil/taluk wise	Hourly, 7 day, 15 day
AccuWeather	Accuweather	District	Hourly, daily, monthly
The Weather Channel	The Weather Channel	District	Hourly, weekend, 10 day, monthly
CFAN	**CFAN**	**18 × 18 sq kilometer**	**5 day, 10 day, 15 day**

Summary of comparative analysis

2.3 Source of weather parameters

CFAN uploads data files containing forecasts for all 38 gridded locations of the ECMWF ensemble model (0.2 × 0.2 degree) corresponding to our CKT user base in Karnataka on its server every day. This datafile consists of ensemble probability distribution for aggregated rainfall quantities at 1-5, 6-10, and 11-15 day accumulations. Here is a sample of the data.

The data processing methodology (described below) built by PxD's in-house engineering team ensures that relevant weather parameters including the lower and upper bounds of rainfall quantity, their difference providing the chance of rainfall quantity range, median rainfall quantity, village grid location and forecast date ranges are pulled, scanned and mapped into a comprehensive data warehouse for further manipulation. Other derived variables provided by CFAN include:

- Daily anomalies
- Daily probabilities of exceedance of specific thresholds
- Daily probabilities of a specific interval of values
- 5-days cumulative departures from climatology (% above & below long term climatology)

[1] The hit rate or probability of detection (POD) provided here is 94% for Hassan district. It is higher in Kodagu and Chikmagalur districts. The POD here considers a 7-day cumulative forecast. In addition, the POD here considers a correctly forecasted event to be one that was forecasted with 50% probability or higher. The skill is higher if we consider events forecasted at 30% probability or higher. So, the metrics here are conservative estimates.

2.4 Data Processing Methodology

- Data Pulling: CFAN data files for 5-day cumulative weather forecasts are uploaded on the CFAN server on a daily basis. Relevant weather parameters from these data files are extracted and pulled into a larger comprehensive dataset stored on the PxD data warehouse
- Data Processing: The pulled data needs to be processed before it can be fed into the weather template. Primary goal of data processing is to generate variables that can be mapped to the weather template variables. The key variable data that need to be generated from CFAN data are:
    - Village: CFAN grid location data needs to be mapped to "village" data from PxD's farmer profile data
    - Date_Time: The month and the dates for which the cumulative forecast is available need to be extracted
    - Rainfall chance: PxD is in the processing of finalizing the probability triggers for generating forecasts. Going by this CFAN data sample, a potential forecast for Virjapet01 could be "**There is 60% chance of rainfall falling between 14.49 millimeters and 35.77 millimeters, with a median rainfall quantity of 23.23 millimeters.** " In this interpretation, the 20th and 80th percentile values are considered as lower and upper bounds of rainfall quantity within the 5 day period, with the difference providing the chance of rainfall quantity range. Using this example, multiple rainfall chances are possible - ranging from 10% to 90%. For each rainfall chance, more than one combination of lower and upper bounds is available. For instance, to arrive at the 60% chance, we can choose from 10-70 percentile, 20-80 percentile, 30-90 percentile, and 40-100 percentile. Based on expert opinion, the logic of generating the probability triggers will finalized, which then shall determine the processing of CFAN data to generate rainfall chance variable
    - Rainfall range: The lower and the upper limit of rainfall quantities from the finalized probability combination shall form the rainfall range.
- Message Generation: Once the CFAN variables data are ready and mapped to weather template variables, the audio-stitching technology will start generating the forecast voice messages in human-voice, customized to the farmer's village. A sample of the forecast template and the operation of the audio-stitching technology is provided in the guide document attached here.

2.5 Protocols for Weather Forecast Dissemination

Broadly the following protocols are followed for forecast dissemination:

i. Based on the chance of the weather event's occurrence and the priority of the ongoing agricultural practice, the agrometeorologist will choose from a set of broadcasting options. As part of the pilot exercise PxD will be experimenting with different broadcasting options to identify which of them achieve higher farmer engagement. Some of the broadcasting options to be considered are:
    a. Forecast + Advisory broadcasted together
    b. Forecast first, and later advisory
    c. Only forecast
    d. Only advisory, but informed by forecast

The above 4 broadcasting options will be tested in 4 different scenarios, each arising from varying chances of weather events and prioritization of agricultural practices. Please refer to the below table.

Priority practice/Weather event chance	High chance of event	Low chance of event
High priority practice	- Forecast + advisory together OR - Only advisory, but informed by forecast	- Forecast first, and later advisory OR - Forecast only
Low priority practice	- Only advisory, but informed by forecast	- Forecast only

ii. In addition to following the coffee crop calendar, the agro-meteorologist will also refer to an interactive dashboard that will be developed to track the forecast data, to craft real-time advisories.

2.6 Selection of Project Site, Beneficiaries and Partners:

Karnataka, India's top coffee producer, accounts for over 50% of total coffee planted area. Additionally, 97% of Karnataka's coffee farmers are small (own 2 hectares or less) or medium-holders (own between 2 and 10 hectares). These farmers have limited access to accurate weather information, making it difficult for them to undertake mitigation measures as rainfall patterns become more erratic. In a recent study , PxD found 88% of the 1200 farmers surveyed reported weather variability as one of the main causes of stress, and 72% reported incurring significant loss to weather events, which together indicate the need for high accuracy rainfall forecasting among small holder farmers. PxD, in collaboration with the Coffee Board, already offers digital extension services through the CKT service in Karnataka, where over 50,000 coffee farmers are registered, offering a convenient and established platform for the project.

To ensure successful implementation of the project, PxD will be working with three partners for this project:

1. Behaviour Change and Advisory Services (LLP) will serve as the local India partner responsible for executing the project.
2. The Coffee Board of India, functioning as our government partner, has been a long standing collaborator with PxD, jointly providing digital extension services to coffee farmers across four Indian states - Karnataka, Tamil Nadu, Kerala, and Andhra Pradesh.
3. Climate Forecast Applications Network (CFAN) is a weather forecast provider with a track record in researching and developing weather information services in South Asia over the last 15 years.

2.7 Phases of the project:

The project has four phases:

1. Inception Phase: The foundational material like the crop calendar and the library of audio snippets will be developed. Simultaneously, PxD will focus on creating the audio stitching technology, integrating forecast data into the backend, and designing dashboards for efficient data monitoring.
2. Pilot and Launch Phase: This phase involves deployment of the service on a pilot basis to a sample of 1000 farmers. Within this group, a representative subset will be surveyed further to assess comprehension and usability of these forecast based advisories, with the collected feedback guiding further service refinement.
3. Scale Up Phase: Following the pilot, the service will be extended to 25,000 coffee farmers before an eventual scale up to 50,000 coffee farmers registered in Karnataka.

4. Final Phase: A post intervention analysis will be conducted, and the knowledge on the entire service will be compiled into a Final Project Report.

3. OVERVIEW OF THE INCEPTION PHASE ACTIVITIES

In the Inception Phase, PxD will primarily focus on developing the project foundations, including developing a strong understanding of agronomic and weather-related information most beneficial for farmer consumption. PxD houses a team of state specific agronomists who are responsible for curating crop and season specific advisories as well as responding farmer queries. In consultation with the Coffee Board and experts from the Central Coffee Research Institute , PxD's agronomy team had previously developed a coffee crop calendar for regular CKT operations. Expanding on the existing calendar and considering the farmer feedback received on the CKT service, along with insights from a lab-in-the-field study (conducted prior to and outside of the scope of this project) PxD has identified high-priory, weather-sensitive topics and has developed mitigation strategies in the event of unfavorable weather conditions.

In addition to the crop calendar, PxD has also created a library of audio files that will be used to compose customized forecast advisories in the coming months. Development of the audio-stitching technology and its integration with PxD's in-house IVR system is in progress and in line with the timeline proposed in the initial work plan.

The activities were planned and work-plan submitted based on the initial timeline provided by ADPC (assuming project commencement from November 2023), however the signing of the agreement with ADPC on December 22, 2023 has caused a delay in some project activities. While PxD has started receiving forecast data from CFAN, a one-month delay in data analysis has impacted subsequent activities. Consequently, tasks such as data cleaning, feeding into the backend, finalizing probability triggers, and determining metrics for data monitoring faced delays. Communication with CFAN could only be initiated after the signing of the agreement with ADPC on December 22, as a result of which thorough analysis of CFAN data could only begin in the first week of January 2024. However, PxD has initiated the necessary steps and is confident of completing this activity by the second week of February. The table below presents the status of tasks in the inception phase. Green highlights signify completed tasks, while red highlights indicate revised timelines due to delays.

Activities in the Inception Phase	Dec	Jan	Feb	Status
Analysis of current seasonal cycle				Completed
Incorporating findings from the lab-in-the-field (conducted prior to and outside of the scope of this project) to generate advisory calendar				Completed
Commencing receipt of forecasts from CFAN				Completed
Finalize set of probability triggers and alert frequencies for non-monsoon and monsoon periods				Delayed by 6 weeks
In-depth analysis of skill for each alert template to arrive at accuracy scores				Delayed by 6 weeks
Translation of forecast templates to kannada				Completed
Recording of audio snippets for testing				Completed
Final recording of voice snippets & quality checks				In progress
Audio stitching technology is developed, configured, and integrated with PxD's in-house IVR system				In progress
Audio stitching of recorded voice snippets is conducted for sample participants for a 5-day forecast period				In progress
Audio-stitched recordings are tested in-house, refined, and adapted				In progress (March)
Finalize set of KPIs and metrics critical for monitoring needs				Delayed by 6 weeks
Raw forecast data integrated into a data warehouse that the dashboard can access				Delayed by 6 weeks
Collected data cleaned, transformed and processed into a format suitable for visualization.				Delayed by 4 weeks

4. STAKEHOLDER ANALYSIS AND PARTNER MAPPING

To successfully implement the project, PxD is partnering with Behaviour Change Advisory Services (BCAS), Climate Forecast Applications Network (CFAN), and the Coffee Board of India.

4.1 Behaviour Change Advisory Services

PxD's activities in India are implemented in partnership with Behaviour Change Advisory Services LLP (BCAS). BCAS has had over 6 years of experience in implementing PxD's projects across various Indian states such as Andhra Pradesh, Delhi, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, and West Bengal. BCAS brings to the table a comprehensive understanding of India laws and a well-established network with local stakeholders, crucial for effective implementation, monitoring and evaluation of projects in the social development sector.

4.2 Climate Forecast Applications Network

CFAN, established in 2006, has risen as a prominent private forecast provider, employing innovative techniques in weather forecasting, including ensemble forecast methods, machine learning, and artificial intelligence, to deliver highly accurate probabilistic forecasts spanning up to four weeks. Collaborating closely with clients, CFAN continually refines forecast solutions to enhance decision-making effectiveness.

In the context of this project, CFAN employs advanced statistical calibration methods to enhance

leading global weather models, resulting in improved forecasts for Karnataka in terms of resolution, lead-times, and informational richness. CFAN's calibrated forecasts have demonstrated significantly higher accuracy compared to the best-performing ensemble forecast model available for the Karnataka region. Notably, CFAN boasts a forecast skill score of 0.8 for a one-day forecast, surpassing the 0.3 skill score of the ECMWF ensemble forecast.

PxD has previously utilized CFAN's forecast data for projects in Punjab, Pakistan and for a pilot study in Karnataka, India. PxD appreciates CFAN's assistance in data interpretation, flexibility in providing forecast information in various formats, and prompt guidance on general matters. While recognizing the strengths, PxD also acknowledges the inherent challenge associated with any forecast information—the potential risk of false alerts or missed rainfall events.

4.3 Coffee Board of India

The Coffee Board of India, established in 1942, operates under the Ministry of Commerce and Industry, Government of India. It regulates and promotes coffee cultivation, processing, and exports to ensure quality and sustainability. Through market research, extension services, and quality control, the Board empowers Indian coffee growers, playing a crucial role in India's position as a leading coffee producer.

In 2018, PxD in collaboration with the Coffee Board, successfully launched the Coffee Krishi Taranga (CKT) service - an IVR-based, two-way, interactive hotline service that is currently operational in Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu. These four states together account for 99% of the total coffee planted in India. Leveraging the existing CKT infrastructure, the weather project presents a potential opportunity for future expansion into Andhra Pradesh, Kerala, and Tamil Nadu in the future. Notably, the Coffee Board is poised to assume full responsibility for CKT operations in the coming months, with PxD facilitating a smooth transition. This strategic shift ensures that the valuable learnings from the project will be carried forward even after the project completion.

However, a potential challenge, closely tied to the issue of false weather alerts by CFAN, is the possible resistance from the Coffee Board should the coffee farmers express concerns about the potential forecast inaccuracies. To proactively address these challenges, PxD is committed to establishing robust feedback loops. Throughout the execution of the project, farmers will be actively engaged to provide ground-based feedback on rainfall accuracy. This feedback will be integrated into the CFAN system as a form of ground-truthing, contributing valuable data to enhance calibration for future forecasting.

5. KEY OUTCOME AND OUTPUTS OF THE PROJECT

The objective of the project is to contribute to an enabling environment for climate resilience policies and investments in select sectors and countries in South Asia. In alignment with this goal, PxD aims to disseminate high accuracy, granular rainfall forecast information, coupled with actionable advisories, to coffee farmers in the South Indian state of Karnataka. The sharing of such information is expected to promote climate resilience among coffee farmers, with PxD intending to gauge the impact through monitoring key indicators, including:

1) Engagement data: This information will be securely recorded on PxD's in-house server. Metrics such as call pickup and listening rates, farmers' engagement with the inbound service for accessing the forecast data, and farmer queries related to building climate resilience, will be established. The collection and analysis of the engagement data will be automated, generating bi-weekly reports.

2) Survey data: Surveys and qualitative feedback will be sought from farmers at two key points in the implementation process to understand comprehension and adoption of forecast information:
    i) After a pilot involving 1000 farmers
    ii) At the end of the first year, when we reach 25,000 farmers

These surveys will be designed to collect comprehensive user feedback and will be conducted with a representative sample of farmers randomly selected from regional clusters stratified by risk level, considering factors such as weather shocks, landholding, and gender. Surveys will be conducted through phone interviews and, when necessary, complemented with on-site visits by field agents.

Simultaneously, PxD will conduct regular forecast ground-truthing exercises on rainfall accuracy. The collected data will be fed into the CFAN system to enhance calibration and improve future forecasting.

The M&E efforts will be led by PxD's research, field, and program teams, with support from the technical expertise of the engineering team.

- Research team: Designing pilot survey, analyzing the impact of the project on the expected outcomes, and drawing conclusions with statistical confidence.
- Field team: Collecting in-depth farmer feedback.
- Program team: Identifying key metrics to monitor engagement data, finalizing the template for bi-weekly reports, conducting data analysis, contributing to development of survey questionnaires.

6. PROJECT MANAGEMENT AND OVERSIGHT

PxD has established a well-structured and collaborative project management and reporting arrangement with the Coffee Board of India. In this partnership, PxD assumes full responsibility for both the technical and day-to-day project operations. The Coffee Board provides the essential logistics and infrastructure including office space, server, internet, phone line connections, desktops, etc. To ensure service quality, the following measures are undertaken:

- Risk management: To mitigate potential risks, in particular, false weather alerts, regular ground-truth efforts will be undertaken to collect farmer feedback which in turn can improve calibration for future forecasting. To tackle risks related to financial matters, PxD maintains sufficient reserves to navigate potential delays in fund disbursements, ensuring the project's financial sustainability.

- Adaptive approach: PxD adopts an adaptive approach to project implementation, regularly reviewing performance metrics, and iteratively improving the service based on feedback from all stakeholders. After a pilot exercise in August 2023, where 7-day daily weather forecasts were shared, the majority of farmers expressed a need for improved forecast accuracy. Responding to this input, PxD collaborated with CFAN to explore alternatives, revealing that 5-day cumulative forecasts exhibited higher skill than 7-day daily forecasts. PxD will now provide updated forecast information in the next phase of the project. This aligns with the larger organization goal to continuously iterate and improve services by establishing strong feedback mechanisms.

- Knowledge sharing: Through the course of the project, PxD will hold regular check-ins with the relevant officials at the Coffee Board, to discuss allocation of resources,

feedback received from stakeholders and field updates. Detailed bi-weekly and monthly reports on farmer reach, engagement, and adoption of the service will be shared. Additionally, updates on project progress, including learnings, challenges, opportunities, and other findings from survey exercises will be presented during periodic Steering Committee meetings, helmed by the senior officials of the Board.

- Internal Project Management Dashboard: PxD will maintain an internal project management dashboard, tracking all deliverables against set timelines and goals.

These measures collectively aim to ensure the project's success, responsiveness to feedback, and the ability to adapt to evolving conditions during implementation.

ANNEXURES

- List of people met/consulted during the inception phase.

#	Name	Organization	Designation
1	Dr M Senthilkumar	Coffee Board of India	Director of Research
2	Mr B Shivakumaraswamy	Coffee Board of India	Deputy Director (Extension)
3	Ms Violeta Toma	Climate Forecast Applications Network	Vice President - Forecast Product Development

- Presentation from the Inception Meeting (4 December 2023) - **Attached**
- Updated Work Plan: Timeline revisions are highlighted in yellow - **Attached**
- Updated Budget: Moved payments for CFAN and for skill analysis from Q4, 2023 to Q1,2024 - **Attached**
- Updated Results Framework - **Attached**
- Updated M&E Plan - **Attached**
- List of key Personnel - **Attached**
- Read me - Guide on Deliverables - **Attached**

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Month	Typical practice for Arabica	Typical practice for Robusta	Ideal weather for this practice	Bad weather for this practice	Mitigation measures in case of bad weather
January	Parchment coffee preparation		No rain	Light rain / Heavy rain / Extremely heavy rain	- In small holdings, where drying yards are not available, polythene sheets or tarpaulins may be used for drying.
	Cherry coffee preparation		No rain	Light rain / Heavy rain / Extremely heavy rain	- Do not dry on bare soil or cow dung plastered surfaces as it create mould formation
	Seed sowing		NA	NA	NA
	Collor rot and stem necrosis	NA	Light rain	Heavy rain / Extremely heavy rain	-Prevent stagnation of water and drench with the fungicides -Provide proper drainage and transplanting -Provide overhead pendal shade
February	NA	Robusta blossom and backing irrigation	Light rain	No rain/ Moderate rain / Heavy rain / Extremely heavy rain	- In case of no rains or delay in rains, go for two rounds of sprinkler irrigation. As Robusta is very succeptable to drought, blossom irrigation at 25-40 mm is provided during second half of February, followed by backing irrigation of 25mm after a gap of 15-20 days after blossom
	Coffee pruning		Light rain/Moderate rain	No rain / Heavy rain/ Extremely heavy rain	- In case of dry hot conditions (no rain), delay pruning till the receipt of summer showers. - In case of heavy or extremely heavy rains, avoid pruning.
March	Nutrient management		Light rain	No rain / Heavy rain / Extremely heavy rain	volatization - In case of rains, apply fertlizers uniformly and evenly using the "drip circle method" around the root zone of the plant to prevent the leaching of nutrients. In sloppy areas, apply fertilizers in semi-arch (horse shoe) form
	NA	Irrigation management	Light rain	No rain/ Moderate rain / Heavy rain / Extremely heavy rain	- In case of no rains or if the blossom showers are delayed or are received in deficient quantity, flower buds turn pinkish and fall. In such conditions, providing immediate supplementary sprinkler irrigation of 25 mm to 40 mm to overcome the damage and induce healthy blossom - In case of rains, avoid irrigation
	White stem borer management during summer flight	NA	No rain	Heavy rain / Extremely heavy rain	In case of heavy rains, avoid taking up shade regulation
April	Nutrient management and Hormonal Balance	NA	Light rain/ Moderate rain	No rain / Heavy rain / Extremely heavy rain	- In case of no rain, before nutrient application, go for sprinkler irrigation - In case of heavy or extremely heavy rain, avoid nutrient applicaiton.
	Secondary Nursery Management	NA	Light rain	Heavy rain / Extremely heavy rain	-Prevent stagnation of water and drench with the fungicides -Provide proper drainage and transplanting -Provide overhead pendal shade
May	Pre monsoon nutrient management		Light rain/ Moderate rain	No rain / Heavy rain / Extremely heavy rain	volatization - In case of rains, apply fertlizers uniformly and evenly using the "drip circle method" around the root zone of the plant to prevent the leaching of nutrients. In sloppy areas, apply fertilizers in semi-arch (horse shoe) form
	Coffee leaf rust	NA	Light rain / Moderate rain	No rain / Heavy rain / Extremely heavy rain	- If high rust infestation is observed during heavy rains, spray 0.5% Bordeaux mixture to control leaf rust - If high rust infestation is observed during no rains, consider manual picking of infested leaves and burn them
June	Black rot and Myrothecium management	NA	No rain / Light rain	Moderate rain / Heavy rain / Extremely heavy rain	- Rains result in falling of leaves. Remove them from the canopy of the bushes to avoid mycelia formation. - Remove and destroy the affected leaves and berries along with strands of mycelia to prevent further spread of disease
	Fruit drop	NA	No rain / Light rain	Moderate rain / Heavy rain / Extremely heavy rain	Provide proper drainage to prevent soil saturation and water logging
July	Leaf spot		Light rain / Moderate rain	No rain	To conserve soil moisture during dry weather maintain overhead shade and take up mulching
August	Berry borer management		No rain	Any rain	- Rains can result in fruit drop. If berries are left on the ground, it could increase the risk of pest infestation for next year's crop. So, clear the berries off the ground (gleanings) - High soil moisture can also increase the chances of berry borer infestation. Thereofer, provide good drainage.
	Management of rot diseases		No rain / Light rain	Moderate rain / Heavy rain / Extremely heavy rain	- Rains result in falling of leaves. Remove them from the canopy of the bushes to avoid mycelia formation. - Remove and destroy the affected leaves and berries along with strands of mycelia to prevent further spread of disease
September	Leaf rust management	NA	Light rain / Moderate rain	No rain / Heavy rain / Extremely heavy rain	- If high rust infestation is observed during heavy rains, spray 0.5% Bordeaux mixture to control leaf rust - If high rust infestation is observed during no rains, consider manual picking of infested leaves and burn them
	White stem borer management during winter flight	NA	No rain	Heavy rain / Extremely heavy rain	In case of heavy rains, avoid taking up shade regulation
October	Soil fertility and weed management	NA	No rain / Light rain	Heavy rain / Extremely heavy rain	During heavy rains, manual weeding would not be possible, hence apply weedicides once the rain stops.
	Post monsoon nutrient mangement	NA	Light rain / Moderate rain	No rain / Heavy rain / Extremely heavy rain	volatization - In case of rains, apply fertlizers uniformly and evenly using the "drip circle method" around the root zone of the plant to prevent the leaching of nutrients. In sloppy areas, apply fertilizers in semi-arch (horse shoe) form
	NA	shot hole borer management	Light rain	No rain / Heavy rain / Extremely heavy rain	- No rain or dry weather promote pest emergence. Therefore, remove and destroy all the infested suckers to prevent further spread of the infestation. - Provide good drainage in the estates during heavy rains.
November	soil sampling and lime application	NA	No rain / Light rain	Moderate rain / Heavy rain / Extremely heavy rain	Delay application of lime to avoid runoff due to rains
	NA	winter irrigation	No rain/Light rain	Moderate rain / Heavy rain / Extremely heavy rain	NA
December	Harvesting		No rain / Light rain	Heavy rain / Extremely heavy rain	In case of heavy or extremely heavy rains, the crop should be harvested quickly. Therefore, avoid stripping of the entire crop, and focus on harvesting only the ripe fruits. Once harvested, do not store the fruits in a gunny bag, instead dry them indoors on a drying yard
	Drying		No rain	Any rain	- Dry the fruit indoors by using tarpaulins - Use polyhouses, solar tunnels and mechanical dryers

High-priority, weather sensitive topics are highlighted in green.

The template has two kinds of content - static and variable. The variables, highlighted in red, are as follows:

1) Villages
2) Months
3) Numbers (used for dates, rainfall quantity, rainfall chance)

While the village data is available on PxD's database, the weather data, including rainfall quantity, rainfall chance, and dates are pulled from the CFAN portal.

Link to audio snippets-
https://drive.google.com/drive/folders/1y6siF8i6pKJV2zoEiuRpO_xCgHmaCmfR?usp=sharing