

Post-Pilot Report

(July 1, 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)

Submitted To: Asian Disaster Preparedness Center (ADPC)

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Acronyms

PxD	Precision Development
CKT	Coffee Krishi Taranga
LIF	Lab-in-field
HFC	High Frequency Checks
IVRS	Interactive Voice Response System

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1. Introduction

1.1 Background of the project

Precision Development (PxD), in partnership with the Coffee Board of India, has developed a two-way IVR-based digital agriculture extension service called “Coffee Krishi Taranga” (CKT). The CKT platform provides outbound services that share regular advisories on coffee cultivation and other critical information, such as price alerts, relevant government schemes, etc. Separately, as part of the inbound services, farmers can call to record questions and access daily local and international coffee prices. CKT is currently operational in the South Indian states of Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu.

As part of the project under the iCARE Innovation Fund, PxD is leveraging CKT's success and is committed to providing “Hyper-local medium-range weather forecasts to improve the climate resilience of smallholder coffee farmers in India” to 50,000 coffee farmers in the state of Karnataka. PxD will disseminate forecast information through voice-based push calls over the CKT service. Our partner and weather forecast provider, [Climate Forecast Applications Network \(CFAN\)](#), provides the forecast information.

The forecast includes information on the chance of rainfall events and median rainfall quantity tailored to each farmer’s village. The forecast predicts cumulative rainfall over five days and has a spatial resolution of 18 x 18 square kilometers. A relevant forecast template is broadcasted to the farmers depending on the predicted median rainfall quantity. An example of the forecast template is below:

Welcome to the CKT weather forecast service! For the next 5 days, that is, from June 25 to 29, in Govindpura village:

[When median rainfall is less than 0.1 inches] No rain is expected.

[When median rainfall is between 0.1 and 1 inch] There is a 60% chance of rain. 0.9 inches of rainfall is expected (on average).

[When median rainfall is between 1 and 2.5 inches] There is a 60% chance of 1 inch or more of rain. 1.8 inches of rainfall is expected (on average).

[When median rainfall is more than 2.5 inches] There is a 60% chance of 2.5 inches or more of rain. 4.4 inches of rainfall is expected (on average).

Please note that this forecast is for an entire 5-day period.

PxD developed the weather forecast service based on the August 2023 lab-in-field (LIF) experiment findings, which showed a high demand for more weather information among farmers and their ability to interpret rainfall chance correctly. Furthermore, the service is powered by the newly developed audio stitching/text-to-speech technology created by PxD’s in-house engineering team. This technology generates customized voice-based forecasts based on variables such as location, dates, rainfall quantity, etc.

1.2 Purpose of the report

A key deliverable under the iCARE project is to submit a post-pilot report on the weather service. This report aims to track key metrics critical for the project, including understanding how farmers perceive the forecast messages, whether they found them helpful, and any other feedback that could improve the service.

The report first presents the progress on the six mandatory metrics, followed by a weekly analysis of user engagement rates. It then details the post-pilot survey exercise, including the design of samples, the creation of the survey questionnaire, and the critical insights from the survey responses.

2. Metrics Tracker

PxD is tracking progress on various indicators, broadly dividing them into “Mandatory Metrics” under the Project Development Objectives, as recommended by iCARE, and “Project-specific Metrics.”

2.1 Mandatory Metrics

The progress on mandatory metrics has been shared regularly in the Monthly Progress Report. Table 1 below briefly summarizes the progress made so far and the upcoming milestones under each metric.

Table 1: Progress on Mandatory Project Metrics

S.No	Indicator/Metric	Progress until date	Upcoming
1	Government agencies and Citizens who have access to climate-resilient solutions tested under the project	The service has been piloted with 1212 farmers who were part of our original LIF sample who expressed a demand for weather information	Expand the weather service offering to 25,000 farmers by July
2	Number of people trained (online) (by sex, country, topic, year, participant category)	1212 farmers trained	Training will be extended to more farmers in the coming month
3	Number of knowledge products provided (by type of product, theme, country)	A video for training on the concept of ‘probability.’	A research paper on the impact and relevance of the service on agriculture decision-making
4	Number of people/organizations provided with knowledge products (by recipient category, type of knowledge product, country, theme)	1212 farmers trained using the video	More farmers will be trained using the video.
5	Number of events supported (by type, year, theme, country)	0	1. Social media post announcing the launch of the service. 2. Blog post sharing results from post-pilot exercise
6	Number of people participating in supported events (by participant category, sex, year, theme, country)	0	150

2.2 Project Specific Metrics

In addition to the mandatory metrics, PxD monitors project-specific indicators, including engagement rates tracked every five days. We are also tracking metrics that measure farmer comprehension, trust, and adoption of the forecast messages, which were the focus of the in-depth post-pilot survey.

2.2.1 Engagement Metrics

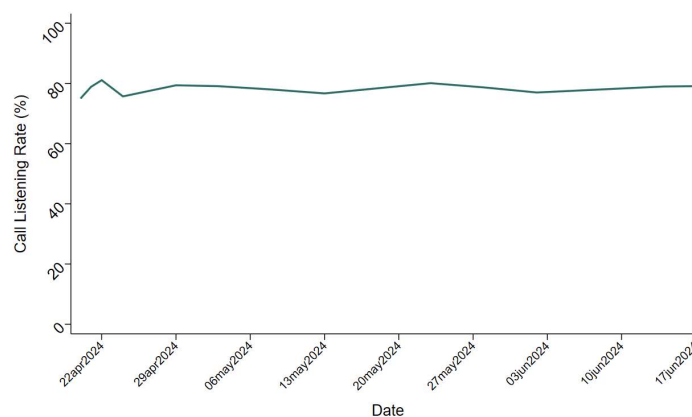
In the context of this project, the pickup rate is defined as the percentage of farmers who answer the calls broadcast to them. The listening rate is defined as the average length of the forecast message listened to by farmers.

Since the pilot launch of the service on April 20 with a sample of 1,212 farmers, the weather forecast service has enjoyed healthy engagement rates. The pickup rates were initially impaired due to the failure of the telecom network provider, an issue that was outside the control of the CKT service. However, the forecasts consistently enjoyed pickup rates of over 70% from the beginning of June. On the other hand, the listening rates have consistently been over 75%, indicating farmers' interest in the forecast messages. An overview of the progression of the pick-up and engagement rates since the launch of the service is shown in Figures 1 and 2 below.

Figure 1: Time-series plot of Call Pick-Up Rate



Figure 2: Time-series plot of Call Engagement Rate



3. Farmer Feedback Survey

A comprehensive farmer feedback survey was conducted to gather valuable insights on the forecast service being provided through CKT. This survey aimed to serve as a critical input for service improvement and gauge the service's value for farmers and their agricultural decision-making. By understanding the farmers' experiences and needs, the service can be tailored more effectively to enhance its utility and relevance.

The survey sample, shown in Table 2, included treatment (farmers receiving regular CKT advisory service + the forecast service) and control (farmers with access to regular CKT advisory service) groups, allowing for comparative analysis. The treatment and control group consisted of farmers from the Somwarpet block in Karnataka.

This approach enabled us to isolate the impact of the forecast service, providing a clear understanding of its effectiveness.

Table 2: Details of Survey Sample

Treatment	Control
400 farmers	200 farmers

3.1 Pilot Survey and Data Collection

Before the launch of the main survey, pilot surveys were administered to collect preliminary inputs from farmers. The primary objective of the pilot surveys was to ensure that the questions were understandable to the farmers and to identify any additional inputs that could enhance the monitoring activity. These insights were instrumental in adjusting the survey tool and improving its relevance and clarity. A timeline of the survey activities is in Table 3 below:

Table 3: Timeline of Survey Activities

Activity	Date
Pilot Surveys	14th June - 18th June
Revision of Survey Tool	18th June
Launch of the Main Survey	19th June
High-Frequency Checks	19th June - 26th June
Completion of the Survey	26th June

The surveys were conducted telephonically by trained and experienced surveyors. To maintain the integrity and accuracy of the data, High-Frequency Checks (HFC) were performed daily. These checks involved rigorous monitoring of the data collection process to ensure it remained error-free and that the highest quality

data was consistently maintained. Steps taken during HFC included cross-verification of collected data, immediate rectification of discrepancies, and continuous feedback to the survey team.

3.2 Survey Results

Of the 600 farmers we attempted to contact, 291 picked up the survey call, 70% of which (206) consented to participate in the survey. Table 4 shows the breakdown of the survey sample. The treatment and control groups are comparable across all parameters, lending credibility to any comparisons made between the groups.

Table 4: Demographics of the consented survey farmers

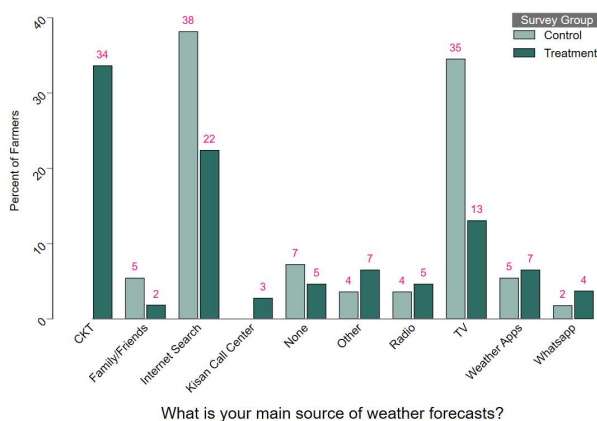
	Treatment	Control
Number of respondents	134	72
Male respondents (%)	83.59	86.57
Female respondents (%)	16.41	13.43
Average age of respondent	51.18	52.90

3.2.1 Weather Forecast Source and Trust

The survey assessed the various sources of weather forecasts farmers use to determine their level of trust and reliance on these sources for their coffee cultivation activities, such as nutrient and pest management, pruning, and shade management, amongst others. Understanding the farmers' trust in and reliance on these sources is crucial for evaluating the effectiveness of different weather forecast services and their impact on farming practices.

For the treatment group, the primary source of weather forecasts is CKT, accounting for 34% of the responses, followed by the internet at 22% and TV at 13%. In contrast, the control group primarily relies on the Internet, accounting for 38%, and TV at 35% (Figure 3).

Figure 3: Main Source of Weather Forecasts for Farmers



When considering the three main forecast sources reported by farmers, trust in CKT ranges from neutral to complete trust. In comparison, trust in TV and internet searches spans from complete mistrust to complete trust.

Among those in the treatment group who consider CKT their main source, 89% rely on it for coffee cultivation activities. This reliance on weather sources for coffee cultivation activities is slightly lower for the Internet at 87% and TV at 76% (Figures 4 and 5).

Figure 4: Trust in Main Source of Weather Forecasts

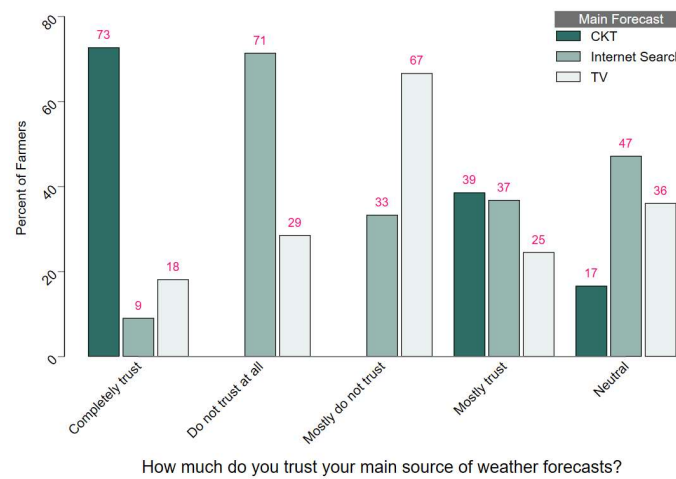
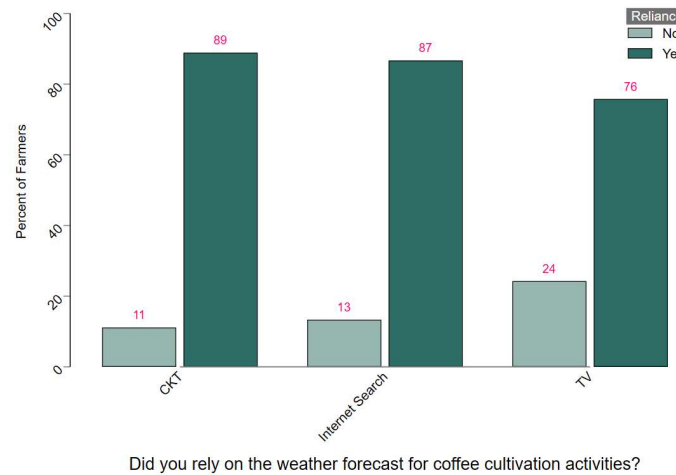


Figure 5: Reliance on Weather Forecasts for Coffee Cultivation Activities



The survey results indicate that CKT may effectively address a gap in weather information for coffee farmers. Farmers regard it as more trustworthy and demonstrate a greater reliance on it for coffee-cultivation activities than traditional sources like the Internet and TV.

3.2.2 Forecast Message Comprehension

The survey assessed farmers' understanding of the 5-day weather forecasts delivered via IVR calls. The standard forecast template presented to farmers included information such as the probability of rain and expected rainfall amounts:

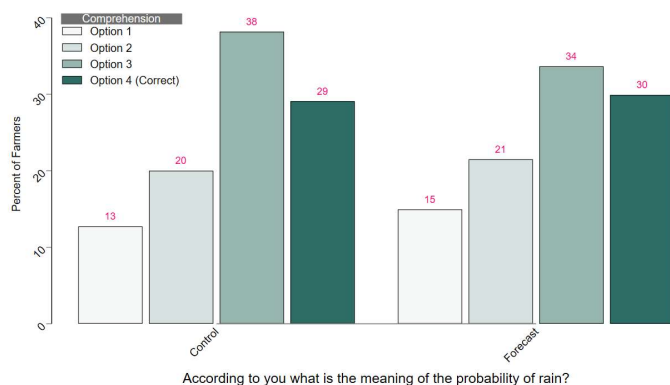
For the next 5 days, that is, from June 2 to June 6, in <village name> village: There is a 70% chance of rain. 2 inches of rainfall is expected (on average).

Surveyors read out the above template and then asked farmers to interpret the statement "There is a 70% chance of rain" using the following options:

- 1. Rain will definitely occur, but not throughout the five days in the village i.e., it will rain for 70% of the time in the next five days**
- 2. Rain will definitely occur in this village, and the intensity or heaviness of rainfall in the next five days will be 70%**
- 3. Rain will definitely occur, but not in all parts of the village i.e., it will rain in 70% of the village**
- 4. Rain is not certain, but rain is more likely to occur than not in all areas in the village in the next five days i.e., there is a 7 in 10 chance of rain everywhere in the village**
- 5. Something else, please explain**

Option 4, stating the likelihood of rain, was the correct interpretation of the probability forecast message. In the treatment and control groups, 30% and 29% of respondents correctly understood this component of the forecast message, respectively (Figure 6). Also, the survey findings indicated that the forecast template read out to the farmers was easily understandable, with 100% of respondents stating that they comprehended the template's language without difficulty.

Figure 6: Farmers' comprehension of the probability of rain



Farmers must interpret forecasts accurately to make informed and effective decisions in agricultural activities. This insight underscores the need to enhance the service further by implementing periodic calls to explain the correct interpretation of forecast messages. This initiative will potentially improve farmers' comprehension of forecasts, strengthening the service's effectiveness in supporting agricultural decisions.

3.2.3 Feedback on the CKT Weather Forecast Service

We also requested feedback from the treatment group farmers, specifically regarding the CKT Weather Forecast Service, to gain insights into potential improvements.

91% of the farmers recalled receiving forecast information from CKT in the past month, indicating the effectiveness of the dissemination process (Figure 7). Furthermore, 77% of the farmers reported listening to the latest IVRS call in its entirety (Figure 8). This suggests strong engagement with the service, reflecting the relevance and value of the content provided.

Figure 7: Farmer recall of CKT Weather Service

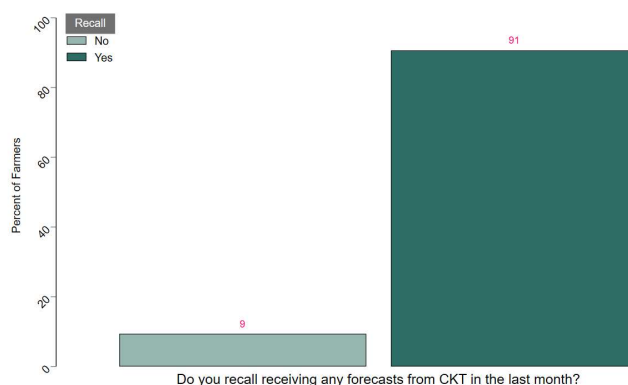
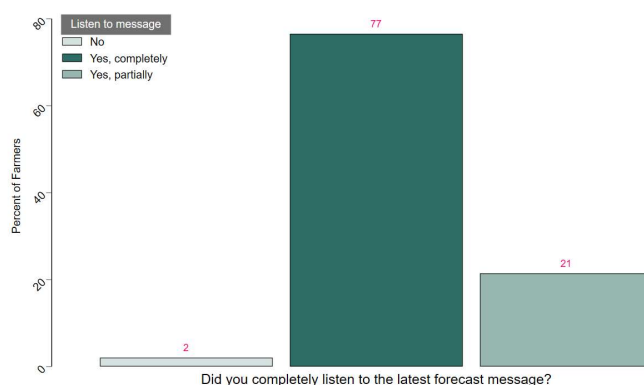


Figure 8: Farmer engagement with CKT Weather Service



Additionally, 79% of the farmers depended on the CKT service to schedule their agricultural activities over the past month, underscoring the service's critical role in supporting farmers' decision-making processes

(Figure 9). Regarding trust, 65% of the farmers mostly trust the service, and an additional 11% completely trust it, making a combined total of 76% with a positive trust level. Meanwhile, 23% of the farmers remain neutral towards the service, and 1% do not trust it (Figure 10). The feedback from this 1% will be carefully reviewed to identify areas for improvement and ensure that trust issues are addressed effectively.

Figure 9: Farmers’ utilization of the CKT weather service for agricultural activities

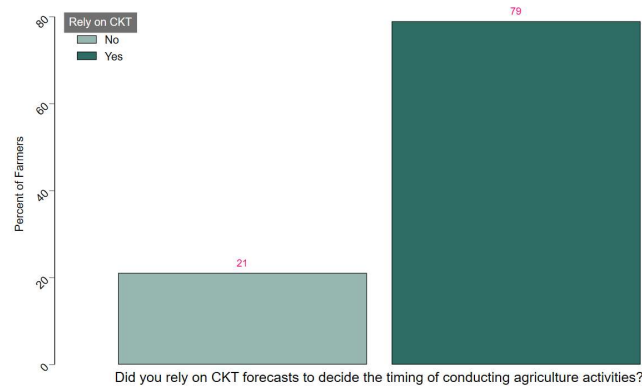
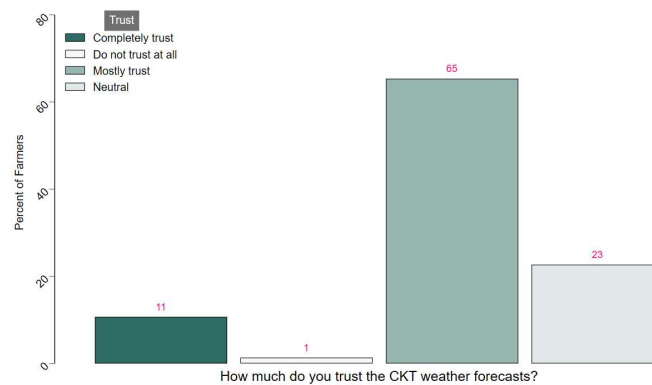


Figure 10: Farmers’ trust in the CKT weather service



4. Conclusion

The CKT weather service has shown promising performance, evidenced by high pickup and listening rates, alongside an impressive recall rate, indicating robust farmer engagement with the forecasts. Findings from the

in-depth survey further bolster this, highlighting farmers' trust in CKT forecasts and the ease with which they comprehend the information provided.

The survey exercise has also pinpointed areas needing improvement, particularly regarding farmers' misinterpretation of the probability of rainfall occurrence. PxD plans to address this by implementing periodic calls to clarify the correct interpretation of forecast messages and considering modifications to the forecast templates.

PxD will incorporate farmer feedback to enhance the service and experiment with different broadcasting options, such as sharing deterministic forecasts and actionable advisories. These experiments will yield deeper insights, enabling PxD to fine-tune the service to meet farmers' information needs better and shape its long-term weather service strategy.

5. Annexure

5.1 iCare Post Pilot - Survey Instrument

Section A: Administration				
Note to surveyor: Please complete this section for every household assigned for you to call. This section is to be completed before commencing the survey. <u>Do not</u> read these questions to the respondent.				
A1	Name of Surveyor	Select name		
A2	Date of Survey	Enter date		
A3	Household ID	Enter ID		
A4	Name of District	Pre-fill		
A5	Name of block	Pre-fill		
A6	Name of village	Pre-fill		
A7	Treatment group	Pre-fill	No forecasts CFAN probabilistic forecasts	0 1

Section B: Preliminaries				
BN1 Note	For surveyors: Call {respondent_name} on their mobile. Mobile number 1: \${mobile1}			
B1	For surveyors: Did the respondent answer the phone call?	No Yes	0 1	→ Section Z → BN2
BN2 Note	Read: Namaskara! My name is _____, and I am calling from the Coffee Krishi Taranga service. I am calling today to invite you to participate in a survey about how coffee farmers use and may benefit from weather forecasts. Do you give your consent to start the survey? No Sec Z Yes B2			
B2	Is your name {respondent_name}?	No Yes No answer	0 1 999	→ B2.1 → B2.1 → Sec Z

B2.1	Are you the primary decision maker on coffee farming activities, or do you listen to the advisories provided by CKT?	No Yes No answer	0 1 999	→ B2.2 → B4 → Sec Z
B2.2	Is the primary decision maker / the person who listens to the CKT advisories available to speak on the phone?	No Yes No answer	0 1 999	→ B2.3 → BN3 Note → B4 → Sec Z
B2.3	Can you please provide the contact details of the primary decision-maker on coffee farming activities or the person who listens to CKT advisories?	Yes No No Answer	1 0 999	→ B2.4 → Sec Z → Sec Z
B2.4	Collect details of the primary decision maker/person who listens to advisory	Name Phone number		→ BN4 Note → Sec Z
B4	May I please ask how old are you? <i>[For surveyor: If the farmer is unsure, ask them for their best guess.]</i>	Enter age _____ [in years]		If B4<18 or >65 → Sec Z
B5	Select the gender of the respondent	Male Female Other	0 1 2	
B6	Do you live in {village} village?	No Yes		→ Sec Z (Z0) → B7
B7	Have you been in {village} most of the last five days?	No Yes	0 1	→ Sec Z
BN3 Note	<p>Read: Namaskara! My name is _____, and I am calling from the Coffee Krishi Taranga service. I am calling today to invite you to participate in a survey about how coffee farmers use and may benefit from weather forecasts.</p> <p>For surveyors: Verbally confirm that you are speaking to the primary decision-maker</p>			
BN4 Note	<p>Read: Thank you for your cooperation and for providing the contact details. I will reach out to the primary decision-maker.</p> <p>For Surveyor: End the survey after this and call the primary decision maker. (Conduct blank survey)</p>			

Section C: Forecast Use, Weather Realization, Weather Expectations

CN1 Note	Read: Thank you for subscribing to Coffee Krishi Taranga! We would like to ask you a few questions to understand your current information needs and feedback on the service. The survey is expected to take about 10 minutes. You can choose to stop participating at any time. Your answers will be recorded and used to improve the quality of the service being provided to you.			
CN2 Note	Read: I will now ask you a few questions about the weather in recent days.			
CN3 Note	Read: Ok. I will now ask you a few questions about what you expect the weather to be or think the weather will be in the next few days.			
C1	<p>What is your main source of weather forecasts?</p> <p>[Select one]</p>	<p>Radio</p> <p>Newspaper</p> <p>TV</p> <p>Peer farmers</p> <p>Friends/family members/Relatives</p> <p>Internet search</p> <p>Weather apps</p> <p>Whatsapp groups</p> <p>Kisan call centers</p> <p>Coffee Krishi Taranga service</p> <p>Other → please specify</p> <p>None</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>997</p> <p>0</p>	<p>→ Option not for the control group (i.e., if A7 is 0)</p> <p>→ C3</p>
C2	<p>How much do you trust the weather forecasts that you mentioned above?</p> <p>[On a scale from 1 to 5, where 1 means 'do not trust at all' and 5 means 'completely trust']</p> <p>[Note to surveyor, please ensure that the farmer understands the scale. Explain only 1 & 5, and ask the farmer to choose within this range]</p>	<p>1- Do not trust at all</p> <p>Mostly do not trust</p> <p>Neutral</p> <p>Mostly trust</p> <p>Completely trust</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p>	
C3	<p>What coffee cultivation activities did you undertake in the last one month?</p> <p>[Select all that apply]</p>	<p>Irrigation</p> <p>Nutrient management</p> <p>Pest management</p> <p>Rot or rot disease management</p> <p>Harvest</p> <p>Drying</p> <p>Weeding</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p>	

		Pruning	8	
		Fruit drop management	9	
		Disease management	10	
		Other → please specify	997	
C4	Did you rely on a weather forecast to decide on coffee cultivation activities in the last month?	No	0	
		Yes	1	
		Don't know/Can't say	998	

Section D: Content Comprehension				
DN1 Note	Read: We want to understand how to provide weather forecasts that are useful for farmers. So, I will read out a few forecast messages to you, and I will then ask you some questions about the forecasts. Please note that these are hypothetical forecasts for a hypothetical village in January, so it has no connection with the real weather. This is only for the purposes of our understanding.			
DN2 Note	Read: Now, I will read out one such hypothetical forecast for you. After that, I will ask you some questions about the message to see if it makes sense. I can read it out again if necessary. [This is the first forecast] For the next 5 days, that is, from June 2 to June 6, in <pushpahalli> village: There is a 70% chance of rain. 2 inches of rainfall is expected (on average).			
D1	According to you, what is the meaning of “there is a 70% chance of rain”. [Note to surveyor: read out all the options, and then ask the respondent to provide their interpretation. Order of options will be randomized. The correct option is “Rain is not certain but rain is more likely to occur than not in the village”.]	“Rain will definitely occur, but not in all parts of the village (i.e., it will rain in 70% of the village)” “Rain will definitely occur, but not throughout the five days in the village (i.e., it will rain for 70% of the time in the next five days)” “Rain is not certain, but rain is more likely to occur than not in all areas in the village in the next five days (i.e., there is a 7 in 10 chance of rain everywhere in the village)” “Rain will definitely occur in this village, and the intensity (or heaviness) of rainfall in the next five days will be 70%” Something else → please explain	1 2 3 4 5	
D2	Do you think the forecast is easy to understand?	No Yes Don't Know/Can't Say	0 1 998	
D3	Please explain if anything in the forecast might be confusing	[open-ended]		

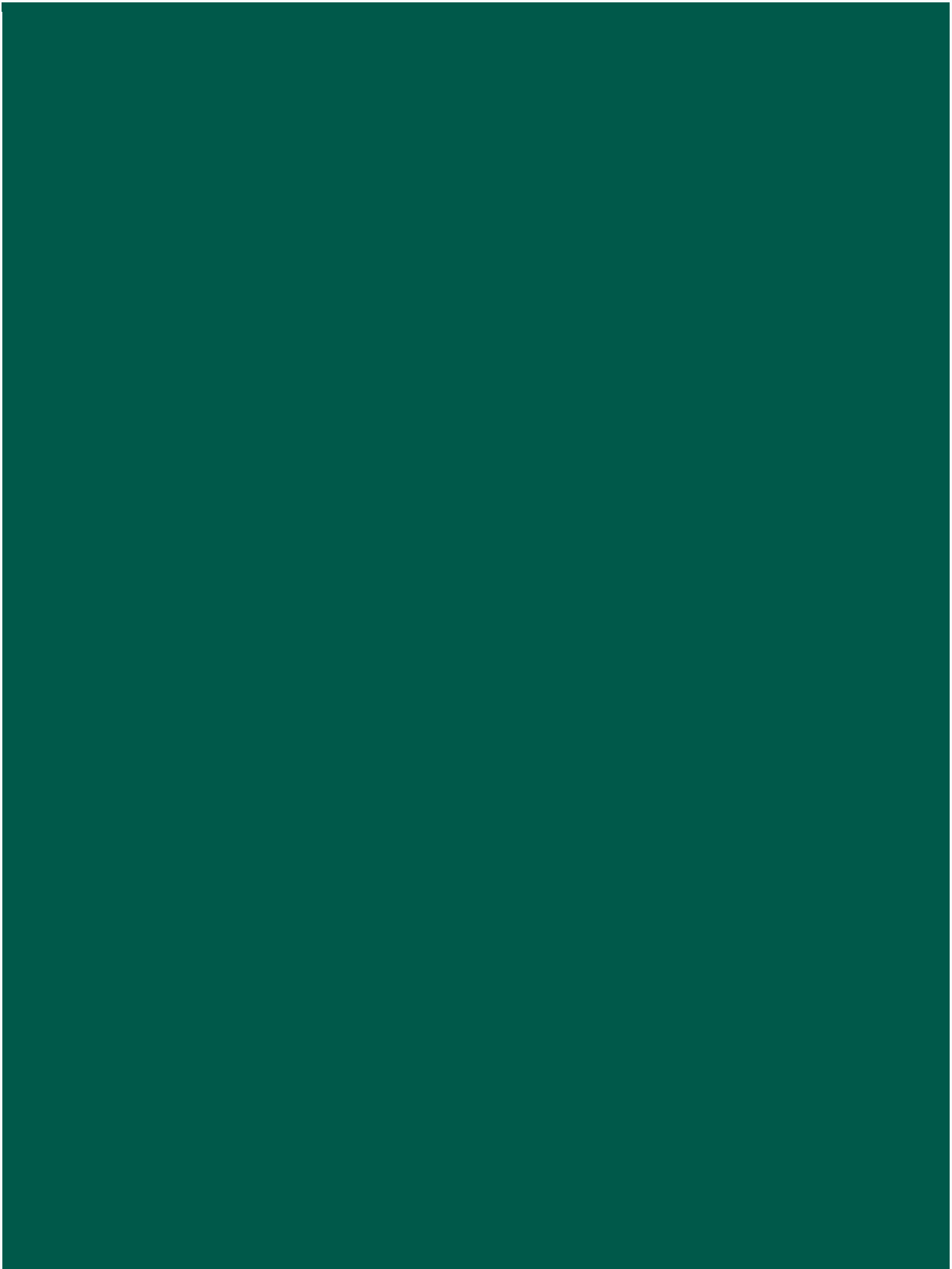
Section E: CKT Forecasts

[Note: This section should only be asked for farmers who receive forecasts from CKT already, i.e., the phone number is in the forecast sample OR the GP is in the forecast sample. Code logic could be such that this section appears when the farmer is in the forecast farmer list]

EN1 Note	<i>I will now ask you a few questions about weather forecasts from the CKT service. Please keep in mind that these are questions about the weather forecast messages alone, and do not relate to the regular advisory messages about how to conduct agricultural practices.</i>			
E1	<p>Do you recall receiving any voice-based weather forecasts from CKT in the last one month?</p> <p><i>[i.e., did you get any phone calls in which you got the weather forecast telling you about whether it would rain in the next five days or not. This is not the usual advisory messages about agricultural practices]</i></p>	<p>No</p> <p>Yes</p>	<p>0</p> <p>1</p>	<p>→ E1.1</p> <p>→ E2</p>
E2	<p>Did you listen to the complete forecast message the last time you received a forecast message?</p> <p><i>[Note that this is referring to the weather forecast message not the regular advisory about how to conduct agricultural practices]</i></p>	<p>No</p> <p>Yes, partially</p> <p>Yes, completely</p> <p>Don't Know/Can't Say</p>	<p>0</p> <p>1</p> <p>2</p> <p>997</p>	<p>→ E3.1</p> <p>→ E3.1</p> <p>→ E6</p>
E3	<p>Did you rely on <u>weather forecasts</u> from CKT specifically to decide the timing of conducting any agricultural practice in the last one month?</p> <p>(If E1 is 1 or E2 is 1,2)</p> <p><i>[Note that this is referring to the weather forecast message not the regular advisory about how to conduct agricultural practices]</i></p>	<p>No</p> <p>Yes</p>	<p>0</p> <p>1</p>	<p>→ E4.1</p> <p>→ E5</p>
E4	<p>How much do you trust the weather forecasts that CKT sends to you?</p> <p><i>[On a scale from 1 to 5, where 1 means 'do not trust at all' and 5 means 'completely trust']</i></p>	<p>Do not trust at all</p> <p>Mostly do not trust</p> <p>Neutral</p> <p>Mostly trust</p> <p>Completely trust</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p>	
E5	<p>Do you have any feedback or suggestions relating to this weather forecast service?</p>	<i>[open-ended]</i>		

Section Z: Survey Close				
ZN1 Note	We have completed the survey, thank you for your time. Please continue to use our service and remember that you can call into our helpline at 080-37685000 to ask questions and listen to advice, free of cost, whenever you like.			
Z0	District Block Village Other <i>[For Surveyor: If the village doesn't exist in the drop-down, choose other]</i>			
Z1	Was the survey completed?	No Yes	0 1	
Z2	Should the respondent be called back?	No Yes	0 1	
Z3	Are there any further notes that you want to add to this survey? <i><u>NOTE TO SURVEYOR:</u></i> Leave this question blank if you don't have anything to add.	[Text entry]		

5.2 Survey response data and engagement data - [Link](#)



Post Pilot Report || Second Deliverable

Sannihit <sannihit@precisiondev.org>

Wed, Jul 3, 2024 at 4:37 PM

To: InnovationGrant Management <innovationgrants@adpc.net>

Cc: Anjaney Singh <anjaney@precisiondev.org>, Gagandeep Kaur <gkaur@precisiondev.org>, Supriya Ramanathan <sramanathan@precisiondev.org>, Adnan Alam <adnan.alam@adpc.net>, Tari