Making India's crop insurance more inclusive through technology
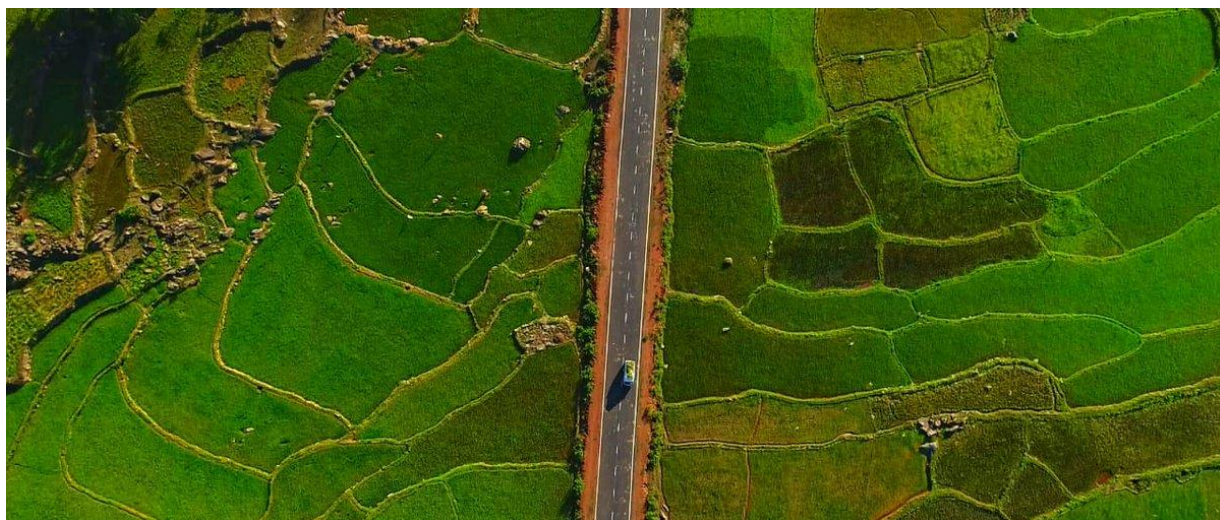
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"Paddy Fields around the road from Munising to Seranga in Gajapati District" by Government of Odisha is licensed under Creative Commons Attribution 4.0 International.

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Executive summary

The Pradhan Mantri Fasal Bima Yojna (PMFBY) is a crop insurance program for smallholder farmers in India. It is implemented by the Government of India (GoI) in partnership with State governments and insurance companies. The program is highly subsidized with farmers paying premiums in the range of 1.5% to 5% depending on the crop. For the *Kharif 2019* sowing season, it provided insurance coverage to nearly 42 million farmers.

While PMFBY has enhanced farmers' access to risk management opportunities, the program has faced several hurdles ever since it was started in 2016 – farmers criticize the long and tedious claim settlement process, and insurers have little confidence in the loss and yield assessment methods defined by the Government. Two of the payment stipulations (prevented sowing and mid-season calamity) are often not triggered since the means for assessing the losses are lacking.

The objective of this project was to test the feasibility of addressing these hurdles and make PMFBY more inclusive through technology. It sought to evaluate the effectiveness of mobile phone campaigns and satellite-based remote sensing data to: 1) Improve financial awareness and literacy among farmers to promote the use of PMFBY and familiarize them with the claims process 2) Enhance farmers' access to insurance payouts under the prevented sowing and mid-season calamities payment stipulations of PMFBY.

The intervention was carried out by a multi-stakeholder partnership comprising of Earth Analytics India, Precision Development (PxD) and Endeva between October 2020 and April 2021 in the districts of Bargarh and Sambalpur in Odisha state, India.

1) **Mobile-based financial literacy:** A randomly selected group of 436 farmers was assigned to treatment and control groups. The treatment group was informed about PMFBY through mobile phone-based outreach including voice calls and SMS messages. They were provided information about PMFBY's guidelines, eligibility, enrolment process and deadline, and potential claim entitlement. The control group received no mobile phone-based information about PMFBY. The study found that farmers have low awareness about PMFBY – only 44.76% of farmers were aware of PMFBY before the intervention began – and that the mobile phone-based farmer outreach was successful in enhancing knowledge and awareness of the program. After the intervention, farmers who received PxD's messages about PMFBY were 3.6 percentage points more likely to know the correct enrolment deadline (a 175% increase relative to the comparison group, in which only 2.05% of farmers knew the enrolment deadline, p = 0.055). Treatment also led to a 0.052 increase in a farmer's score on an overall knowledge index, relative to an average score of 0.213 in the control group (p = 0.054).[1] However, the project could not generate conclusive evidence that the

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[1] The knowledge index included whether the farmer knew the correct enrolment deadline and whether the farmer could correctly identify at least one of the documents required for enrolment. While conventional guidelines for interpreting regression analysis interpret results with a p-value above 0.05 as a failure to find a statistically significant effect, we view these patterns as encouraging evidence that messages from Ama krushi have the potential to increase farmers' knowledge of the PMFBY scheme, especially given that the small sample size reduces our ability to detect treatment effects.

intervention led to an increase in PMFBY adoption given the small sample size. While adoption rates among those who received advisory increased, this was accompanied by a corresponding increase among control group farmers as well. We believe further research with a larger sample and over a longer time period is merited, along with further investigation of other factors such as logistical and financial barriers.

2) **Remote sensing-based payouts:** The rice cropping pattern in the two districts was monitored using remote sensing technology (satellite data), with baseline maps at the start of the season and crop stress maps during the season to detect signs of prevented sowing and/or the extent of particular calamities which could trigger the respective PMFBY payment stipulations. It revealed a lack of rainfall for most of December 2020 and late sowing by farmers. However, the prevented sowing payment stipulation was not triggered as late sowing seems to be the agronomic pattern in the region. Satellite data on the moisture content of the vegetation was used as a proxy to draw inferences on crop health during the season. It revealed that although there were some small patches of area which underwent water stress during the season, it was too localised and /or short term (perhaps related to fallow land) to trigger mid-season calamity payouts. The project established that remote sensing data could be a useful tool for tracking agricultural activity relevant for PMFBY. While some elements of the proof of concept could not be explicitly tested as no indemnification event took place during the course of the project, it still demonstrated that the key moments of crop phenology can be monitored using remote sensing data which was validated with also GPS-tagged ground control points. The technology provides near-real-time crop stress- and loss-related information to PMFBY stakeholders (farmers, insurance companies and the state agricultural department) and could also be relevant for similar crop insurance programs in other states. The continuous engagement with the insurance companies throughout the project revealed their interest in deploying remote sensing data for loss detection and assessment. Actual take-up will be influenced also by other factors, including the PMFBY design (e.g., the stipulated loss assessment methods by the states and the overall operational guidelines of the scheme). Finding use cases outside a strictly regulated and complex scheme like PMFBY might be a more viable approach.

1. Background

Agriculture is a major source of livelihood for a large proportion of the Indian population. Nearly 58% of the Indian population depends on it as the primary source of its livelihood.[2] With 86.2% of all farmers holding less than two hectares of land, the sector is dominated by smallholder farmers.[3]

PMFBY is a large-scale crop insurance program aimed at providing risk cover from production vulnerabilities to smallholder farmers. It is an area-based yield-index program. The yield is determined for an area through 'crop cutting experiments' (CCEs). Under the area-based approach risk is assumed to be similar in an insured area – usually the whole village. The payouts under PMFBY are made under three stipulations as shown in the table below:

Payout Stipulation	Description	Trigger Clause
Prevented sowing (25% of sum insured)	Compensation for farmers if they are prevented from sowing due external reasons as defined in the guidelines (usually drought, flood, unavailability of irrigation).	Area sown by the cut-off date is less than 50% of the previous season. After triggering of this stipulation, the insurance policy is voided and the farmer is no longer eligible for payouts under other stipulations.
Mid-season calamity and localised calamities (25% down payment of expected claim amounts)	Losses that occur in the middle of the season. For localised calamities, the farmer has to claim for the same.	For mid-season, it has to be declared as such by the district government. For a localised calamity, the farmer has to file a claim which is inspected by the insurance company.
End of season yield (Up to 100% of sum insured)	Yield shortfall determined at the end of season	Crop cutting experiments determine the end of season yield, following a particular protocol

The program is implemented by the GoI in partnership with State governments and insurance companies. The program is highly subsidized: Farmers pay a very low premium of a maximum of 2% of the sum insured during the summer sowing season (i.e., *Kharif* season), 1.5% the winter sowing seasons (i.e., *Rabi* season) for food and oilseed crops, and a maximum of 5% for annual commercial

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[2] Indian Brand Equity Foundation (2021). Indian Agriculture and Allied Industries Report. Retrieved 7th June 2021 from https://www.ibef.org/industry/agriculture-india.aspx

[3] Bisht, I., Rana, J.C., Ahlawat, S.P. (2020). The Future of Smallholder Farming in India: Some Sustainability Considerations.

crops. The difference between actuarial premium rates and the farmer rates is shared equally between the GoI and State governments.

The State governments are responsible for contracting and appointing insurance companies in a time-bound manner through a tendering process. While some states appoint insurance companies for longer time periods, others award annual contracts only. They are also responsible for assessing damage and deciding when to trigger insurance payouts.

Since the beginning of PMFBY, some states, such as Andhra Pradesh, Bihar, Gujarat, Jharkhand, Madhya Pradesh and Telangana, have exited the scheme while some others never joined the scheme at all (for instance in the case of Punjab). Some of these states have also launched their own crop insurance schemes, for instance *the Mukhya Mantri Kisan Sahay Yojana* launched in Gujarat in 2020.[4,5,6,7]

For the *Karif* 2019 season, the program provided insurance coverage to nearly 42 million farmers.[8] Until 2020, it was mandatory for "loanee" farmers, i.e., those availing credit via a Crop Loan account / Kisan Credit Card account (if they grow an insured crop) to enrol in PMFBY. In this case, the premium was deducted directly from the loan amounts. "Non-loanee" farmers, i.e., those who did not avail credit, could obtain coverage voluntarily and pay the premium directly. In February 2020, however, the GoI made PMFBY optional for all farmers.

[4] AgroSpectrum (August 2020). 5 States exit PM crop insurance scheme. Retrieved 28th June 2021 from http://www.agrospectrumindia.com/news/89/1101/5-states-exit-pm-crop-insurance-scheme.html

[5] The Indian Express (June 2021). Maharashtra uncertain on how to implement crop insurance scheme after Centre says no to Beed model. Retrieved 28th June 2021 from https://indianexpress.com/article/india/pmfby-faces-uncertainty-as-centre-says-no-to-beed-model-7374526/

[6] The Financial Express (August 2020). Crop insurance: Rising costs force states to quit PM Modi's flagship scheme. Retrieved 28th June 2021 from https://www.financialexpress.com/money/insurance/crop-insurance-rising-costs-force-states-to-quit-pm-modis-flagship-scheme/2045018

[7] The Hindu Businessline (August 2020). Gujarat, too, exits PM crop insurance scheme, citing premium burden. Retrieved 28th June 2021 from https://www.thehindubusinessline.com/economy/agri-business/gujarat-too-exits-pm-crop-insurance-scheme-citing-premium-burden/article32319981.ece

[8] Latest published figures by the GoI. Source: Ministry of Agriculture & Farmers Welfare (n.d.). PMFBY State Wise Business Statistics, Retrieved on June 30, 2021 from https://pmfby.gov.in/stateWiseDataPage.

2. Project scope

While PMFBY has enhanced farmers' access to risk management opportunities, the program has faced certain hurdles since it was started in 2016. The objective of this project was to test the feasibility of addressing some of these hurdles and make PMFBY more inclusive through technology. In particular, the project envisaged to tackle two major issues associated with the scheme:

- **Low enrolments among some farmers:** While the number of enrolled loanee farmers has risen and fallen in the past years, the number of enrolled non-loanee farmers has remained stagnant at a low level of awareness about PMFBY. The uptake of insurance is often hindered by 1) the lack of financial literacy and awareness among smallholder farmers, and 2) the exclusion of some farmers from the formal financial channels. This is compounded by the removal of the mandatory clause for loanee farmers in 2020.

- **Low payouts for some of the specified stipulations:** Farmers criticize the long claim settlement times and insurers have little confidence in the loss and yield assessment methods defined by the government. Two of the payment stipulations (prevented sowing and mid-season Calamity) are often not triggered since technical means to assess those losses are lacking or are often disputed due to the lack of reliable data.

2.1 Project components and rationale

Corresponding to the issues identified above, the project envisaged to test if PMFBY adoption and the insurance claim process could be enhanced through technology.

Project components

The project was carried out through two complementary components:

Component	Description	Implementation Lead
Improve financial awareness and literacy among farmers	Test the feasibility of using mobile phone-based extension for: - Improving farmer financial literacy, awareness about PMFBY and encouraging adoption of the PMFBY as a risk mitigation strategy. - Increasing insurance adoption rates and insurance claims in case of losses by informing farmers about the correct processes.	Precision Development (PxD)
Enhance access to	Test the feasibility of using satellite technology for crop stress monitoring and loss assessment for:	Earth Analytics India (EAI)

| insurance payouts based on robust datasets	• Triggering insurance claims under the prevent sowing and mid-season calamity stipulations. • Speeding up the verification process.	

Project rationale

The improved literacy among the smallholder farmers can improve their access to agricultural insurance and aid their integration in formal financial channels even without a formal loan. They would understand how to make an insurance claim if they had been prevented from sowing or if their crops are struck by a mid-season calamity.

The project would also ensure higher, and early- and mid-season payouts for affected farmers and that they are based on robust datasets. The satellite-based technology can address the data-related shortcomings associated with prevented sowing and mid-season calamity, particularly for losses caused by flood and drought which are the most frequent peril. This in turn would improve farmers' access to claims under these stipulations, thereby improving their incomes in times of adverse weather events. Policyholders would benefit from an earlier payout, which would enable them to manage losses more effectively, potentially by replanting crops or investing in other income-generating activities. This could avoid farmers falling into deep poverty and having to sell off assets, and increasing resilience to climate change by reacting more quickly to losses.

2.2   Project implementation

The project was carried out in the districts of Bargarh and Sambalpur in the eastern state of Odisha, India. The considerations for selection of these districts included:

• A large number of farmers who are engaged with PxD's extension services.

• EAIs presence for satellite monitoring.

• Presence of an insurance company partner that was keen on collaborating.
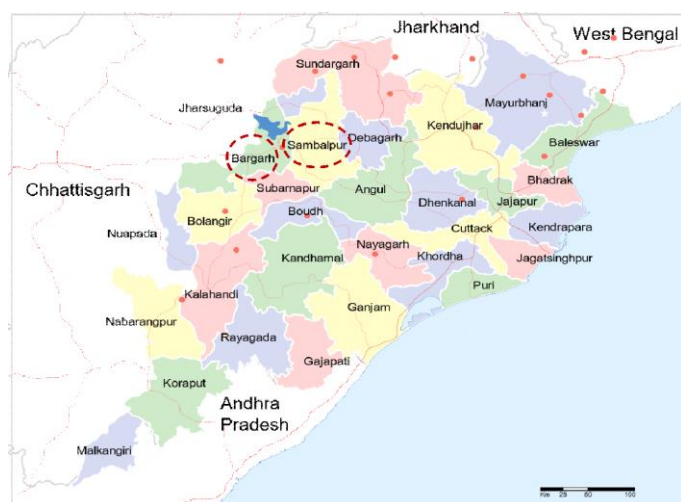
The project was implemented by a multi-stakeholder partnership. The partners included:

Implementation Partner		Responsibility
	EAI is a spin-off of the SDC-and GIZ-funded RIICE programme and its partner Sarmap. RIICE established a rice crop monitoring system across Asian countries; Earth Analytics India is monitoring various crops using satellite data.	EAI was in charge providing the satellite data analysis to detect prevented sowing or mid-season calamities.
	PxD is a global non-profit that provides customized agricultural advisory to over 2 million farmers in 7 countries as of date. In Odisha, PxD currently reaches roughly 1,250,000 active farmers through its platform.	PxD led the component to improve farmers' insurance literacy and access to insurance through its mobile information services.
	Endeva is a system-change facilitator with the mission to make the global economic transformation inclusive. It supports multi-actor projects through facilitation and project management, measurement, and learning.	Endeva coordinated the consortium, managed the project, enabled a strategic dialogue among partners and tracked and documented results.

Box 1: Impact of the COVID-19 pandemic and other local developments

In light of the COVID-19 pandemic in India, the certain project activities had to be changed.

Study period: Due to the restrictions on movement introduced by the government in response to COVID-19, the feasibility study was carried out during the *Rabi* 2020 season instead of the *Kharif* 2020 season as earlier planned.

Geographical scope: The original geographical scope for the study included one district each from the states of Gujarat and Odisha. However, the Government of Gujarat, decided to discontinue the Pradhan Mantri Fasal Bima Yojna (PMFBY). Thus, the study is proposed to be carried out in two districts in the state of Odisha.

Field work: The conduct in-depth field-testing of all content and collect farmer feedback in person could not be carried out due to the movement restrictions. The protocols were adapted for remote calling - all content was field-tested on the phone, and similarly, some one-on-one qualitative interviews were planned to delve deeper into farmer experiences.

The following sections elaborate on the activities carried out under the two components of the project and their respective findings.

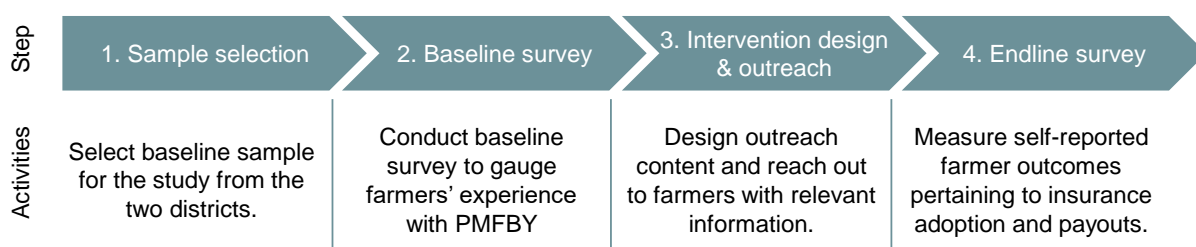# 3. Improving financial awareness and literacy among farmers

Led by PxD, this component aimed at testing the feasibility of using mobile phone-based outreach through voice calls and SMS messages in order to improve farmers' awareness about the PMBFY program, encourage adoption of insurance and also acquaint them of potential claims in case an insurance payout was triggered.

3.1 Implementation

The project was conducted in two districts in Odisha where PxD already operates a mobile phone-based extension platform. PxD added a PMFBY awareness and insurance literacy information campaign to its existing advisory content.

The project was designed as an experiment, in which farmers for the pilot sample were randomly assigned. As part of the pilot, the treatment group of farmers received voice-based advisory messages twice a week in Odia, the locally spoken language, occasionally supplemented by text messages, encouraging them to adopt PMFBY. At the end of the intervention, outcomes for the treatment group were compared with the control group of farmers which did not receive the messages.

The farmers were first approached in December 2020, i.e., prior to the *Rabi* 2020 season when they also signed up for the insurance, and the pilot continued till March 2021. The following steps and activities were carried out during this period:

Step	1. Sample selection	2. Baseline survey	3. Intervention design & outreach	4. Endline survey
Activities	Select baseline sample for the study from the two districts.	Conduct baseline survey to gauge farmers' experience with PMFBY	Design outreach content and reach out to farmers with relevant information.	Measure self-reported farmer outcomes pertaining to insurance adoption and payouts.

These steps and activities are detailed out in the following sections.

3.1.1   Sample selection

Baseline Sample		
District	Treatment	Control
Bargarh	117	102
Sambalpur	115	102
Total	**232**	**204**

A baseline sample of 436 farmers was selected from the districts of Bargarh (219 farmers) and Sambalpur (217 farmers) in Odisha. The selection of these farmers was based on two criteria:

- Farmers who were cultivating crops covered by PMFBY in the *Rabi* season.

- Randomly sampled from the selected pool.

Nearly 50% of the selected farmers in each district were randomly assigned to the treatment group and the rest to the control group. The table below illustrates the sample composition:

Farmers in the treatment group received information on PMFBY throughout the month of December 2020, prior to the enrolment deadline of 15 December.

3.1.2   Baseline survey

Existing literature and farmer interviews point to information asymmetry being a major hurdle for farmers in enrolling in the PMFBY scheme. To get a better picture and to inform the content design, PxD conducted a baseline survey to gauge farmers' understanding and feedback on PMFBY. The survey with the baseline (see Appendix 7.3 for detailed sample questionnaire) sample of 436 farmers from the districts of Bargarh and Sambalpur in Odisha. The baseline survey revealed the following:

Low awareness and knowledge about PMFBY and the enrolment process

- Only 44.76% of farmers, both in the treatment and the control group, were generally aware of PMFBY.

- Only 40% of the farmers mentioned that they found the enrolment process for the scheme satisfactory, with a complex enrolment process being the primary reason for dissatisfaction.

- When it comes to the knowledge about the PMFBY enrolment process, less than 20% of the farmers could actually name a document required or recall the deadline for enrolment.

Low access to mechanisms for crop loss recovery

- Almost all the farmers experienced crop loss due to natural calamities in the previous 5 years.

- Only 29% of farmers who had faced a crop loss were able to recover some of their losses.

- 36% of those who recovered some of their losses were able to do so because they participated in an insurance scheme.[9]

These provided insights were used for designing the approach for the intervention.

3.1.3   Intervention design and outreach

The content for the pilot was decided based on a mapping exercise conducted in consultation with various stakeholders (insurance companies, sectoral experts, government partners), baseline results and literature review. The content covered information about different aspects of PMFBY, eligibility,

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[9] PMFBY is the only crop insurance scheme operational in Odisha. According to the latest available data, the total number of farmers insured by PMFBY in Odisha in the previous years was: 4.7 million during Kharif 2019 season; 2.1 million in 2018-19; 1.9 million in 2017-18 and 1.8 million in 2016-17. Source: Ministry of Agriculture & Farmers Welfare (n.d.). PMFBY State Wise Business Statistics, Retrieved on June 30, 2021 from https://pmfby.gov.in/stateWiseDataPage.

enrolment process and deadlines as well as claim entitlements. The information was complimented by farmer testimonials. The table below presents further details of the information shared (see Appendix 7.4 for SMS content):

Content type	Information provided
Guidelines	• Protection against crop losses in events such as lack of rainfall, natural disaster, or pest attack for insured crops. • Amount of premium payable in the range of 1.5% to 5% depending on the crop.
Eligibility	• Eligible crops including paddy, potato, green gram, black gram, mustard, and onion.
Enrolment process and deadline	• Documents required for enrolment and where to enrol for the scheme, i.e. Aadhar Card copies, Bank passbook copies, land ownership records (RoR/LPC) and state government's proposed sowing certificate or self-declaration for sowing crops). • Place to enrol for PMFBY, i.e. Agriculture officer or Common Service Center (CSC) or banks. • Deadline for enrolment, i.e. 15th December 2020.
Claim entitlement	• Reminder about triggering of potential claim entitlement in case of prevented sowing in the case of rainfall deficit or adverse weather conditions, relevant deadline (31st December 2020 in this case) and location to file the claim (i.e. CSC).

The treatment group farmers were provided information on PMFBY through PxD's two-way advisory service that sends farmers voice-based advisory customized to their location and other farming characteristics.

3.1.4   Endline survey

Endline Survey		
District	Treatment	Control
Bargarh	82	78
Sambalpur	79	78
Total	**161**	**156**

At the end of the intervention, an endline survey (see Appendix 7.5 for detailed sample questionnaire) was implemented to measure self-reported outcomes. As expected, some attrition was observed between the baseline and the endline, implying that some of the study participants declined to participate in the endline survey.[10] At the endline, 317 (160 in Bargarh and 157 in Sambalpur) out of the original 436 sample completed the final survey. There was no evidence of differential attrition between the treatment and the control groups.

The final sample considered in this study at the end of the study period is described below:

3.2 Key findings

3.2.1 Engagement

Farmers appear to engage with the content on PMFBY, with mobile phone-based information quickly becoming the primary source of information for some; however, information recall values remain low given the short information campaign.

Engagement refers to farmers' receptiveness to the intervention provided. For this pilot, the engagement was tracked through metrics of farmers picking up the calls and listening to advisory   messages sent. PxD's platform allows such tracking through the system itself.

- **Pick-up rate:** Based on this administrative data, it was deduced that farmers in the treatment group picked up 86% of messages related to PMFBY and listened to 56% of the content. Listening rates were relatively consistent across messages and geographies.

- **Recall:** The treatment group farmers were asked if they could recall the messages. Of the 161 treatment group farmers who completed the endline survey, however only 33% of farmers (53 out of 161 treated farmers that completed the endline) could recall receiving a message about PMFBY in the previous 6 weeks. This could be a result of farmers receiving agricultural advisory information in parallel, hindering the PMFBY recall as a separate topic.

- **Information relevance:** 92.5% of the farmers who recalled receiving the PMFBY content, found the abovementioned PMFBY information received through PxD useful or very useful (49% of these farmers rated the content as very useful).

- **Mobile phone outreach efficacy:** Prior to the intervention, radio & TV were reported to be the most popular sources of information on PMFBY by the farmers. After the intervention, treatment farmers were more likely to report our mobile platform to be their primary source of information on PMFBY. 23.6% of the treatment group participants reported that PxD was the primary source of information about PMFBY. (See Appendix 7.6 for the detailed result).

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[10] Attrition is a phenomenon in which fewer people respond to round 2 of a survey than round 1. This is a common phenomenon, and so long as there are no systematic differences between the people who "attrit" from the treatment and control groups, we do not expect this to make a difference in the results.

3.2.2 Awareness

The mobile phone-based intervention appears successful in increasing farmers' knowledge about PMFBY and its enrolment process.

To test the effectiveness of the intervention in increasing farmers' awareness about PMFBY, two questions were asked: 1) Can the farmer recall the deadline for enrolment? 2) Can the farmer recall the documents needed for enrolment?

The deadline for enrolling in the PMFBY scheme was 15 December 2020. In order to enrol, farmers require three documents:

- Identity proof: The farmers require a government-issued identity proof, which in most cases is the Aadhar card.

- Land title: Farmers can produce a copy of their latest land record, State Record of Rights (RoR) or a Land Possession Certificate (LPC)

- Bank account details: For this the farmers need to provide details of their bank passbook.

From the table below, we can see indicative evidence that our intervention increased knowledge about the process of enrolling in the PMFBY scheme in the treatment group.

	Control (N= 156)		Treatment (N=161)	
	Before Intervention (Baseline)	After Intervention (Endline)	Before Intervention (Baseline)	After Intervention (Endline)
Mentioned the correct deadline for enrolment	0.00%	1.28%	0.62%	4.35%
Mentioned all the documents required for enrolment correctly.	9.62%	5.77%	3.10%	9.32%
Mentioned at least one document for enrolment correctly	14.74%	12.42%	9.94%	18.63%

A linear regression conducted on endline data finds suggestive evidence that treatment increased participants' knowledge about enrolment deadline, and about at least one document required for enrolment. The following two were controlled in this regression: The impact of (i) whether a farmer told us that they had recovered from crop loss using insurance in the past and (ii) the district where a farmer lives, accounting for any district-specific characteristics. The results are presented in the tables below:

	Whether farmer knew correct enrolment deadline
Treatment	0.036 (0.019)*
Whether farmer had recovered from crop loss using insurance in the past	0.074 (0.031)**
District	-0.012 (0.019)
Constant	0.021 (0.032)
R^2	0.03
N	317

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

	Whether farmer knew at least one correct document
Treatment	0.067 (0.040)*
Whether farmer had recovered from crop loss using insurance in the past	0.140 (0.066)**
District	-0.162 (0.040)***
Constant	0.351 (0.068)***
R^2	0.08
N	317

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

These results were found to be not statistically significant at conventional significance levels (5% significant levels); however, given the small sample size (which reduces our ability to detect small changes in the outcome variable with a large amount of confidence) and the positive treatment effects which are significant at the 10% significance level are interpreted as suggestive evidence that the treatment did lead to increased knowledge about how to enrol in the PMFBY scheme.

The intervention also led to a 0.052 increase in a farmer's score on an overall knowledge index, relative to an average score of 0.213 in the control group ($p = 0.054$).[11]

3.2.3 Adoption

While the intervention helps address information challenges, there are possibly other driving factors (financial or logistical) that also play a role in farmers' participation in PMFBY.

Less than 30% of treatment and control farmers were enrolled in PMFBY at the time of the baseline as can be seen from the table below. It also shows the changes in adoption at the end of the intervention:

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[11] The knowledge index included whether the farmer knew the correct enrolment deadline and whether the farmer could correctly identify at least one of the documents required for enrolment. While conventional guidelines for interpreting regression analysis interpret results with a p-value above 0.05 as a failure to find a statistically significant effect, we view these patterns as encouraging evidence that messages from PxD's intervention have the potential to increase farmers' knowledge of the PMFBY scheme, especially given that the small sample size reduces our ability to detect treatment effects.

	Control (N= 156)		Treatment (N=161)	
	Before Intervention (Baseline)	After Intervention (Endline)	Before Intervention (Baseline)	After Intervention (Endline)
% Of farmers that report enrolling in PMFBY	29.49%	41.67%	26.71%	34.78%

A linear regression examining the relationship between enrolment and treatment status (controlling for district and whether the farmer had recovered from crop loss by using insurance in the past) found no discernible effect of the messages on enrolment in PMFBY. The hypothesis derived from this is that while the intervention helped address information challenges, there are other driving factors (financial or logistical) that prevent farmers from participating in PMFBY (or potentially even being eligible for PMFBY). However, drawing firm conclusions is difficult due to the limited sample size included in this pilot study.

As can be seen in the chart below, in the control group, 70.79% of the farmers who did not enrol in PMFBY pointed out the lack of information to be the reason for non-enrolment; in the case of treatment group this stood at 61.17%. This indicates that PxD's intervention was able to reduce the information gaps which prevent farmers from enrolling in PMFBY.
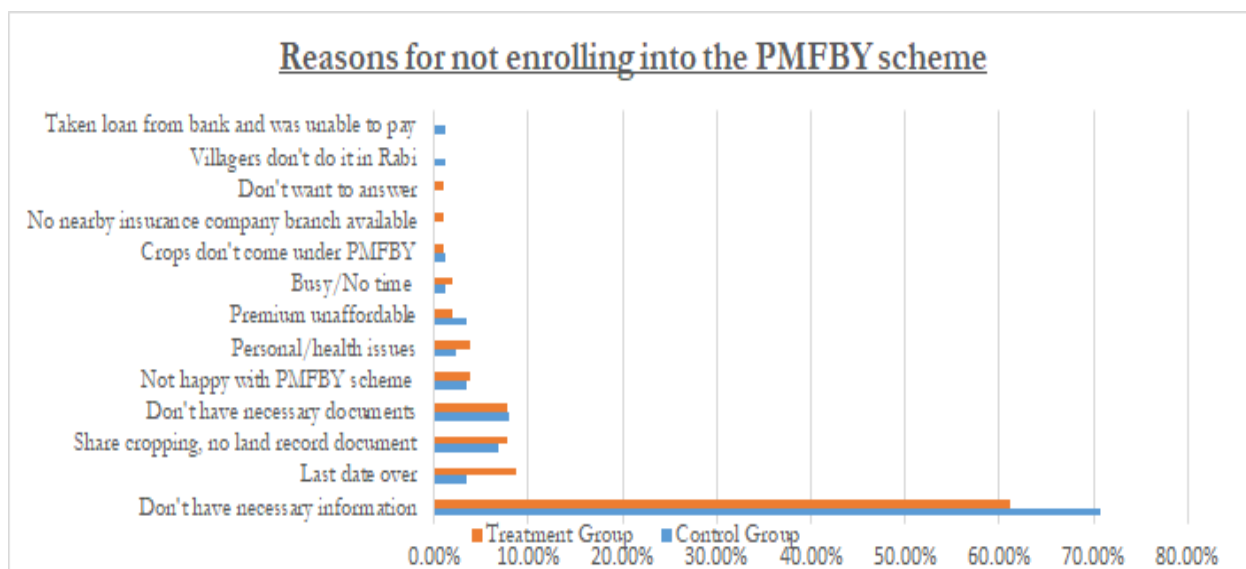
3.2.4 Payouts

No conclusive evidence derivable about the efficacy of the intervention in enhancing payouts received by the farmers.

Farmers in the treatment group were informed about the potential PMFBY indemnification for prevented sowing in case their crop could not be sowed, planted or germinated. They were also informed about the deadline for filing the claim and guided to the nearest CSC[12] to get more information or file the claim. Only 2 out of 161 farmers, i.e. 1.24%, in the treatment group and none in the control group filed a prevented Sowing claim under the study period. Given the lack of adverse weather conditions during this time period, it is difficult to draw any inferences from this data about the impact of this program on whether farmers received payouts.

3.3 Conclusion

The findings from the mobile phone-based intervention to improve financial awareness and literacy among farmers generated indicative evidence of an information gap on PMFBY among farmers. Following the intervention, a majority of treated farmers report that our service as their primary source of information on the scheme (moving away from TV and radio). Overall, the intervention seems to have increased access to information on PMFBY and farmers' knowledge of the scheme as elucidated by the fact that farmers were better able to recall the deadline and the process of enrolment for PMFBY.

However, the project could not generate conclusive evidence that the intervention particularly influenced PMFBY adoption, in part given the small sample size. While adoption rates among those who received advisory increased, this was accompanied by a corresponding increase among control group farmers as well. We believe further research with a larger sample and over a longer time period is merited, along with further investigation of other factors such as logistical and financial barriers. In follow-up interviews to understand why treatment farmers didn't enrol in PMFBY, we saw a few highlights: 1) Some farmers who had initially intended to grow *Rabi* crops, ended up not doing so, or ended up farming it on very small plots of land for subsistence purposes and did not enrol in PMFBY, 2) There may be additional logistical and financial constraints that limit enrolment - for instance, many farmers who didn't enrol still state that they find the content informative and useful.

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[12] Each village has a CSC that handles all the process related to PMFBY.

4. Remote sensing use case / Enhancing insurance payouts access based on robust datasets

Led by EAI, this component aimed at testing the feasibility of triggering PMFBY claims using satellite technology for crop stress monitoring and loss assessment. The prevented sowing and mid-season Calamity stipulations of PMFBY have often been disputed due to the lack of reliable data leading to a decrease in trust in PMFBY by farmers and insurers, the two main stakeholder groups. The lack of trust, in turn, leads to reinsurance companies charging higher premiums by adding higher loadings to the technical insurance rates. The lack of trust in the claim handling procedures is even more pronounced for the yield determination at the end of the season. However, the contribution of remote sensing in determining end-of-season-yield is not yet fully matured due to aspects related to technical readiness and stakeholder willingness. This is also the reason why the project focused on the former payout points.

4.1 Implementation

The satellite data used for this project was based on Synthetic Aperture Radar (SAR) remote sensing technology. The main advantage of this technology is that remote sensing can penetrate even through thick cloud coverage, while the traditionally used optical technology cannot. This feature is important particularly in the coastal areas of India where cloud coverage is prevalent even during the *Rabi* season that is otherwise not so cloudy. The following steps and activities were carried out during this period:

Step	1. Product design	2. Data acquisition and input	3. Data processing and calibration	4. Data analysis
Activities	Design products to address PMFBY shortcomings.	Acquire European Sentinal 1 and NASA CHIRPS data from to meet product needs.	Process satellite data using MAPscape and SNAP tools to make it analysis-ready.	Conduct analysis using ERDAS and QGIS to understand phenology development.
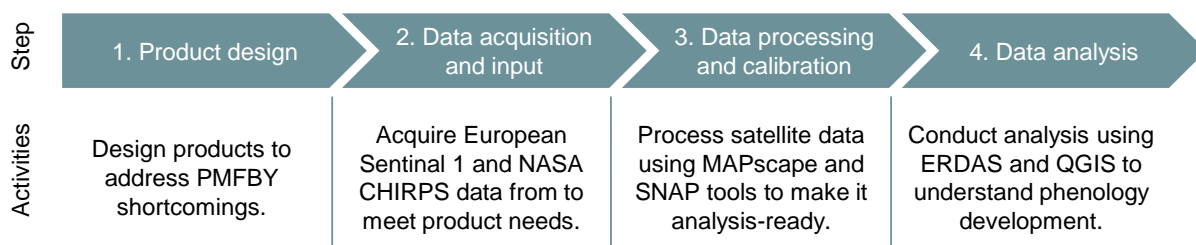
These steps and activities are detailed out in the following sections.

4.1.1   Product design

EAI's remote sensing products were designed to respond to PMFBY's above mentioned shortcomings. These products were aimed at creating transparency on losses. By sharing remote sensing-based observations with all key stakeholders (farmers, insurance companies and the government agencies), they also envisaged to eliminate information asymmetries which often exist   if only one or select parties have access to remote sensing data to make claims (or dispute another one).

A brief description of EAI's products designed for this project is provided in the table below:

PMFBY Payout stipulation	EAI's Remote Sensing Product	Product Description	Data collection period	Payment stipulation cut-off date
Prevented sowing	Start of season map	An information in spatial (map) and numeric (table) format to inform on the area that has been planted between the start of the season and the cut-off date.	Until first week of January 2021	End of December 2020
Mid-season calamities	Crop Stress map	Measurement of the spatial extent of a particular calamity (mostly flood or drought) on the sown crop.	Until second week of February 2021	End of February 2021
Localised calamities[13]	Forensic examination of impact of crop loss	Forensic examination of an individual loss (on field level) that requires cadastre-level information and ideally higher resolution satellite data.	Until second week of February 2021	End of February 2021
End of season yield shortfall[14]	Yield assessment	n.a.	n.a.	n.a.

4.1.2   Data acquisition and input

EAI acquired different satellite-borne data sources to deliver on the above-mentioned products. The most relevant dataset was based on satellite images from the European Sentinel 1 satellite constellation. This constellation, operated by the European Space Agency, is equipped with radar sensors which are needed for remote sensing during cloudy conditions. EAI downloaded the satellite images over the project geographies from the servers of the European Space Agency which makes them available immediately after the satellites have flown over a particular geography. The satellite has a repeat frequency of 12 days, i.e., it flies over any given territory every 12 days and acquires data ("taking pictures") continuously. The publicly available rainfall data from NASA's CHIRPS satellite served to verify the above-mentioned satellite datasets providing a crosscheck mechanism and ensuring its robustness.

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[13] Refers to a mid-season calamity that only affects a small number of fields. Not in the scope of the project.
[14] Not in the scope of the project.

4.1.3　Data processing, calibration, and treatment

The data acquired from the satellite was processed to make it analysis ready. After downloading the data from Sentinel 1, it was pre-processed with MAPscape, the proprietary software of Sarmap, an investor into Earth Analytics India and a participant in the RIICE project. This step is necessary prior to analysing the data to transform the reflected radar signals into readable information that can determine the relative moisture and the extent of biomass of the object observed. The step consists of several activities such as atmospheric corrections, proper geographic registrations, and noise filtering techniques. There are only a few algorithms available on the market to perform those tasks - one is MAPscape software from Sarmap (which is not fully commercialised) and the other one is a free toolbox that users of Sentinel 1 data can use to make SAR satellite data analysis-ready (called SNAP). Both of these tools were used to process data over the two project districts in Odisha.

The radar satellite data from Sarmap over the same location which served as a benchmark for the in-season processing was also processed and analysed. Furthermore, EAI used gridded rainfall data publicly available from NASA's CHIRPS mission throughout the season to confirm or guide the remote sensing products. That dataset is helpful to confirm the existence of a crop stress event as observed by Sentinel 1.

4.1.4　Data analysis

The processed and calibrated data was analysed with Earth Resources Data Analysis System (ERDAS Image (a software by Earth Resources Data Analysis System) and Quantum GIS (QGIS) tools, and verified with weather data and local intelligence by PxD and the insurance companies. In this step, layer stacks of the images were prepared and overlaid with weather data. A time series of the satellite data was also created to understand the phenology development. However, in order to derive correct insights from radar satellite data, it is both necessary to deploy a good algorithm as well as understand the object of interpretation to set the correct input values (thresholds) and derive the correct conclusions from the satellite data. As a result, the different data products could be derived, notably the start of season map, that indicates the area planted at different times in the beginning of the season.

The remote sensing analysis was validated with previous year's remote sensing-derived crop phenology map that Sarmap had produced taking ground control points from the International Rice Research Institute (IRRI), reaching accuracy levels of around 90%. Previous year's validated map was deemed appropriate given the similarity in seasonal characteristics in 2019 and 2020.

4.2　Key findings

The major findings of the remote sensing analysis were as follows:

4.2.1　Prevented sowing

No prevented sowing event was triggered, despite late planting compared to other parts in Odisha.

The prevented sowing stipulation is triggered if farmers are prevented from sowing due to specific causes (among them are lack of rainfall, natural disaster, or pest attack for insured crops; see section 4.1.1 and Ch. 1). The definition of the triggering event is that the area sown by the cut-off date is less than 50% of the previous season, which affects the majority of the insured farmers in the area. After triggering of this stipulation, the insurance policy is void, and the farmer is no longer eligible for payouts under other following stipulations.

The *Rabi* season 2020/2021 in the two project districts started later than in other parts of Odisha and therefore deviated from the official crop calendar of the state. However, this seems to be the agronomic pattern for both districts observed, since last year's satellite data revealed a similar pattern and insurance companies also confirmed this to be the norm. The lack of rainfall for most of December 2020 as observed by satellite-based rainfall data left farmers no choice but to wait for better rains which would be followed by planting in this mostly rain-fed agricultural districts. (See box 3 for rainfall patterns across the districts and box 4 and 5 for planting time for the two districts). Eventually, rice transplanting only took place during the second half of January. This is not only later than the enrolment deadline (i.e. December 31st for *Rabi*) but also just after the cut-off date to file prevented sowing claims (i.e. January 15th for *Rabi*). There was no interest by farmers to file the claims which would have subsequently voided their insurance policy.[15] We infer that this was because late *Rabi* start seems to be the norm in the two districts, and the higher level of indem   nity in the case of end-of-season yield payment stipulation as compared to that in the case of prevented sowing influences farmers' decision to file for claims.

Box 3: Rainfall patterns in December 2020 and January 2021 for Bargarh and Sambalpur
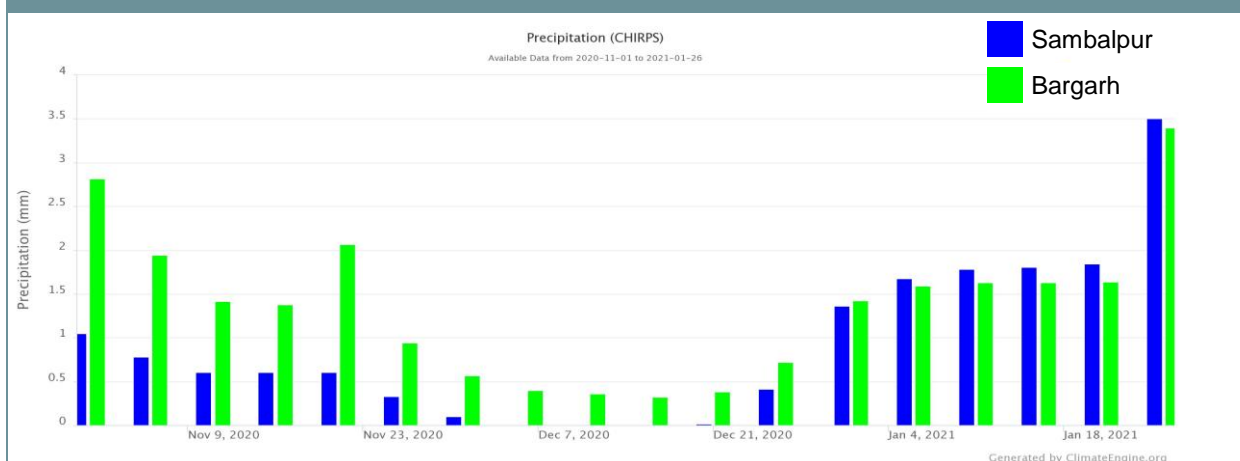
The rainfall data captured by CHIRPS shows low precipitation in Bargarh and Sambalpur particularly in the month of December, leading farmer to push planting until after the first rains in early- and mid-January. While this is later than the official Odisha crop calendar, the same pattern took place in the previous year.

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[15] The data collected by PxD revealed that only two out of 161 farmers, i.e. 1.24%, in the treatment group and none in the control group filed a prevented sowing claim under the study period.

Box 4: Rice transplanting in Bargarh district during *Rabi* 2020

Bargarh Paddy Sowing Status (Rabi 2020-21)
Sentinel-1 Time Series

Sowing Dates

Not of interest
2 : 28-NOV-2020
3 : 04-DEC-2020
4 : 10-DEC-2020
5 : 16-DEC-2020
6 : 22-DEC-2020
7 : 28-DEC-2020
8 : 03-JAN-2021
9 : 09-JAN-2021
10 : 15-JAN-2021
11 : 21-JAN-2021
12 : 02-FEB-2021
13 : 14-FEB-2021
14 : 26-FEB-2021
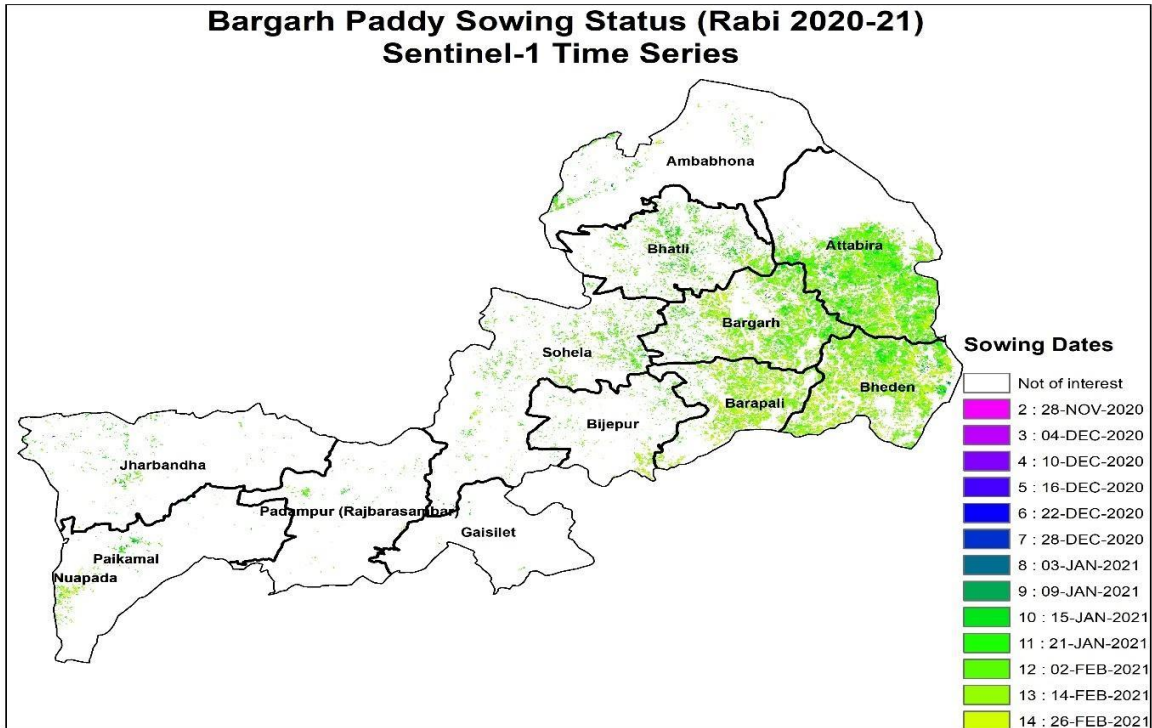
The satellite data indicates the rice transplanting dates that primarily took place in mid-January (Attabira block) and mid-February (elsewhere) in 2021. It was foreseen that rice transplanting times would correspond with the start of the season and PMFBY enrolment timelines, however, it actually happened later, i.e. in the second part of January in 2021. It can also be seen that the area that is under cultivation in *Rabi* (only rice crops had been cultivated) is quite small and concentrated in the East of the district (of which Bargarh is also the name of one subdivision of the district of Bargarh). However, such a delay in planting is not expected to lead to a loss in yield at the end of the season.

Box 5: Rice transplanting in Sambalpur district during *Rabi* 2020

Sambhalpur Paddy Sowing Status (Rabi 2020-21)
Sentinel-1 Time Series

Sowing Dates

	Not of interest
	2 : 28-NOV-2020
	3 : 04-DEC-2020
	4 : 10-DEC-2020
	5 : 16-DEC-2020
	6 : 22-DEC-2020
	7 : 28-DEC-2020
	8 : 03-JAN-2021
	9 : 09-JAN-2021
	10 : 15-JAN-2021
	11 : 21-JAN-2021
	12 : 02-FEB-2021
	13 : 14-FEB-2021
	14 : 26-FEB-2021
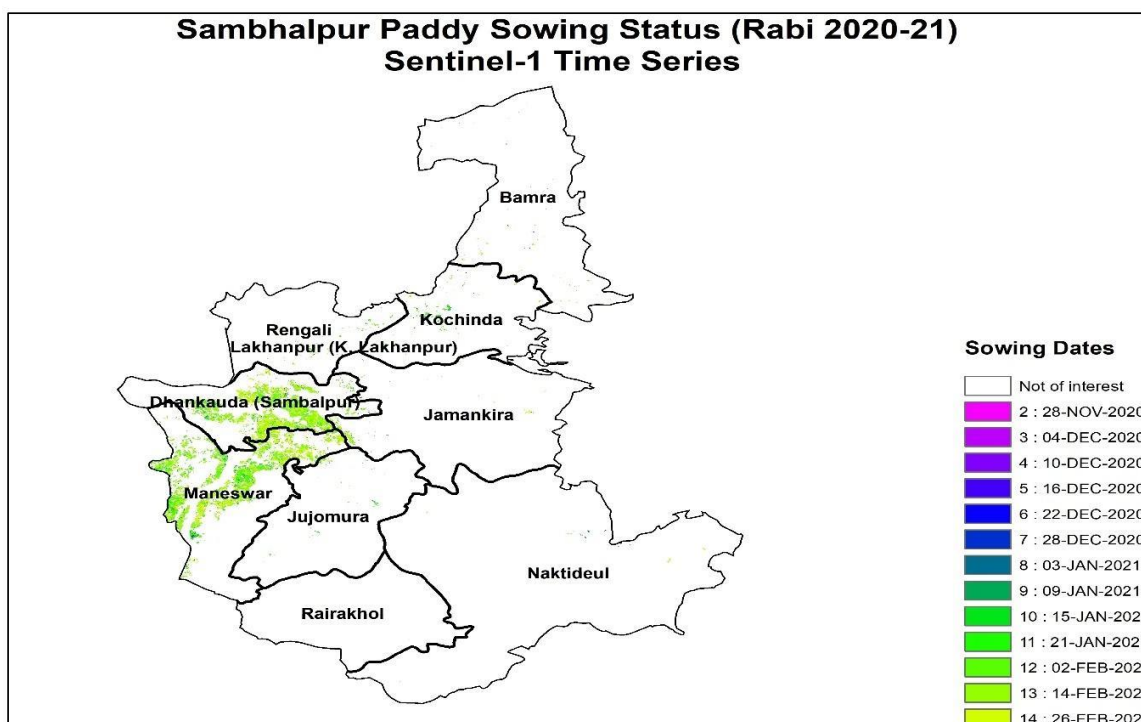
The rice transplantation in Sambalpur was following a very similar pattern to that of Bargarh.

4.2.2 Mid-season calamity

No mid-season or localised calamity event was observed and hence that the payment stipulation was not triggered.

A mid-season calamity refers to a large-scale loss in the middle of the season in which case the farmers are entitled to a payout of 25% of the sum insured (see section 4.1.1 and Ch. 1). While a mid-season calamity is to be declared by the Government, a localised calamity has to be claimed by the farmer.

Mid-season calamities often occur in the form of a flood or a drought. Both can be detected using SAR remote sensing data.[16] Confirmed by the remote sensing observations, as well as by the local intelligence from PxD and the insurance companies, the season evolved without any disruption in the weeks after the sowing. Remote sensing data did not pick up a major flood or drought event (as confirmed in the graph in box 6). Some very small patches in the area under observation did show water stress, yet this was too localised and too short-term, possibly related to fallow land, to have qualified for a mid-season or localised calamity. Furthermore, it is also not unusual for slight water stress to occur during the harvest season in March when temperatures are on the rise again.

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[16] See Appendix 7.7 for an illustrative use case showing the impact of a mid-season calamity in a district of Tamil Nadu that Earth Analytics India analysed in the same season for another insurance company as part of a separate commercial arrangement.

Box 6: No Mid-season observed

Microwave Polarization Difference Index (MPDI)

Median of 7 Sentinel-1 observations during March 2021

MPDI
- <= 0.2 (Dry areas)
- 0.2 - 0.5 (Areas under water stress)
- 0.5 - 0.8 (Moist areas)
- > 0.8 (water bodies)
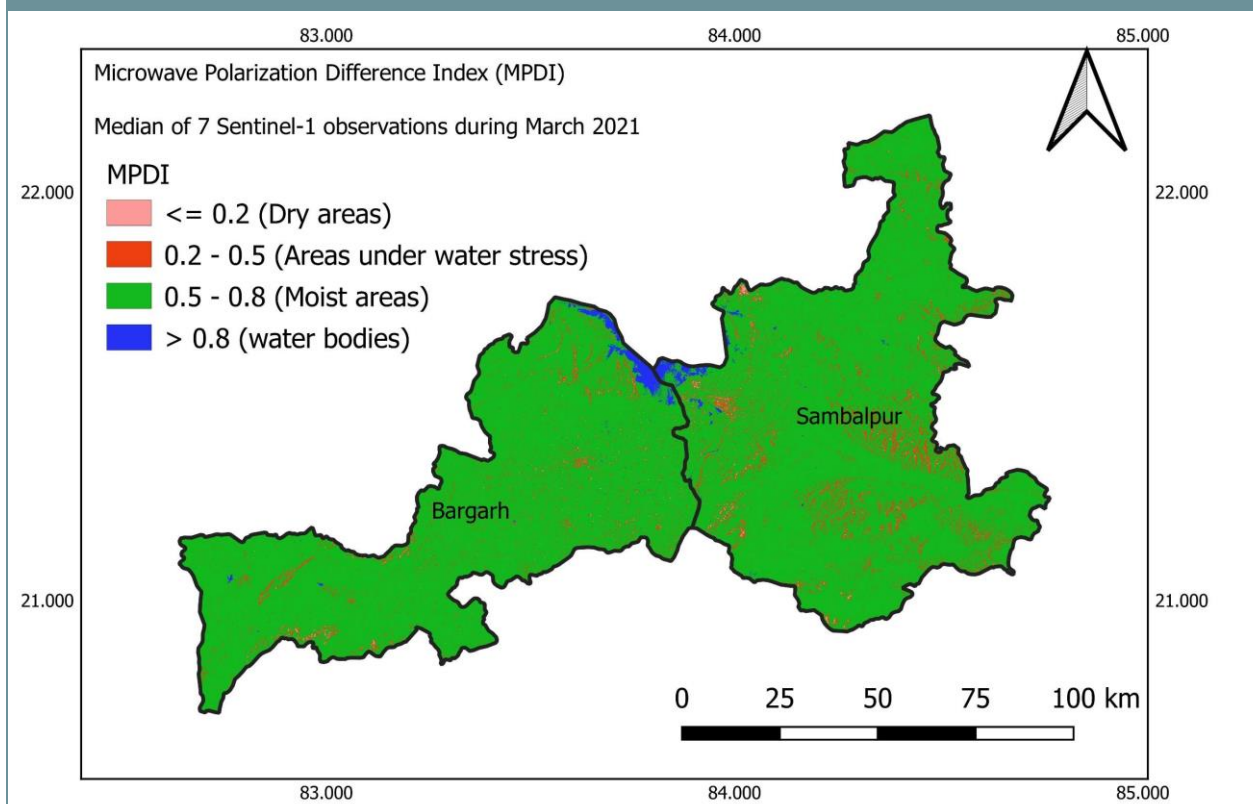
The map above derived based on satellite data shows the moisture content of the vegetation and was used a proxy for the crop health in the observed area. It reveals that some small patches in the area were subject to water stress during the season. However, qualitative ground information from the insurance company and PxD did not confirm any drought impact on a crop. We conclude that the dry patches could be related to fallow land, considering that in those two districts only a relatively small area of rice fields had been cultivated during the *Rabi* season.

4.3 Conclusion

The study demonstrated that remote sensing data from Sentinel 1 is able to track agricultural activity relevant for PMFBY, such as determining the planting moment of rice crops and also detecting anomalies after sowing. The key moments of crop phenology can be monitored using radar satellite data, providing information to the crop insurance stakeholders (including farmers, insurance companies and state insurance departments) where and when it is needed to monitor crop stress and losses within PMFBY.

Based on the ongoing interaction with primary insurance companies (HDFC Ergo and Reliance General Insurance)[17] throughout the study, we inferred that they do have interest in deploying remote sensing. However, the actual deployment is influenced by the structure and design of PMFBY (such as the stipulated loss assessment methods in the state as well as the national level operational guidelines of the scheme).

Unlike some other states (such as Tamil Nadu where the state government has formalized the use of remote sensing for loss detection)[18], the state of Odisha has only applied remote sensing on a case-by-case basis. Finding use cases outside a strictly regulated and complex scheme like PMFBY might be a more viable approach.

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[17] HDFC Ergo and Reliance General Insurance were implementing PMFBY in Bargarh and Sambalpur. They actively engaged in the design and implementation of the project components by sharing their messaging and approaches to insurance literacy with PxD as well as by participating in the regular calls with the project team.

[18] See Appendix 7.7 for details of this use case implemented by EAI as a part of a separate project.

5. Outreach and roadshow

During the course of this study, several activities were carried out to reach out to relevant stakeholders in order to demonstrate the effectiveness of a remote sensing-based approach for crop stress monitoring.

5.1 Hackathon 2019 ("Crops Under the Radar")

On November 27th and 28th, 2019, EAI and Scor Reinsurance hosted a Hackathon for primary insurance companies and their vendors (such as WRMS, Skymat, Satsure). The participants were given specific cases on crop type differentiation and loss assessments to be solved. The jury consisted of experts from Sarmap, Airbus, Indian Space Research Organisation (ISRO) and Mahalanobis National Crop Forecast Centre[19] (MNCFC). The contestants came from four crop insurance companies that had invested into remote sensing monitoring within their crop insurance teams (Bharti AXA, Reliance General Insurance, IFFCO Tokio, HDFC Ergo).

The specific challenge presented to the participants was to determine the area under crop in the season of *Kharif* 2019 (in a district in Andhra Pradesh) and to analyse the impact of a typhoon event. However, none of the participants managed to address the challenge which required the processing and analytics of radar satellite data (which is important to overcome the dense cloud coverage in the main summer season).

This event and its outcome helped to sharpen the problem statement for the intervention of this InsuResilience-funded initiative by addressing in particular a radar-satellite crop monitoring in collaboration with two crop insurance companies that are strongly involved in PMFBY.

5.2 Hackathon 2020 ("Second Geospatial Lab")

On September 27th and 28th 2020, hence during the term of the study funded by InsuResilience, EAI and Scor Reinsurance held the "Second Geospatial Lab" following a format similar to the previous hackathon. The event was opened by the CEO of PMFBY, Mr Ashish Buthani. The panel of experts (that replaced a formal jury) which participated in the event also included the Director of MNCFC and a member of the Indian Space Application Center. Teams from Reliance General Insurance and HDFC Ergo also participated in the event, both of which were the insurance partners for the study in Odisha.

The participants were given the challenge to perform a crop analysis (stress, crop type, start of season map) based on pre-processed satellite data. All participating teams (same as the year before) more or less failed to perform that analysis and most admitted that it was due to the lack of their inhouse capabilities (teams and software). While some insurance companies (HDFC Ergo, Reliance, Bharti AXA, IFFCO Tokio, AIC) do have remote sensing experts as well as basic GIS or even image processing software, they are only able to make use of optical satellite data. However, in order to monitor crops in

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[19] MNCFC is an agency of the agricultural ministry to which the Government mandates all remote sensing-related assessments around PMFBY.

the presence of cloud coverage it is necessary to use radar satellite data which is considerably more difficult to analyse due to its long processing chain and the complexity of the raw data.

5.3 Engagement with insurance companies

Later in 2020, the Agricultural Insurance Company of India (AICI) launched a crop insurance product in West Bengal, a state that dropped out of PMFBY. The insurance product was purely based on a remote-sensing indicator which in turn are being computed by the ISRO that was also a jury member of both editions of the Geospatial Lab.

The Sarmap and EAI teams analysed the information available for the so-called Crop Heath Factor index proposed by AICI and also discussed it with reinsurers. The index relies on both optical and radar data. The technical requirements, in terms of algorithm excellence and computing power, to build and run the radar part of the index are very high and require significant computing power to run at scale. Reinsurance market participants interviewed also noted that the index applied was not transparent and claims had been settled mostly based on ground observations.

Both the Hackathon and our market conversations on the West Bengal scheme confirmed the view that PMFBY stakeholders from government (central and state) as well as insurance companies (primary and reinsurance) are keen to deploy remote sensing-based approaches to assess losses and yields and are doing their best to do so in practice. However, there is still a gap in deploying those methods at scale and with the reliability needed.

5.4 Outreach to government

The government of Odisha is evaluating almost a dozen pilot tests of remote sensing that took place in its state, ours being one of them. The Department of Agriculture in Odisha, that oversees the implementation of PMFBY in the state, has acknowledged that remote sensing technology can be of significant benefit to improve the implementation of PMFBY. It had previously also awarded a project to International Rice Research Institute (IRRI) and Sarmap, two parties of the RIICE project. PxD will share our report to the government of Odisha and West Bengal to offer support on an integrated outreach to farmers and use of our remote sensing technology.

In addition, PxD is also in the process of handing over of all its interventions, including the PMFBY-related campaign developed as a part of this project, to the government of Odisha for further roll out and operations. The campaign and learnings from this project are also going to be used by PxD for its World Bank-supported interventions in the state of Maharashtra.

6. Conclusion and next steps

This study sought to evaluate the effectiveness of the following two interventions:

- Mobile phone-based outreach in i   mproving financial awareness and literacy among farmers in order to promote PMFBY uptake and acquaint them of potential claims.
- Remote sensing-based satellite data enhances   access to insurance payouts under the Prevented sowing and mid-season calamities payment stipulations of PMFBY.

It revealed that there is indicative evidence of an information gap on PMFBY among farmers and the intervention seems to have increased farmers' knowledge on PMFBY. However, there was no conclusive evidence that the intervention influenced PMFBY adoption, implying that there may be other constraints which were not analysed as a part of the study. We believe that the response received after one season of messaging is still promising. There is scope to explore these ideas further. Conducting these interventions over a longer time-horizon, and focusing on a multi-pronged approach, to tackle not just information barriers, but also other constraints could prove to be effective in eliminating some of the barriers that prevent farmers from enrolling in PMFBY.

As mentioned above, PxD is in the process of handing over   all its interventions, including the PMFBY-related campaign developed as a part of this project, to the government of Odisha for further roll out and operations. The campaign and learnings from this project are also being used by PxD for its World Bank-supported interventions in the state of Maharashtra.

Further, the project also demonstrated that remote sensing data covering key moments of crop phenology is appropriate for tracking agricultural activity, crop health and stress relevant for PMFBY or other similar insurance programs. Since no indemnification events which would trigger the PMFBY payment stipulations took place during the project period, some of the project elements could not be tested. The continuous engagement with the insurance companies throughout the project revealed their interest in deploying remote sensing data for loss detection and assessment. Actual take-up will be influenced also by other factors, including the PMFBY design (e.g., the stipulated loss assessment methods by the states and the overall operational guidelines of the scheme). Finding use cases outside a strictly regulated and complex scheme like PMFBY might be a more viable approach.

7. Appendix

7.1 Major sowing seasons in India: *Kharif* and *Rabi*

	Kharif	Rabi
Months	Apr – Sept	Oct – Mar
Crops	Paddy, maize, jowar, bajra, tur (arhar), moong, urad, cotton, jute, groundnut and soyabean	Wheat, barley, peas, gram and mustard.
Region	Assam, West Bengal, coastal regions of Odisha, Andhra Pradesh, Telangana, Tamil Nadu, Kerala and Maharashtra, particularly the (Konkan coast) along with Uttar Pradesh and Bihar	Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir, Uttarakhand, and Uttar Pradesh

7.2 Key dates for mobile phone-based outreach

Date (revised)	Topic	Content
3rd December 2020	General Awareness	Usefulness of PMFBY
5th December 2020	Information	Crops covered, docs required, cut-off date, processes,
9th December	General Awareness (repetition)	
9th December	Information	Through text message- Checklist-Docs required etc
14th December	Information	Processes, crops covered, docs required, cut-off date
21st December	Deadline (Prevented sowing) & Bad behaviour	Declaration of prevented Sowing
26th December	Deadline (Prevented sowing) & Bad behaviour	Declaration of prevented Sowing

7.3 Baseline questionnaires:

The following table presents the baseline survey questions in English and Odia.

Section A- Consent & profile information				
ଖଣ୍ଡ A- ସମ୍ମତି ଏବଂ ପ୍ରୋଫାଇଲ୍ ସୂଚନା				
SLNo.	Question / ପ୍ରଶ୍ନ	Options / ବିକଳ୍ପ	Protocol / ପ୍ରୋଟୋକଲ	Instructions/ ନିର୍ଦ୍ଦେଶାବଳୀ
A1	Surveyor's name / ସର୍ଭେୟରଙ୍କ ନାମ	……...	Dropdown	
A2	Farmer's ID / କୃଷକଙ୍କ ID		Dropdown	
A3	Farmer's name / କୃଷକଙ୍କ ନାମ		Dropdown	
A4	Am I talking to ${farmer's name}? ମୁଁ ${କୃଷକଙ୍କ ନାମ} ସହିତ କଥା ହେଉ ଅଛି କି?	1. Yes / ହଁ 2. No / ନା	If No, can we connect later. If wrong farmer, end survey. ଯଦି ନା, ଆମେ ପରେ ସଂଯୋଗ କରିପାରିବା କି? ଯଦି ଭୁଲ କୃଷକ ହୁଅନ୍ତି, ସର୍ଭେ ସମାପ୍ତ କରନ୍ତୁ।	
A5	We would like to ask you a few questions now. Would you like to participate in the survey? ଆମେ ବର୍ତ୍ତମାନ ଆପଣଙ୍କୁ କିଛି ପ୍ରଶ୍ନ ପଚାରିବାକୁ ଚାହୁଁ। ଆପଣ ସର୍ଭେରେ ଅଂଶଗ୍ରହଣ କରିବାକୁ ଚାହିଁବେ କି?	1. Yes / ହଁ 2. No / ନା	If A5=2 No, end the survey ଯଦି ନା, ସର୍ଭେ ସମାପ୍ତ କରନ୍ତୁ	
Section B- Background for PMFBY				
ଖଣ୍ଡ B- ପ୍ରଧାନମନ୍ତ୍ରୀ ଫସଲ ବୀମା ଯୋଜନା ପାଇଁ ପୃଷ୍ଠଭୂମି				

B1	Have you experienced crop loss due to natural calamities (floods, droughts, landslides, forest fires, insect outbreak, uncongenial weather conditions such as temperature, humidity etc.) in the past 5 years? □□□□□□ □□ 5 □□□□ □□□□□□ □□□□□□□□□ □□□□□□□□□□□ (□□□□□, □□□□□, □□□□□□□/□□□□ □□□□□, □□□□□□□□ □□□□ □□□□□□, □□□/□□□ □□□□□□□□□□□, □□□□□□□□□ □□□□□□□ □□□: □□□□□□□□□, □□□□□□ □□□□□□□) □□□ □□□□ □□□□□□ □□?	1. Yes / □□ 2. No / □□	If B1=2 skip to C1 □□□ B1=2 □□□ C1 □□ □□□□□□□	
B2	Were you able to recover from crop loss? □□□□□□ □□□ □□□□□□ □□□□□□ □□□□□ □□□□ □□□□□□□ □□?	1. Yes / □□ 2. No / □□	If B2=2 skip to C1 □□□ B1=2 □□□ C1 □□ □□□□□□□	
B3	What were the main factors that enabled you to recover ? (tick multiple if needed) □□□□ □□□□□ □□□□□□□□ □□□□□ □□□ □□□□□ □□□□ □□□□□□□? (□□□ □□□□□ □□□ □□□□	1. Bank loan / □□□□□□□ □□□ 2. Borrowed from relatives/friends/ □□□□□□□□□/□□□□□/□		

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		3. Sold assets (land, cattle, etc) / □□□□□□□□ □□□□□□ (□□□, □□□, □□□□□□□)	
		4. Insurance scheme / □□□□ □□□□□	
		5. Other / □□□□□□□□	
B3	How did you come out of the loss? Others □□□ □□□□□□□ □□□□□ □□□□ □□□□□? □□□□□□□□	Fill in the blanks □□□□□ □□□□□ □□□□ □□□□□□		

Section C- PMFBY scheme Awareness

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| C1 | Are you farming in Rabi season?

□□□ □□□ □□□□□ □□□ □□□□□□ □□? | 1. Yes / □□
2. No / □□ | If C1=2 skip to end
□□□ C1=2 □□□ □□□□□ □□□□□ □□□□□□□ | |
| C2 | Are you aware that there is a Govt. scheme that provides insurance for farmers' crops (PMFBY scheme)?

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2. No / □□ | If C2=2 skip to C6
□□□ C1=2 □□□ C6 □□ □□□□□□□ | |

	(□□□□□□ □□□□□□□□ □□□ □□□□ □□□□□□)?			
C3	From where did you hear about the PMFBY scheme? (Multiple choice questions) □□□ □□□□□□ □□□□□□□ □□□ □□□□ □□□□□ □□□□□□ □□□□□□□□ □□□□□□? (□□□□□□ □□□□□ □□□□ □□□□□)	1. Block officer/ extension worker (VAW, Krushak saathi, AAO)/ DDA □□□□ □□□□□□□/ □□□□□□□□ □ □□□□□□□ □□□□ (VAW, □□□□ □□□□, AAO)/DDA 2. GP Pradhan/ Ward Members □□□□□ □□□□□□□ □□□□□/ □□□□□ □□□□□□ 3. Common service Centers □□□ □□□□□□ □□□□□□/□ □ □□□□ □□□□□□□ 4. Newspapers/ Radio/TV		Please nudge farmers and give some time to farmers to respond. (Please don't read the options) (Select all that apply) □□□□□□□□ □□□ □□□ □□□□□□□ □□□□ □□□□□□ □□□□□□□□ □□□ □□□□□ □□□□ □□□□ □□□□ □□□ □□□□□□□ I (□□□□□□□□ □□□ □□□□□□□□□□ □□ □□□□□) (□□□□□ □□□□□□□ □□□□□□□□□ □ □□□ □□□□□□)

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		5. Wall paintings/ billboards/ posters		
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		6. Bank		
		▢▢▢▢▢▢▢		
		7. Insurance companies		
		▢▢▢▢ ▢▢▢▢▢▢▢		
		8. Friends/ neighbours/ family		
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		9. NGOs / Agricultural clinics/ cooperatives/ KVKs		
		NGO / ▢▢▢▢ ▢▢▢▢▢▢		

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C3_others	From where did you hear about the PMFBY scheme? Others □□□ □□□□□□ □□□□□□□ □□□ □□□□ □□□□□ □□□□□□ □□□□□□□ □□□□□□? □□□□□□□□	Fill in the blanks □□□□□ □□□□□ □□□□ □□□□□□		
C4	Have you taken any loan under the Kisan Credit Card(KCC) scheme? □□□ □□□□□ □□□□□□□ □□□□□ (KCC) □□□□□□□	1. Yes / □□ 2. No / □□ 3. Don't want to answer / □□□□□ □□□□□□		

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C5	Are any of your crops insured under Pradhan Mantri Fasal Bima Yojana (PMFBY) during this current cropping season? □□□□□□□□□ □□□□□□□□ □□□□□ □□□□□□ □□□□□ □□□□ □□□□□□ □□□□□□□ □□□ □□□□ □□□□□□□ □□□□ □□□□□□□□ □□?	1. Yes / □□ 2. No / □□	If C5=1 skip to C8 □□□ C5=1 □□□ C8 □□ □□□□□□□	(Ask farmers if they are willing to enroll)
C6	If you haven't enrolled into the PMFBY scheme, why not? (Multiple choice questions) □□□ □□□ □□□□□□ □□□□□□□ □□□ □□□□ □□□□□□□ □□□□ □□□□□□□□□□□, □□□□□□□ □□□□ □□□□□□□□□□□? (□□□□□□ □□□□□ □□□□ □□□□□□)	1. My crops don't come under PMFBY / □□□ □□□ □□□□□□ □□□□□□□□ □□□ □□□□ □□□□□□ □□□□□□□□ □□□ □□□□□ I do shared cropping, hence no land record documents / □□□ □□□ □□□ □□□, □□□□□□□ □□□□ □□□□□□□□ □□□□□ 2. Don't have necessary information /		Please don't read the options (Select all that apply) □□□□□□□□ □□□ □□□□□□□□□□ □□ □□□□□ (□□□□□ □□□□□□□ □□□□□□□□□ □ □□□ □□□□□□)

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		3. Don't have necessary documents / □□□□□□□ □□□□ □□□□ □□□□□		
		There is no nearby bank/insuranc e company branch is available / □□□□□□ □□□□□ □□□□□□□/ □□□□ □□□□□□□□ □□□□ □□□□□		
		4. Not interested in PMFBY scheme / □□□□□□ □□□□□□□ □□□ □□□□ □□□□□ □□□□ □□□□□□ □□□□□		
		Others (specify)		

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		5. Don't want to answer / □□□□□ □□□□□□ □□□□□ □□□□□		
C6_other	If you haven't enrolled into the PMFBY scheme, why not? Other specify	Fill in the blanks □□□□□ □□□□□□ □□□□ □□□□□□		
C7	Will you enroll if you are provided with relevant information on PMFBY? □□□□□□□ □□□□□□ □□□□□□ □□□ □□□□ □□□□□ □□□□□□ □□□□□□□ □□□□ □□□□□ □□□ □□□ □□□□□ □□□□□□□□ □□□□ □□?	1. Yes / □□ 2. No / □□ 3. Don't want to answer / □□□□□ □□□□□□ □□□□□□□ □□□	Skip to D1 D1 □□ □□□□□□□	If C2=2 & C7=2 end survey □□□ C2=2 □□□ & C7=2 □□□ □□□□□ □□□□□□ □□□□□□
C8	How much do you understand about the PMFBY program? □□□ □□□□□□ □□□□□□□□ □□□ □□□□ □□□□□ □□□□□□ □□□□ □□□□□□□□?	1. Don't know much / □□□□ □□□□ □□□□ □□□□□ 2. Basic understanding / □□□□□ □□□□□ □□□		

		3. Good understanding / 🔲🔲🔲🔲 🔲🔲 🔲🔲🔲🔲🔲 🔲🔲🔲 4. I understand it fully / 🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲🔲 🔲🔲🔲		
C9	Can you name some of the documents required to enrol in the PMFBY scheme? (Multiple choice questions) 🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲 🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲 🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲 🔲🔲🔲🔲 🔲🔲🔲🔲/🔲🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲🔲? (🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲🔲 🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲)	1. Aadhar Card / 🔲🔲🔲🔲 🔲🔲🔲🔲🔲 2. Voter I card / 🔲🔲🔲 🔲🔲🔲🔲🔲 🔲🔲🔲🔲 3. PAN Card / PAN 🔲🔲🔲🔲🔲 4. Ration Card / 🔲🔲🔲🔲 🔲🔲🔲🔲🔲 5. Copy of latest land record / 'State Record of Rights (RoR) /' Land Possession Certificate (LPC) / 🔲🔲🔲🔲🔲 🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲/🔲🔲🔲🔲 🔲 🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲	Select multiple 🔲🔲🔲🔲 🔲🔲🔲🔲 🔲🔲🔲 🔲🔲🔲🔲🔲🔲	Please don't read the options (Select all that apply) 🔲🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲🔲🔲 🔲🔲 🔲🔲🔲🔲🔲 (🔲🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲🔲 🔲🔲🔲🔲🔲🔲🔲🔲🔲 🔲 🔲🔲🔲 🔲🔲🔲🔲🔲🔲)

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C9_oth	Can you name some of the documents required to enrol in the PMFBY scheme? Others ▯▯▯▯▯▯ ▯▯▯▯▯▯▯ ▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯▯▯▯ ▯▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯ ▯▯▯▯ ▯▯▯▯/▯▯▯▯▯▯▯ ▯▯▯ ▯▯▯▯▯▯▯? ▯▯▯▯▯▯▯▯	………..	Fill in the blanks ▯▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯	
C10	Can you tell me the enrollment deadline to PMFBY? ▯▯▯▯▯▯ ▯▯▯▯▯▯▯ ▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯▯▯▯ ▯▯▯▯ ▯▯▯▯ ▯▯▯▯ ▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯▯▯▯	………..	Fill in the blanks ▯▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯	
C11	What is the amount of PMFBY premium you pay? ▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯▯▯▯ ▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯▯ ▯▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯▯▯?	…………..	Fill in the blanks ▯▯▯▯▯ ▯▯▯▯▯▯ ▯▯▯▯ ▯▯▯▯▯▯	

C12	Is this premium affordable to you? □□□ □□□ □□□□□ □□□□□□ □□□□□□ □□□□□ □□□□□□ □□?	1. Yes / □□ 2. No / □□ 3. Not applicable / □□□□□□□□ □□□□□ 4. Don't want to answer / □□□□□ □□□□□□ □□□□□□□ □□□		
Section D- PMFBY process feedback **□□□□□ D- □□□□□□□ □□□□□□□ □□□ □□□□ □□□□□□ □□□□□□□□□□□**				
D1	Are you satisfied with the PMFBY enrollment process? □□□ □□□□□□ □□□□□□□ □□□ □□□□ □□□□□ □□□□□□□ □□□□□□□□□□□ □□□□□□□ □□□□□ □□?	1. Yes / □□ 2. No / □□ 3. Don't want to answer / □□□□□ □□□□□□ □□□□□□□ □□□	If D1=1 skip to D3	
D2	If no, what are the difficulties you faced? (Multiple choice questions) □□□ □□, □□□ □□□□ □□□□□□□ □□□□□□□□□ □□□□□□□? (□□□□□□ □□□□□ □□□□ □□□□□□)	1. Convoluted process / □□□□ □□□□□□□ □□ 2. Too many documents required / □□□□□□□□□ □ □□□□ □□□□ □□□□□□		Please don't read the options (Select all that apply) □□□□□□□□ □□□ □□□□□□□□□ □□ □□□□□ (□□□□□ □□□□□□□ □□□□□□□□

		3. Unavailability of bank near me / ଦା ଦୀଦୀଦୀଦୀ ଦୀଦୀଦୀଦୀ ଦୀଦୀଦ		ଦ ଦୀଦ ଦୀଦୀଦୀ)
		4. Unavailability of CSC / ଦା ଦୀଦୀଦୀଦୀ ଦୀ ଦୀଦୀ ଦୀଦୀଦୀଦ ଦୀଦୀଦ		
		5. Don't want to answer / ଦୀଦୀଦ ଦୀଦୀଦୀ ଦୀଦୀଦୀଦ ଦୀଦ		
		6. Other / ଦୀଦୀଦୀଦୀ		
D2_oth	If no, what are the difficulties you faced?	Fill in the blanks		
D3	Can we share your phone number and information with Insurance companies and our partners? ଦୀଦ ଦୀଦୀଦୀଦ ଦୀଦ ଦୀଦୀଦ ଦୀଦ ଦୀଦୀ ଦୀଦୀଦ ଦୀଦୀ ଦୀଦୀଦୀଦ ଦୀଦ ଦୀ ଦୀଦୀଦୀଦୀଦୀଦୀଦ ଦୀଦୀଦୀଦୀଦ ଦୀ?	1. Yes / ଦୀ 2. No / ଦୀ		Please make it clear that this is only for research purposes. ଦୀଦ ଦୀଦୀଦୀଦ ଦୀଦୀଦୀଦୀଦ ଦୀ ଦୀଦୀଦୀଦ ଦୀଦ ଦୀଦୀ ଦୀଦୀଦ ଦୀଦୀଦ

7.4 SMS content

The text messages sent to farmers are presented below in English and Odia.

Salon.	Content type	Transcript (English and Odia)
1	General awareness- Advantages	Namaskar, Welcome to Ama Krushi! agricultural advisory service, brought to you by the Department of Agriculture and Farmers' Empowerment, Government of Odisha. Today we will talk about the Pradhan Mantri Fasal Beema yojna (PMFBY). [Odia text] This is a crop scheme that will provide you protection leading to financial assistance in case of damaged crops / 'failure' due to natural disasters and pest attacks. This scheme has low premiums of 1.5% of insured sum for Rabi crops and 5% in case of horticultural crops. To enrol in this scheme, three Aadhar Card copies, Bank passbook copies, land ownership records (RoR/LPC) and state government's proposed sowing certificate or self-declaration for sowing crops is needed. [Odia text] Enrol in this scheme to protect yourself from future unforeseen risks affecting your crops. For more information, please reach out to the nearest Agriculture officer or Common Service center (CSC) or banks. [Odia text]

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2	Information- **Bargarh**	Namskar, Welcome to Ama Krushi! agricultural advisory service, brought to you by the Government of Odisha.
		Today we will talk about the Pradhanmantri Fasal Beema yojna (PMFBY). It is a government sponsored scheme that provides agriculture insurance for crops Paddy, Potato, Green Gram, Black Gram, Sugarcane in your area. To enroll in PMFBY you will need an Aadhar card, Bank passbook, land ownership records and your passport photo. You can enroll in this scheme by visiting your nearest CSC, bank.
		The last date to enroll in the scheme is 15th December. Please enroll in this scheme to protect yourself against future unforeseen risks.
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3	Information- **Sambalpur**	Namskar, Welcome to Ama Krushi! agricultural advisory service,brought to you by the Government of Odisha. Today we will talk about the Pradhanmantri Fasal Beema yojna (PMFBY). It is a government sponsored scheme that provides agriculture insurance for crops Paddy, Potato, Green Gram, Black Gram, Mustard, Onion in your area. To enroll in PMFBY, you will need an Aadhar card, Bank passbook, land ownership records and your passport photo. You can enroll in this scheme by visiting your nearest CSC, bank. The last date to enroll in the scheme is 15th December. Please enroll in this scheme to protect yourself against future unforeseen risks. □□□□□□□□, □□□□□□ □□□□□□□□□ □□□□ □□□□□□□□ □□□□ □□ □□□□□□ □□□□□□□ □□□□□□ □□□□□| □□□ □□□ □□□□□□ □□□□□□□ □□□ □□□□ □□□□□ (PMFBY) □□□□□□ □□□□□□ □□□□□| □□□ □□ □□□□□□ □□□□□□□□□□ □□□□□□ □□□□ □□□□□□ □□□□□□□ □□□, □□□, □□□, □□□□, □□□□□□, □□□□ □□□□□ □□□□ □□□□ □□□□□□ □□□□□□| □□□□□□ □□□□□□□ □□□ □□□□ □□□□□□□ □□□□□□□ □□□□□□ □□□□□□ □□□□ □□□□□, □□□□□□□ □□□□□□, □□□ □□□□□□□ □□□□ □□□□ □□□ □□□□□ □□ □□□□□□□ □□□ □□□□□□ □□□| □□□□□□ □□□□□□□ □□□□□□ □□□□□□ (CSC) □□□□□□ □□□□□□□□□ □□□ □□□ □□□□□□□ □□□□□□□ □□□□□□□|

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4	General awareness-with testimonial	Namskar, Welcome to Ama Krushi! agricultural advisory service, brought to you by the Department of Agriculture and Farmers' Empowerment, Government of Odisha. Today we will talk about the Pradhanmantri Fasal Beema yojna (PMFBY).

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This is a crop scheme that will provide you protection leading to financial assistance in case of damaged crops / 'failure' due to natural disasters and pest attacks. Please listen to Shri xyz, who is a beneficiary of this scheme.

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Enrol in this scheme to protect yourself from future unforeseen risks affecting your crops. For more information, please reach out to the nearest Agriculture officer or Common Service center (CSC) or banks.

Myself Lakshyapati Behera, Barpali Block of Bargarh district. I had registered in PMFBY during 2018-19 and got an amount of Rs 70,000 due to crop loss. I am requesting other farmers to register their crops under PMFBY to get the benefits of it.

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5	Information (text message)	Namskar, Welcome to Ama Krushi by the Government of Odisha. To enroll in PMFBY, you will need an Aadhar card, Bank passbook, land ownership records and your passport photo. You can enroll in this scheme by visiting your nearest CSC or bank. The last date to enroll in the scheme is 15th December. ▢▢▢▢▢▢▢, ▢▢▢▢▢ ▢▢▢▢▢▢▢▢ ▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢। ▢▢▢▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢▢▢ ▢▢▢▢ ▢▢▢▢, ▢▢▢▢▢▢▢ ▢▢ ▢▢▢▢ ▢▢▢▢▢, ▢▢▢▢▢▢▢ ▢▢▢▢▢▢, ▢▢▢ ▢▢▢▢▢▢▢▢ ▢▢▢▢ ▢▢▢▢ ▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢ ▢▢▢। ▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢▢▢ ▢▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢। ▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢▢▢▢▢▢ ▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢ 15 ▢▢▢▢▢▢▢ ▢▢▢।
6	Deadline (Prevented sowing) & Bad behaviour	Namskar, Welcome to Ama Krushi! agricultural advisory service, brought to you by the Department of Agriculture and Farmers' Empowerment, Government of Odisha. We wanted to remind you about the upcoming PMFBY prevented sowing deadline. If you have enrolled in the PMFBY scheme and due to rainfall deficit or adverse weather conditions, you have not been able to sow/ plant/germinate this Rabi season then the deadline to file your claim is 31st December. However please be truthful as your claim will be verified. Please visit the nearest CSC to file your claim or get more information. ▢▢▢▢▢▢▢, ▢▢▢▢▢ ▢▢▢▢▢▢▢▢ ▢▢▢▢ ▢▢▢ ▢▢▢▢ ▢▢▢▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢। ▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢▢▢▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢, ▢▢▢▢▢▢▢ ▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢। ▢▢▢ ▢▢▢ ▢▢▢▢▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢ ▢▢▢▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢▢▢ ▢▢▢▢▢ ▢▢▢▢▢▢▢ ▢▢▢ ▢▢▢▢▢ ▢▢▢ ▢▢▢ ▢▢▢▢▢ ▢▢▢▢ ▢▢▢▢▢▢▢▢▢▢ ▢▢▢▢▢/ ▢▢▢ ▢▢▢▢▢▢▢▢▢ ▢▢▢▢▢/ ▢▢▢ ▢▢▢▢▢▢▢▢ ▢▢▢▢▢ ▢▢▢▢ ▢▢▢▢▢ ▢▢▢▢▢▢▢▢

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7.5 Endline Questionnaires

The following table presents the baseline survey questions in English and Odia.

Section A. Consent ବିଭାଗ A. ସମ୍ମତି			
Sl. no	Name ନାମ	Script ସ୍କ୍ରିପ୍ଟ	Protocol ପ୍ରୋଟୋକଲ
A1	Surveyor's name ସର୍ଭେୟରଙ୍କ ନାମ	Dropdown option ଡ୍ରପଡାଉନ ବିକଳ୍ପ	
A2	Farmer's name କୃଷକଙ୍କ ନାମ	Dropdown option ଡ୍ରପଡାଉନ ବିକଳ୍ପ	
A3	Am I talking to ${farmer's name}? ମୁଁ ${farmer's name} ସହିତ କଥା ହେଉଛି କି?	1. Yes / ହଁ 2. No / ନାହିଁ	If A4=1 skip to A5 ଯଦି A4=1 ତେବେ A5କୁ ସ୍କିପ୍ କରନ୍ତୁ
A4	Can you tell me when we can talk to ${farmer's name}? ମୁଁ ${farmer's name} ସହ କେବେ କଥାବାର୍ତ୍ତା କରି ପାରିବି?		
A5	We are conducting a survey with farmers regarding the PMFBY	1. Yes / ହଁ 2. No / ନାହିଁ	If A5=2 skip to end

	scheme. Do you agree to participate in the survey? □□□ □□□□□□□□□□□□□□ □□□ □□□□ □□□□□ □□□□□□ □□□□□□□□□□ □□□□ □□□□□ □□□□□ □□□□□I □□□ □□□ □□□□□□□ □□□□□□□□ □□□□□ □□□□ □□□□ □□□□□□ □□?		□□□ A5=2 □□□ □□□□□ □□□□□ □□□□□□□

Note for surveyor: Please explain to the respondent that in this section we would like to ask you about PMFBY messages.

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Section B. PMFBY Services			
□□□□□ B. □□□□□□□□□□□□ □□□ □□□□ □□□□□ □□□□			
B1.	Did you receive PMFBY messages from Ama Krushi service in the last six weeks? □□□ □□ □□ □□□□□□ □□□□□ □□□□□□□□□□ □□□ □□□□ □□□□□ □□□□□□ □□□□□ □□ □□□□ □□□□□ □□□□□□□ □□?	1. Yes / □□ 2. No / □□□□□ 3. Don't know /Can't remember □□□□ □□□□□/□□□ □□□□□	If B1=2, 98 skip to B7 □□□ B1=2,98 □□□, B4□□ □□□□□□□
B2.	How many PMFBY messages did you listen to?	1. One / □□□□□ 2. Two / □□□□□	If B2= 2,3,4, 98, skip to B4 □□□ B2=2, 3,4, 98

		3. Three / □□□□□□	□□□ B4□□ □□□□□□□□
	□□□ □□□□□□□□□□□□□□□ □□□ □□□□ □□□□□□□ □□□□□□□ □□□□□□ □□□□□ □□□□□□□□□□?	4. More than three / □□□□□□□□ □□□□	If B2=5 skip to B6 □□□ B2=5 □□□ B6□□ □□□□□□□□
		5. None / □□□□ □□□□□ □□□□ □□□□□	
		6. Don't want to answer / □□□□□ □□□□□□ □□□□□ □□□□□	
B3	Do you remember the topic of the message? □□□ □□□□□□ □□□□ □□□□□ □□□ □□□□□□□ □□?	1. General Awareness of PMFBY scheme / □□□□□□□□□□ □□ □□□ □□□□ □□□□□ □□□□□□ □□□□□□ □□□□□	
		2. Information on how to enroll in the scheme / □□□□□□□ □□□□□ □□□□□□□□ □□□□□□□□□ □□'□ □□□□□	
		3. Deadlines of the scheme / □□□□□□ □□□□□□ □□□□□	
		4. Prevented sowing claims / □□□□□ □□□□□□ □□□ □□□□□ □□□ □□□□ □□□□□□□□ □□□□□ □□□□ □□□□ □□□□□□ □□□□□	
B4	Do you remember the last date of enrolment in the PMFBY scheme?	Fill in the blanks / □□□□□ □□□□□□□	

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B5	Can you tell me some of the documents required to enroll in the PMFBY scheme? □□□□□□□□□□□□□□ □□□ □□□□ □□□□□□□ □□□□□□□□ □□□□□□□□ □□□□ □□□□□□□ □□□□□□ □□□□□□□□□ □□?	1. Aadhar Card / □□□□ □□□□□ 2. Bank passbook / □□□□□□□ □□□□□□ 3. Land ownership records / □□□ □□□□□□□□ □□□□□ 98 Don't remember / □□□□□□□□□	
B5_others	Can you tell me some of the documents required to enroll in the PMFBY scheme? other □□□□□□□□□□□□□□ □□□ □□□□ □□□□□□□ □□□□□□□□ □□□□□□□□ □□□□ □□□□□□□ □□□□□□ □□□□□□□□□ □□? □□□□□□□□□	Fill in the blanks / □□□□□ □□□□□□□	
B6	Why did you not listen to PMFBY messages? **Multiple options are allowed** Note: Respondent doesn't want to answer can't be	1. Did not receive the call / □□□ □□□ □□□□□ 2. Was busy / □□□□□□ □□□□ 3. Did not have access to my phone / □□ □□□□□ □□□ □□□ □□□□□	**[multiple select]**

	selected with any other options □□□ □□□□□□□□ □□□□□□□□□□□□□ □□□ □□□□ □□□□□□ □□□□□□ □□□□□□ □□□□ □□□□□?) □□□□□□ □□□□□ □□□□□ □□□: □□□□□□□□□□ □□□□□ □□□□□□ □□□□□ □□□□□□□□ □□□□□□ □□□□ □□□□□ □□□□□□ □□□□ □□□ □□□□□□ □□□□□ □□□□□	4. The connection was bad, I couldn't hear clearly / □□□ □□□□/□□□□□□ □□□ □□□□□, □□□ □□□□□□ □□□□□ □□□□□□□ □□□□□ 5. I already knew the information in the phone call / □□□ □□□□□ □□□□□□□□□ □□□□□ □□□□□□ □□□□ □□□□□□□□ 6. The call was too long / □□□□□ □□□□ □□□□□ □□□□ 7. The timing of recommendations is not aligned with my current needs / □□□ □□□□□□□□□□ □□□□□□□□ □□□□□□ □□□□□ □□□□□ □□□ □□□□□□□□ □□□□□ 8. I am not doing farming in Rabi season / □□□ □□□ □□□□□ □□□ □□□ □□□□□ 9. I am not interested in the service / □□□ □□□ □□□□ □□□□□ □□□□ □□□□□□ □□□□□ 95 Other □□□□□□□□ 99 Respondent doesn't want to answer / □□□□□□□□□ □□□□□	[□□□□ □□□□ □□□□□ □□□ □□□□□ □□□□□]	

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B6_oth	If you did not listen to PMFBY messages, why did you not listen? Others, please specify. □□□ □□□ □□□□□□□□□□□□□ □□□ □□□□ □□□□□□ □□□□□ □□□□ □□□□□□, □□□ □□□□□□□ □□□□ □□□□□□? □□□□□□□□□, □□□□□□□□□□	Fill in the blanks / □□□□□ □□□□□□□	
B7	Did you enroll in the PMFBY scheme? □□□ □□□□□□□□□□□□□□ □□□ □□□□ □□□□□□□ □□□□□□□□ □□□□□□□ □□?	1. Yes / □□ 2. No / □□□□□ 99 Don't want to answer / □□□□ □□□□□/□□□ □□□□□	If B7=1 skip to B9 □□□ B7=1 □□□ B9 □□ □□□□□□□
B8	If not, why didn't you enroll in the PMFBY scheme? □□□ □□□□□, □□□ □□□□□□□ □□□□□□□□□□□□ □□□ □□□□ □□□□□□□ □□□□□□□ □□□□□□□□?	1. My crops don't come under PMFBY/ □□□ □□□ □□□□□□ □□□□□□□ □□□ □□□□ □□□□□□ □□□□□□□□□□ □□□□□ 2. I do shared cropping, hence no land record documents / □□□ □□□ □□□ □□□, □□□□□□□ □□□□ □□□□□□□□ □□□□□	end survey □□□□□ □□□□□□

		3. Don't have necessary information / ⬜⬜⬜⬜⬜⬜⬜ ⬜⬜⬜⬜ ⬜⬜⬜⬜⬜	
		4. Don't have necessary documents / ⬜⬜⬜⬜⬜⬜⬜ ⬜⬜⬜⬜ ⬜⬜⬜⬜ ⬜⬜⬜⬜⬜	
		5. There is no nearby bank/insurance company branch is available / ⬜⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜⬜⬜/⬜⬜⬜⬜ ⬜⬜⬜⬜⬜⬜⬜ ⬜⬜⬜⬜ ⬜⬜⬜⬜⬜	
		6. Premiums are unaffordable for me / ⬜⬜⬜ ⬜⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜	
		7. Not happy with PMFBY scheme / ⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜ ⬜⬜ ⬜⬜⬜ ⬜⬜⬜⬜ ⬜⬜⬜⬜⬜⬜⬜ ⬜⬜⬜⬜ ⬜⬜⬜⬜⬜	
		95 Others (specify) / ⬜⬜⬜⬜⬜⬜⬜⬜)(⬜⬜⬜⬜⬜⬜⬜⬜)	
		99. Don't want to answer / ⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜	
B8_other	Why didn't you enroll in the PMFBY? other specify	Fill in the blanks / ⬜⬜⬜⬜⬜ ⬜⬜⬜⬜⬜⬜⬜	

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B9	What was the most important source of information for you regarding PMFBY? □□□□□□□□□□□□□□ □□□ □□□□ □□□□□□ □□□□□□□ □□□□□□□ □□□□□□□□□□□□ □□□□□□ □□□□/□□□□□ □□ □□□□□?	1. Amakrushi messages / □□□□□□ □□□□□ 2. Block officer/ extension worker (VAW, Krushak saathi, AAO)/ DDA / □□□□ □□□□□□□/ □□□□□□□□□ □□□□□□□□□□□ (VAW, □□□□ □□□□, AAO)/DDA 3. GP Pradhan/ Ward Members / □□□□□ □□□□□□□ □□□□□□/□□□□□ □□□□□□ 4. Common service Centers / □□□ □□□□□□ □□□□□□□/□□ □□□□ □□□□□□□ 5. Newspapers/Radio/TV / □□□ □□□□ /□□□□□/□□□□ 6. Bank / □□□□□□□□ Insurance companies / □□□□ □□□□□□□	

		8. Friends/neighbours/family / निगंधी/पड़ोसी/परिवार / दोस्तों और परिवार
		95 Others (specify) / अन्य(स्पष्ट)(करें निर्दिष्ट)
		99 Don't want to answer / जवाब नहीं देना चाहते
B9_other	What was the most important source of information for you regarding PMFBY? others प्रधानमंत्री फसल बीमा योजना के बारे में आपके लिए जानकारी का सबसे महत्वपूर्ण स्रोत क्या/कौनसा था स्रोत? अन्यस्पष्ट करें	Fill in the blanks / खाली जगह भरें
B10	How did you enrol in PMFBY scheme? आप प्रधानमंत्री फसल बीमा योजना में कैसे नामांकित हुए?	1. Through CSC / कॉमन सर्विस सेंटर (CSC) के माध्यम से 2. Banks / बैंकों के माध्यम से 3. Self/PMFBY / website स्वयं/प्रधानमंत्री फसल बीमा योजना की वेबसाइट के माध्यम से 4. Insurance companies / बीमा कंपनियों के माध्यम से

		95. Others / □□□□□□□□	
B10_other	How did you enrol in PMFBY scheme? Others □□□ □□□□□ □□□□□□□□□□□□□ □□□ □□□□ □□□□□□□ □□□□□□□□ □□□□? □□□□□□□□	Fill in the blanks / □□□□□ □□□□□□□	
B11	Are you growing crops this Rabi season? □□□ □□□ □□□ □□□□□□ □□□ □□□ □□□□□□□□□ □□?	1. Yes / □□ 2. No / □□	If B11=1 skip to B14 □□□ B11=1 □□□ B14□□ □□□□□□□
B12	If not, did you file a Prevented sowing claim for the PMFBY scheme? □□□ □□, □□□□□□□□□□□□□ □□□ □□□□ □□□□□□□ □□□ □□□□□□□ □□□□□□□ □□□□□□□□□ □□□□ □□□□□□□□ □□?	1. Yes / □□ 2. No / □□	If B12=1 skip to B14 If B12=1 □□□ B14□□ □□□□□□□
B13	Why didn't you file a prevented sowing claim? □□□ □□□□□□□ □□□ □□□□□□□ □□□□□□□ □□□□□□□□ □□□□ □□□ □□□□□□□□?	1. Lack of information / □□□□□□ □□□□ 2. Necessary documents were not available / □□□□□□□□ □□□□□□□□ □□□□□ 3. Complicated process / □□□□ □□□□□□□□□□	

| B13_other | Why didn't you file a prevented sowing claim?other | Fill in the blanks / [Hindi text] | |
| B14 | How would you rate the PMFBY contents you received? **Read all the options** [Hindi text] | 1. Not Useful / [Hindi text]
2. Slightly Useful / [Hindi text]
3. Moderately Useful / [Hindi text])
4. Useful / [Hindi text]
5. Very Useful / [Hindi text]
99 Respondent does not want to answer [Hindi text] | End survey [Hindi text] |

7.6 Primary source of information on PMFBY.

	Before the intervention (Baseline)		After the intervention (Endline)	
	Control (N = 156)	Treatment (N = 161)	Control (N = 156)	Treatment (N = 161)
PxD's mobile phone-based platform	-	-	8%**	23.60%

| Block officer/ extension worker	8.33%	4.97%	5.77%	12.42%
GP Pradhan/ Ward Members	1.92%	2.48%	5.77%	0.62%
Newspapers/Radio/ TV	16.03%	14.90%	9.62%	11.18%
Bank	10.26%	6.21%	14.74%	8.07%
Insurance companies	0.64%	0%	0.64%	0%
Friends/neighbours/ family	8.97%	10.56%	21.15%	14.29%

** The control group farmers were not sent any PMFBY content. We hypothesize that the control group farmers who said they received the content from our service might have received other agronomic content, and confused that with PMFBY messaging.

Source: PxD baseline survey

7.7 Illustration of a mid-season calamity from another case during Rabi 2020 in Tamil Nadu

In this use case for an insurance company in the state of Tamil Nadu, EAI investigated a mid-season calamity that was caused by a flood event. It was determined by using the backscatter of the radar satellite and later the recovery of the crop was observed using a dual polarisation index of SAR that measure the moisture content of the vegetation as a proxy for the crop health. An examination of the crop stress showed that the crop recovered towards the end of the season.
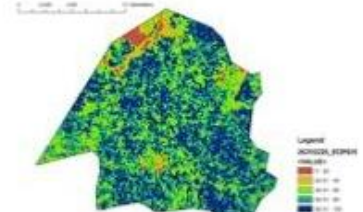
Majority of fields in Povallai village in Tamil Nadu have been planted prior to the flood event in December 4, 2020.
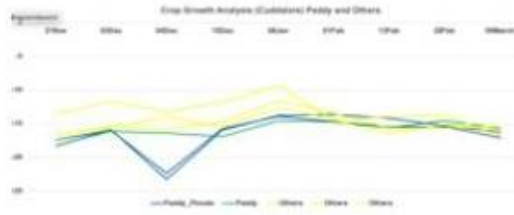
Crop area planted

Village area flooded

Crop area recovered (in blue) on February 25th

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