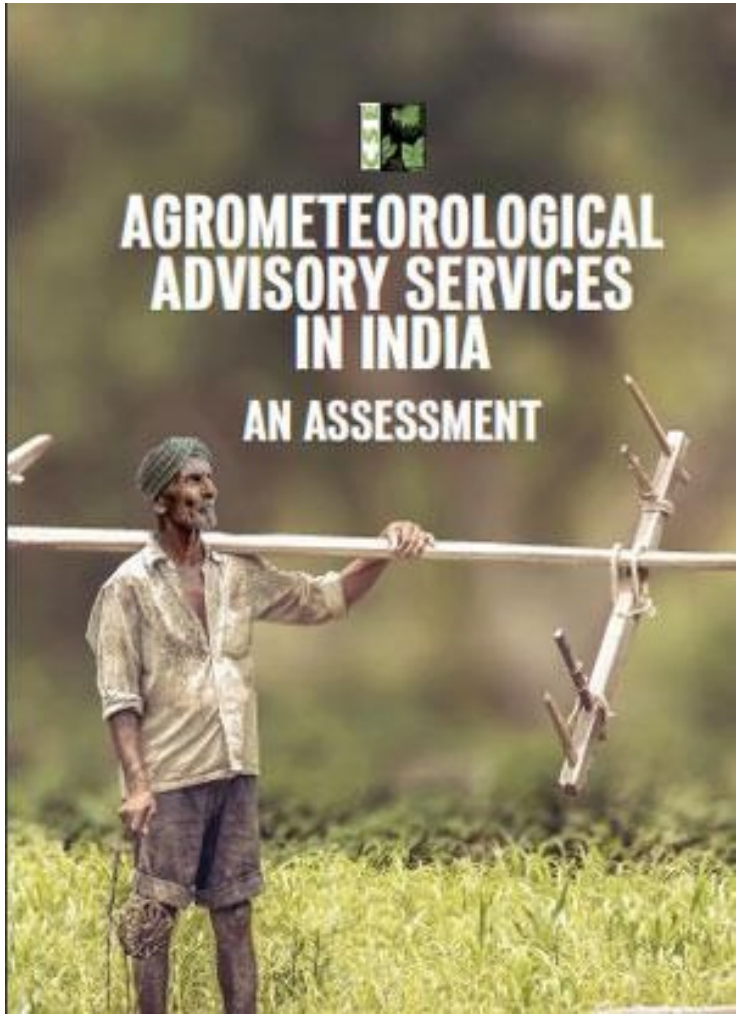
Agromet Advisories in India: An Assessment

23 April 2020



CSE's new report presents a breakdown of the agromet system, details of current challenges and policy recommendations.

Introduction

- Agromet advisory – combination of weather and crop-related information to provide practical advice to farmers
- Why are they important?
  - Farmers face multiple risks – unforeseen weather, pests, crop diseases, needing combined advisories. Traditional knowledge helps on this front.
  - Rapid evolution of risks – climate change driving extreme weather, as well as changes in geographical range of pests and diseases. Traditional knowledge not enough.

Introduction

- This is a global challenge with equity implications – for India, FAO projects due to climate change:
  - Decrease in agricultural production of 2.6 per cent between 2011 and 2050 (second worst projected decline among world regions, after sub-Saharan Africa).
  - Food consumer prices are expected to rise by 4.6 per cent and food purchasing power is anticipated to decline by 6.2 per cent, with poor rural households hardest hit

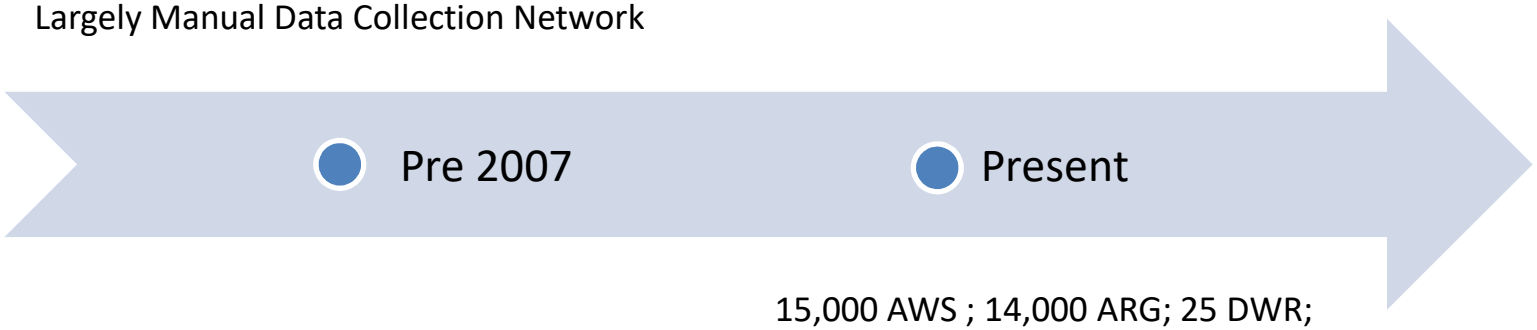
Current Scale of the Indian Agromet System

- Indian meteorological system has a long history; first weather data collection stations set up by the British in the 1700s
- Till recently, weather data collection was largely manual
- Since mid-2000s, there has been an explosion in automatic weather stations, which use automated instruments, and information technology for data sharing and collation.

Current Scale of the Indian Agromet System

- Now, around 30,000 automatic weather data collection points in the country – automatic weather stations (AWSs), automatic rain gauges (ARGs), Doppler Weather Radars (DWRs) and lightning sensors.

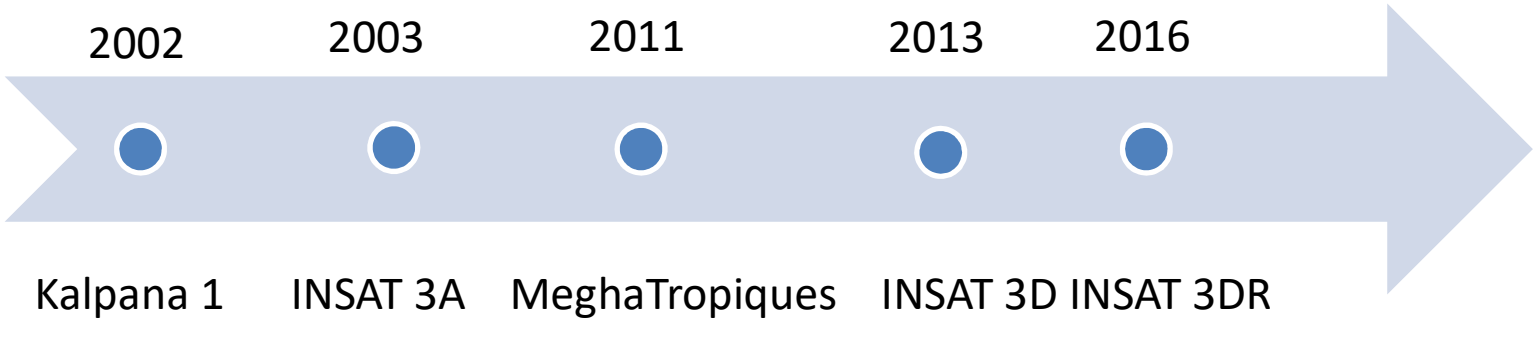
- Capability to measure rainfall, temperature, wind speed and direction, humidity, lightning and transmit data multiple times a day



Current Scale of the Indian Agromet System

- In parallel, a big expansion in Indian satellites focused on weather data collection.

- Also, significant recent upgrades of super-computing capacity for weather forecasting
  - This gives India the capacity to run advanced weather modelling software (probabilistic and ensemble models).



Current Scale of the Indian Agromet System

- This expansion in weather data collection sits atop a massive pre-existing system to develop agricultural technology for farmers and train them to use it (known as the ‘extension’ system).
- It also links with another massive pre-existing system – the crop data collection system.
- The extension and crop data collection systems have not expanded in the same way as weather data collection. (Details in a bit)

Structure

- We are going to discuss the agromet system as three sub-sectors:
  - Weather data collection and forecasting
  - Generation of agromet advisories
  - Dissemination of advisories
- In each sub-sector, we will recap some recent positive developments, and then highlight the key current challenges.
- At the end, we will pull together the common themes across sub-sectors to make policy recommendations.

Weather Data Collection and Forecasting

Recent developments

The big positive – massive scale up in automatic weather data collection, across public and private sector, and including (to some extent) state governments

Total automatic data collection points	**15000 AWS , 14000 ARG , 25 DWR (approximately)** **Central government: 1800 AWS, 1350 ARG, 25 DWR** **State governments: 4100 AWS, 12500 ARG (big data gaps)** **Private sector: 9000 AWS, 160 ARG**

Density of the automatic data collection network

- How many weather data collection points does the country need?
- Best available estimate from a 2015 government committee report regarding the agricultural insurance system - 40,000 functional automatic weather stations needed.
- Requires on average a station for every 5 km radius (which equates to one every 80 square km or so).

Source: Report of the Committee to Draft Guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARG) by private agencies and their accreditation standardization, validation and quality management of weather data etc. (2015)

Density of the automatic data collection network

- What do we have? 15,000 AWSs, which is not quite enough, but heading in right direction (especially if we also consider the 14,000 ARGs, which collect more limited data, but still useful).

- Bigger problem – network density differs drastically across states, some are well below one automatic weather station per 5 km radius.

AWS density	Approximately 1 AWS per 220 sq. km (3.28 million sq. km/15,000). Average radial distance of around 8 km. Range: Kerala (1 per 87 sq. km), Orissa (1 per 281 sq. km), Assam (1 per 472 sq. km), Uttar Pradesh (1 per 1005 sq. km).

Source: IMD website, discussions with IMD regional offices, private sector, state government officials.

Data quality and sharing

- Large data collection network is good news if it is reliable. However…
- Multiple audits regarding inspection and maintenance of automatic stations have reported that –
  - Comptroller and Auditor General (CAG) report in 2015 – in Bihar and West Bengal, failure to replace stolen/malfunctioning batteries, other equipment
  - CAG report in 2017 - no monitoring/quality control of weather stations in Assam, non-installation of stations in Rajasthan which were indicated as installed

Data quality and sharing

- Besides, the track record on data sharing between private and public sector is poor -
  - Comptroller and Auditor General Report in 2017 - Maharashtra state government resolution stipulated that weather data received by the insurance companies from a third-party data provider should be sent every week to the government.
  - Insurance + weather data companies did not collect data every week. Delays in submitting any collected data ranged between 19 to 34

Generation of Agromet Advisories

The Agromet Advisory Generation System Has Been Deepened

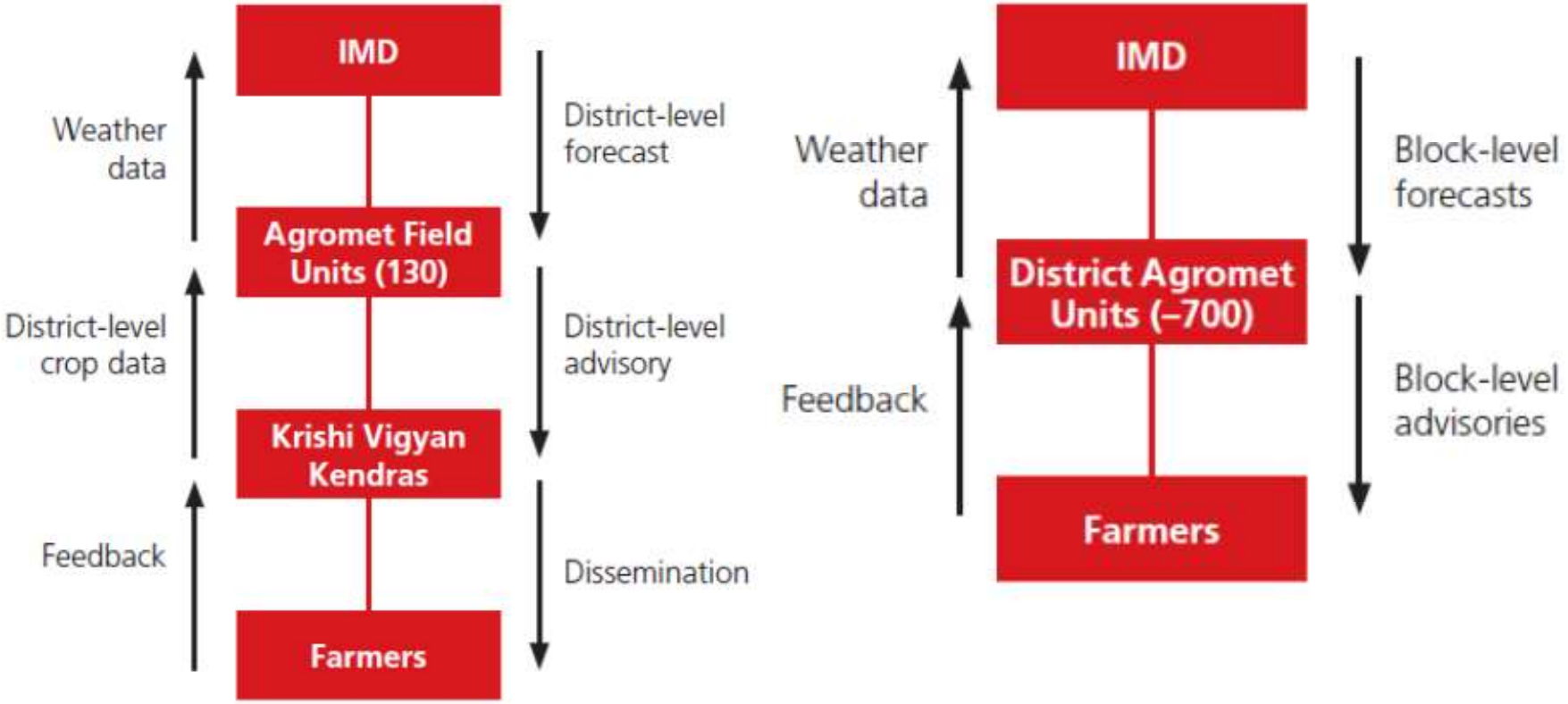
- To connect weather forecasting to the farmers, the Government of India, under the leadership of the Indian Meteorological Department, set up **Agromet Field Units** (AMFUs).

- These Units collect data and send it to the IMD, receive forecasts from the IMD, and employ meteorologists and crop experts to generate agromet advisories.

- Till recently, there were 130 Agromet Field Units – one for each agro-climactic zone in the country. These zones were based primarily on regional weather and crop patterns.

- This network has now been expanded to *each district* in the country and renamed – so there are now around 700 **District Agromet Units** (DAMUs)

Recent Developments



Transitioning

Hyper-local advisories pose technical challenge

- Despite the deepening of the network, challenges remain. Demand for quality forecasts is increasing across all parameters –
  - Lead-time
  - Accuracy
  - Resolution/Location specificity

  Difficult to simultaneously deliver across all three.

- IMD default level for forecasts is currently the district level.

- The IMD is piloting block-level advisories for 200 blocks but:
  - Accuracy of IMD 5-day forecasts at the block level is currently around 60%.
  - “If you need block-level forecasts, you need to put in block-level initial values.” i.e. you need data collection in each block.

Source:
The Hindu. 2016. ‘IMD to Issue Block Level Forecasts Soon’ ; Ankur Paliwal. 2018. ‘Why India Struggles to Predict the Weather Over Its Lands’. The Wire. Available at: https://thewire.in/environment/ imd-weather-prediction-forecast-monsoons-drought-agrometeorology-kharif

Crop data quality is lacking

- Present status of crop data collection is “far from satisfactory”. (MOSPI)
  - Frequent revisions, often quite significant ones, of crop estimates and the publication of final estimates is considerably delayed.

- Reason - village-level and supervisory officials who play a key role in collecting land use statistics “do not attach much importance to this work” (MOSPI)
  - Possible underlying reason - Long-term decline in the role of state Revenue Departments in the agricultural space, initiated by the reduction of taxation of agricultural land

- This is out of the control of the IMD, but compromises the quality of the current integrated agromet system

Agriculture research and education system

- Agricultural research and education system struggling to produce enough trained personnel generally
  - Decline in absolute numbers of faculty at State Agricultural Universities – above 17,000 in 1991, now closer to 14,000.
  - Decline is despite setting up new SAUs. So average faculty per SAU has declined from 426 (2001) to 267 (2017)
  - “SAUs are starved of funds to maintain buildings, laboratories, and infrastructure” (Tamboli & Nene 2013)
- “The problem could be attributed to both, lack of funding and state recruitment policy, which is sometimes accorded low priority due to austerity measures adopted by the state governments.” (ICAR 2017)

Integration of weather information and advice

- Advisory in Assam – advice and forecast not integrated

Significant past weather for the preceding week	Weather forecast valid up to 13th March, 2019
No information available	In the coming 5 days **clear sky** will prevail; **No** rainfall is predicted from **9th to 13th March, 2019**. The maximum temperature predicted is **27-30°C** and minimum of **14-16°C**. The expected morning and evening RH will be **75-78%** & **26-29 %**, respectively. Mostly **North easterly** wind with a speed of **10-11 Kmph** is expected.

AGRO-METEOROLOGICAL ADVISORIES

Crop	Crop Stage	Diseases/pest	Advisories
Boro rice	Maximum tillering stage	Stem borer, sheath blight	Due to favourable infestation of stem borer may be observed in boro paddy crop, farmers may apply Chloropyriphos 20EC at the concentration of 0.02% solution @ 2ml per 10 litre of water. Spray Carbendazim @ 0.5g/lit or Hexaconazole 2ml/lit, one at the appearance of the sheath blight disease, another 10 days after the first spray.
Chilli	Transplanting	-	About 4-5 weeks old seedlings of chilli are to be transplanted in the field with a row to row and plant to plant spacing of 45cm X 45cm respectively. Irrigation water of 4cm depth at 18-20 days interval should be provided by surface flooding method in the crops which were planted during the previous years.
	Fruiting	Fruit rot	Spray Captan 50 WP 0.2% (@ 2 g/lit. of water) or Dofolatan 0.2% against Fruit rot or anthracnose disease.

Integration of weather information and advice

- Agromet advisory in Karnataka – better integration of weather information and advice

Crop	Stage/ Condition	Pest and Disease	Agro advisories
Agriculture crop			
Rabi crops	Poorvabhadra rainstar starts from March 4th and remains up to March 17th . The normal rainfall of Poorvabhadra rainstar is 8.5 mm. The grains of the harvested crops should be properly dried by retaining moisture percentage to 11-12 % in Cereals, 9% in Pulses, 8% in Oilseeds and 5-6% in Vegetable seeds for long storage & to minimize the store pest damage. In already harvested fields the farmers are advised to remove the half cutted stubbles of pigeon pea from their fields. This will avoid multiplication and spreading of sterility mosaic disease		
	Provide irrigation, as the fruits are in marble stage, this will helps for the better development of fruits. If sufficient water is available, irrigation can be given at 15-20 days interval starting from fruit setting till maturity. Due to continuous dry spell since October month, the termite attack is common in horticulture and Forestry tree and shrubs hence control to apply Aldrin termicides for control of termites. Spray Lamda Cyhalothrin 5EC @ 0.5 ml/ litre of water or sulphur dust (SULTAF) 80 W @3g/litre of water against the Powdery mildew diseases.		

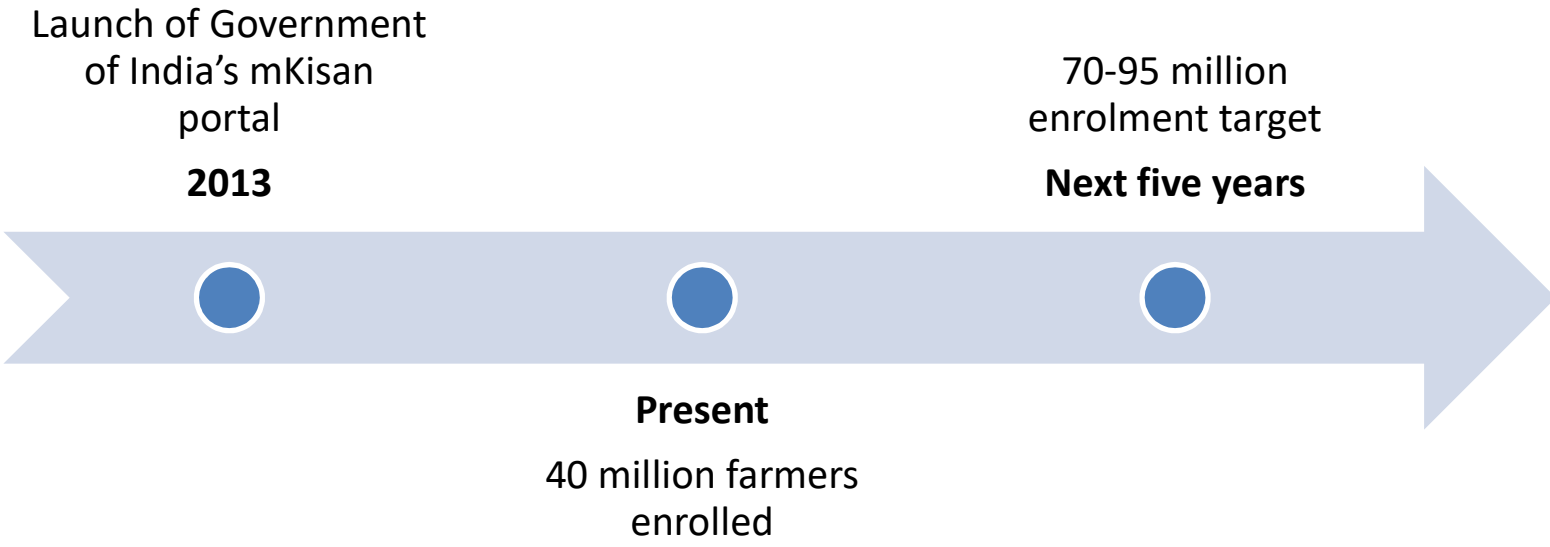
Dissemination of Advisories

The Dissemination System is focused on Mobile Technology Driven Expansion

- The dissemination of advice to farmers was until recently a largely manual exercise.
- The Central Government, State Agricultural Departments and State Agricultural Universities employ huge numbers of ‘extension’ professionals to take information directly to farmers.
- The trend is to combine manual dissemination with information, particularly mobile technology.

The Dissemination System is focused on Mobile Technology Driven Expansion

- The Central Government launched its mKisan online portal in 2013, has seen massive enrolment numbers, and is targeting a doubling in the immediate future.



The Dissemination System is focused on Mobile Technology Driven Expansion

- Significant expansion of private/NGO actors in this sector. Examples:

- **IFFCO Kisan Sanchar Limited**: Joint venture by Indian Farmers Fertilizer Cooperative Limited and Bharti Airtel, a telecom company, and Star Global Resources, a non-banking finance company. Dissemination methods: mobile app, call centre helpline, Green SIM card.

- **Skymet**, a private company primarily engaged in owning and operating automatic weather stations, which partners with USAID in a pilot to distribute advisories in 9 Indian states. Diseemination methods: mobile app, manual

The Dissemination System is focused on Mobile Technology Driven Expansion

- Significant expansion of private/NGO actors in this sector. Examples:

- **Farmbee** (formerly Reuters Market Light): Private company that provides weather forecasts and agromet advisories to farmers based on their location. Dissemination methods: mobile app, call centre. Other private companies: CropIn, Agrostar

- **Watershed Organization Trust (WOTR)**: Non-profit, which has developed a weather-based and agromet advisory system called AGRIMATE and has piloted it in 61 villages within Maharashtra. Dissemination methods: Mobile app, call centre, manual dissemination

Regularity, reliability of advisories

- Information technology based expansion has benefits, but the **increase in numbers connected masks some challenges**.
- From discussions with farmers in Ludhiana (Payal tehsil)
  - SMSs received from the government later than expected.
  - Lack of response/disinterest displayed by government agromet information helpline operators - made to wait on the phone for 20–30 minutes, not connected if calling multiple times
  - Recall receiving messages from IFFCO (a public–private partnership), but report that these dwindled over time.
  - Government weather forecasts not sufficiently accurate or specific enough to their location; private forecasts considered to be more accurate

Inability/unwillingness to pay for weather information

- Farmers in Payal tehsil - Quality of private service is good, but if converted to paid model, would either
  - Go back to monitoring government forecasts
  - Rely on own eyes and traditional knowledge

- From private and NGO operators in this space - initiatives for high-accuracy, high-relevance forecasts for subsistence farmers will likely continue to need grant funding
  - 85% of farming in India estimated to be subsistence farming

Inability/unwillingness to pay for weather information

- Information difficult to monetise on an individual basis – weather forecast generally shared by whoever receives it.

- Some willingness to pay for services if –
  - track record of trust-worthiness demonstrated by the service provider
  - availability of advisories that are sufficiently specific to the farm level or the individual (which takes us back to technical challenges with hyper-local advisories)

Lack of grassroots network and limitations of ICT methods

- China employs six times as many extension personnel as India while having less area under cultivation (Sajesh & Suresh, 2016).
- Strong emphasis on expanding mobile connectivity, and associated solutions like mKisan
- Limitations –
  - Misconceptions – farmers don't pick up calls for fear of having credit deducted
  - Technology overwhelms attention span – do not look at / miss advisories due to flood of messages
  - Even when information received, training still needed to practically apply it

Common themes across sub-sectors

- Mobile information network expansion is significantly driven by private and NGO sector, but is not toward a cohesive public purpose.
- Coordination of expertise is critical, but integration under a single unified system is not sufficient
- Central investment is important but insufficient, state investment is lacking

Policy recommendations

- **Greater integration and devolution of crop and weather data network expansion -** While the IMD should take responsibility to expand, coordinate and strengthen the weather forecasting system, the role of the KVK in collecting crop data and providing accurate, timely crop-based advisories should be strengthened and better coordinated with weather forecasts.

- **Integration of data collected on a common platform** – under the stewardship of the IMD.
  - By law, all weather data collected in the country, public or private, and across government departments and levels, must flow into a central database.
  - Development of minimum standards (such as BIS) for weather equipment and data, including metadata, mainstreamed through a viability gap funding policy.

Policy recommendations

- **Investment in state-level networks:** This field is moving towards:
  - increasing use of satellite-based data; states need to invest in creating a demand for block/local level data from such technologies.
  - mobile technology for dissemination of advisories. This has advantages, but is not a substitute for human extension services, which need significantly more investment from states.

- **Conclusion:** For a subsistence farming economy, the agromet system needs to balance affordability with quality. This requires treating this system as a **public good**. The private sector must be supported in its strengths – particularly innovation – but creating a deeper system requires investment across all levels of government, not just the IMD.