

# 6th Seminar on Enterprise Risk Management

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## Crop Insurance – Pricing in an Uncertain market

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# Who we are:



- The Swiss Re Group is a leading and highly diversified global re-insurer, founded in Zurich, Switzerland, in 1863. We operate around the world and have about 14,200 employees who contribute to our success.
- We are organized in three Business Units:
  - Our Reinsurance Business Unit offers reinsurance products and related services for property and casualty, as well as for life and health businesses.
  - Corporate Solutions offers commercial insurance to mid-sized and large corporations.
  - Life Capital manages open and closed life insurance books.
- We also support the public sector with our Public Sector Solutions team to help increase insurance penetration around the world.

# Agriculture Re/Insurance - Sublines



Crops



Livestock



Bloodstock



Forestry



Aquaculture



Greenhouse



# Agriculture and Crop Insurance in Indian Context



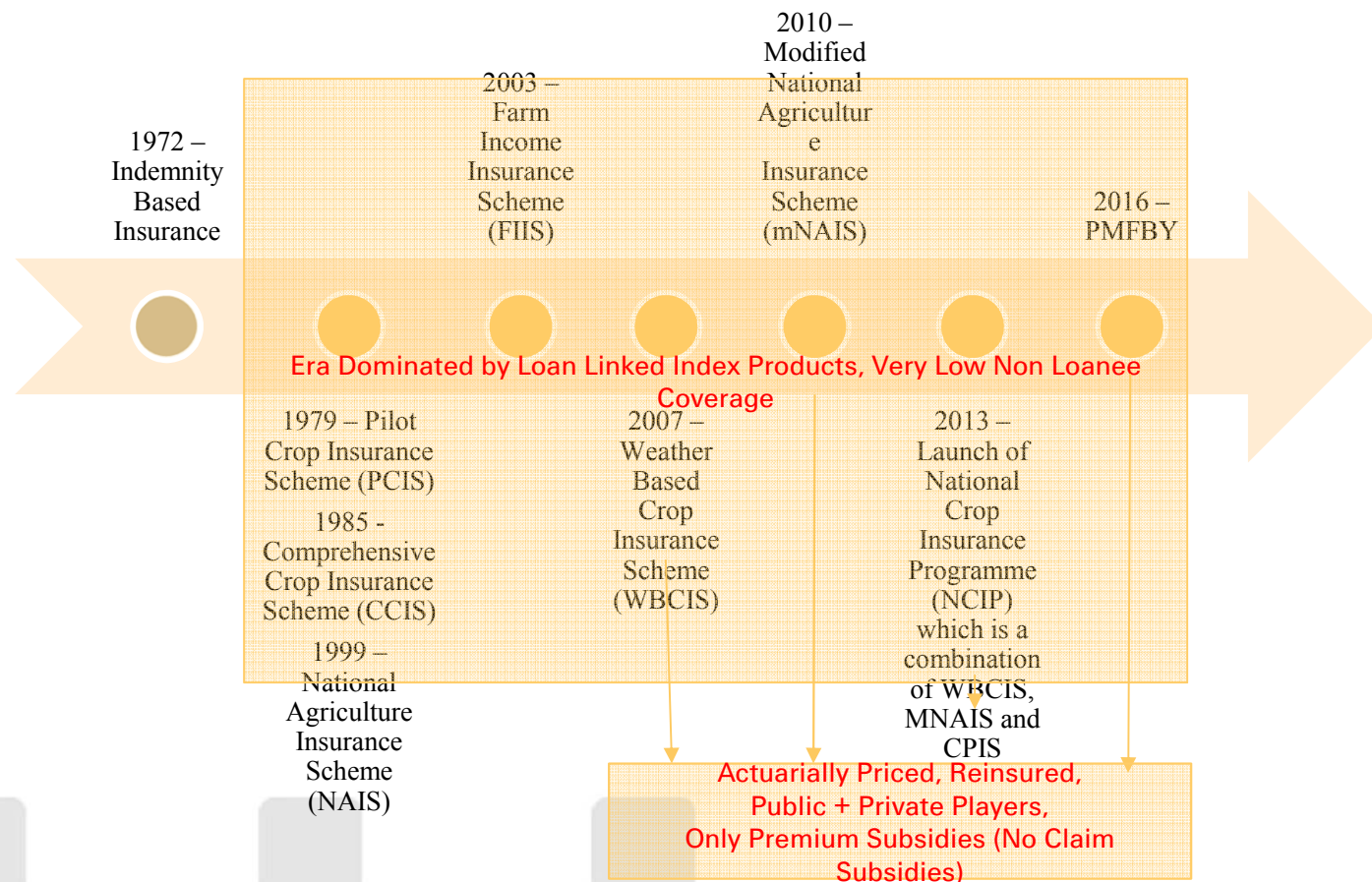
## Agriculture sector:

- More than 130 mn landholdings, extremely small 'per capita' land available
- Agriculture contribution to GDP about 16.5%
- About half of the labor force involved in agriculture
- Key risks – Droughts, Floods, Cyclones, Hailstorms, Unseasonal Rainfall
- Excessive dependence on weather decreases productivity of crops which directly impacts the small farmers, for whom crops invariably form their primary source of income
- There are secondary effects on livestock and fisheries sector – as fodder and water availability decreases

## Agriculture insurance:

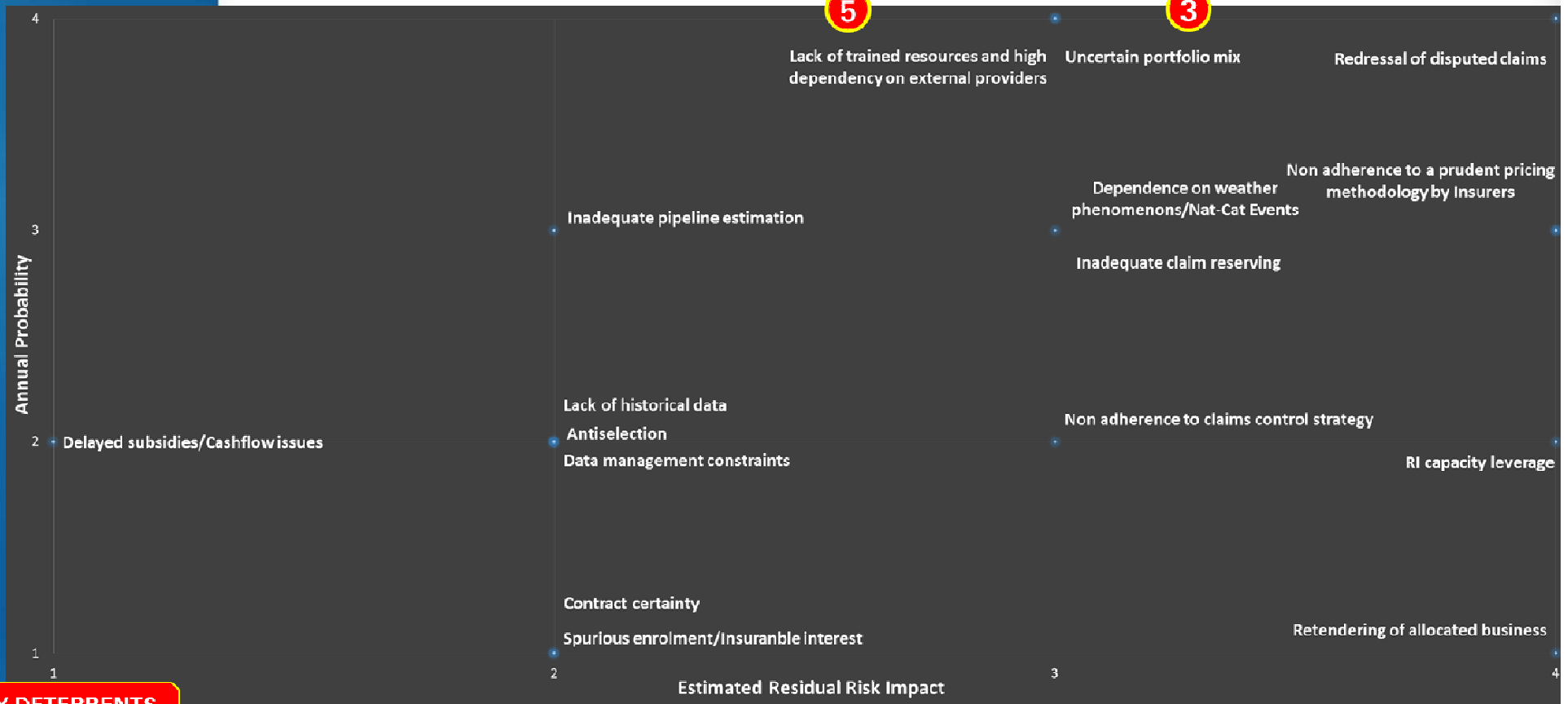
- Biggest index market – both yield index and weather index insurance products are prevalent
- Third largest agriculture insurance market after USA and China
- Covers mainly limited to crop domain, focusing on 'production' rather than 'revenue'

# Evolution of agriculture insurance in India





# PMFBY Scheme Challenges – Risk Matrix



## KEY DETERRENTS

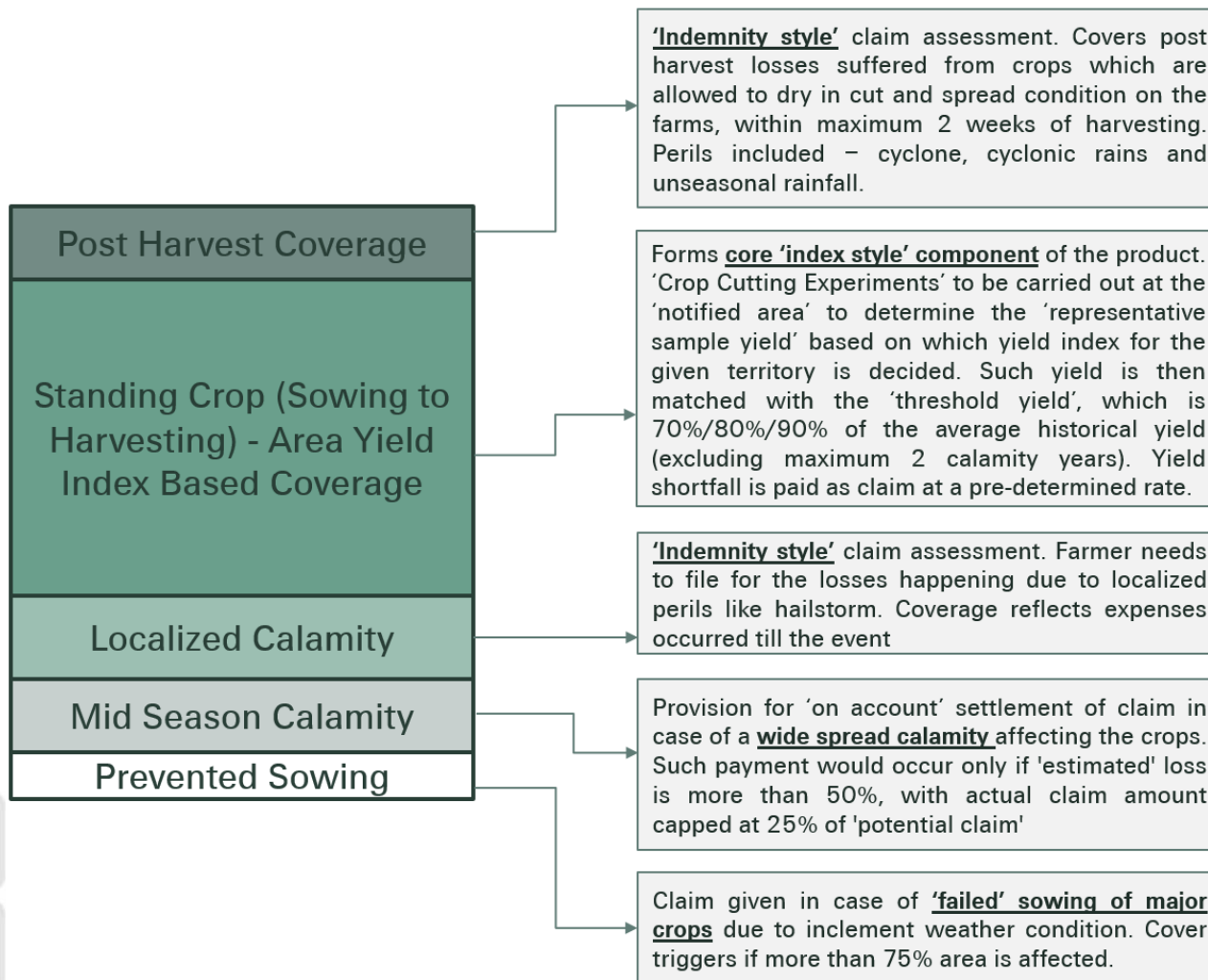
- PMFBY guidelines addresses this challenge, with provision to refer cases to Technical Advisory Committee of Center. Successful intervention seen in case of Gujarat (Groundnut and Cotton). Cases are also under discussion for Rajasthan and Karnataka
- With tighter RI conditions, pricing discipline has been brought under control to large extent, but need to see how RI market shapes up in near future in line with increasing competition in primary market.
- Need continuous trainings for internal & external resources to manage enrollment and claims. Need longer commitments from states through multi-year or -season allocations
- With limited capacity being pushed into market and GIC almost reaching its capacity limit, high possibility to correct market through RI intervention.
- Market has mostly stabilized in 2017 and the issue is self resolving with time.
- In certain cases the state government calls for a retender or a insurer backs out from tender. New draft guidelines handles this issue by penalty and blacklisting

# Prevalent Products in the Indian Crop Market



- PMFBY (Dominant Product)
  - Standardized product, predominantly based on the concept of yield index
  - Covers certain other perils which can't be captured efficiently through indexing
  - States decide the indemnity levels (70%, 80% or 90%) of the yield indices, depending on their view of the risk and also the availability of funds for subsidies
- RWBCIS (Minor Product)
  - Fairly non standardized products, predominantly based on the concept of weather index
  - States study and recommend the product structure and parameters to be covered (rainfall, temperature etc.)
- *Central government has issued detailed standardized guidelines for implementing both the products on ground. No substantial difference found in the products filed by different insurers, due to uniformity in the way in which the products are implemented.*
- A single district can have both – PMFBY as well as RWBCIS running together for separate set of crops. Usually RWBCIS is preferred for horticulture and cash crops.
- Market share of RWBCIS has dropped considerably with the evolution of PMFBY. About 10% premium contribution done by RWBCIS now.

# Prevalent Products in the Indian Crop Market





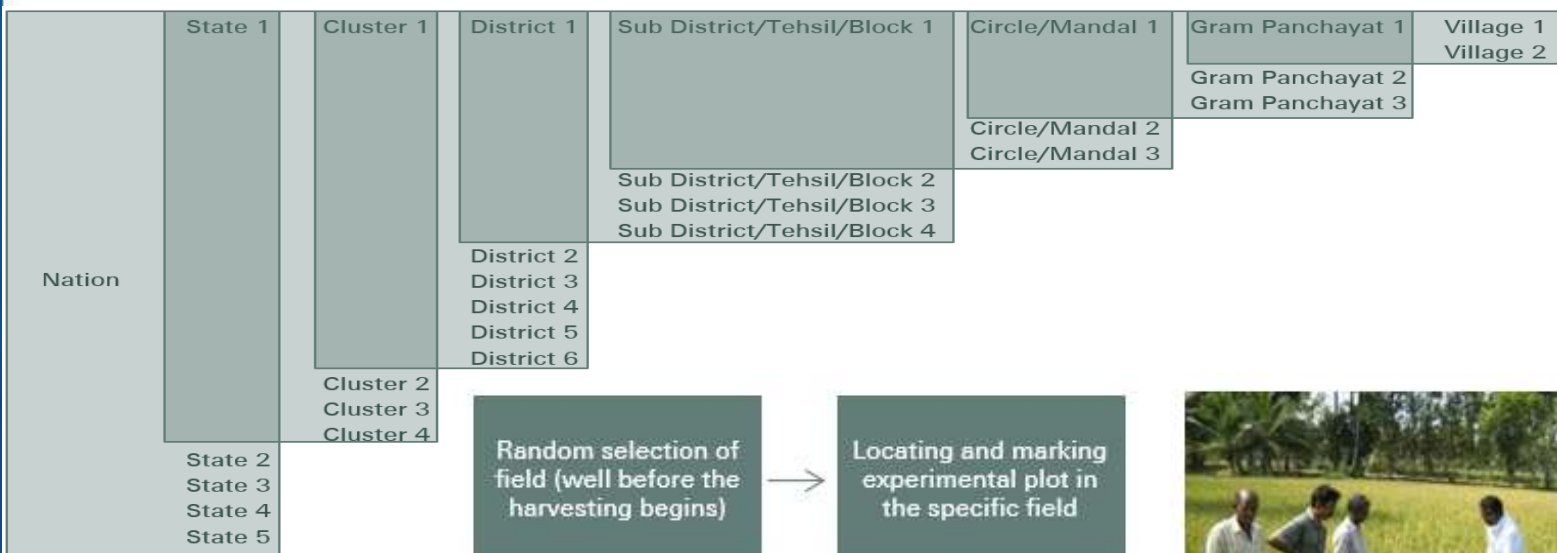
## Performance of PMFBY+RWBCIS (post 2016)



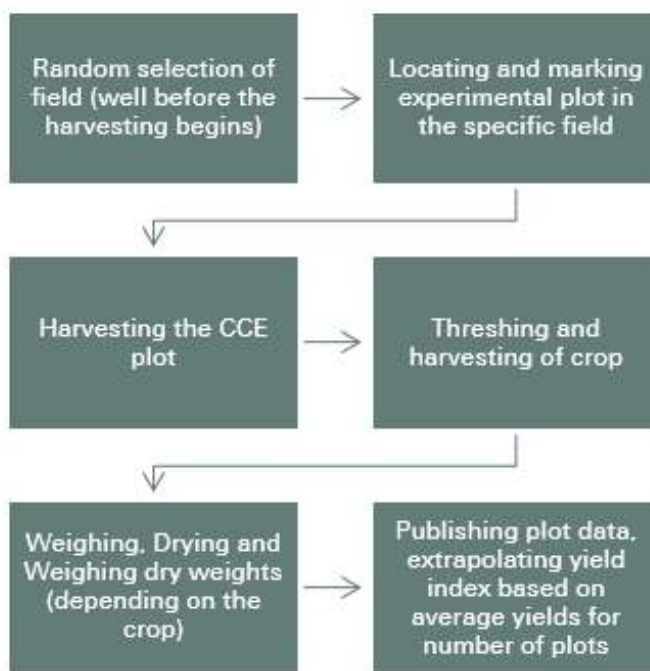
Year	Premium INR cr	Claim INR cr	Claim Ratio %
2016	22,345.51	16,177.72	72.4%
2017	25,307.80	21,511.63	85.0%
2018	28,000.00	25,200.00	90.0%

- PMFBY – Yield Index - dominant product, RWBCIS – Weather Index - minor product
- Direct markets as well as reinsurance markets remain competitive
- Most players retain in the range of 20%-25%. Rest is ceded out through Quota Share arrangements. Stop loss purchased for retained premiums.
- Tighter operational guidelines launched in 2018 by the government. Intent and efforts to streamline several processes, right from loan-linkage up to claim computation, through a centralized portal. Heavy focus on technology.
- Several challenges seen around –
  - Exposure uncertainty, shortfall and overachievements in plans due to ‘bidding’ practice
  - Uniformity/gaps in the historical datasets used for pricing
  - Implementation of CCEs on ground (number, resources etc.)
  - Adverse selection due to cut-off dates in some cases
  - Short time gap between flow of subsidies and claim disbursement – impacting investment income
  - Overdependence on loanee channel, lower uptake in non-loanee base

# Crop Cutting Experiments and Heterogeneity/Granularity



- Not much emphasis on agro-climatic segregation.
- Costs increase exponentially as granularity increases!
- Historical data not necessarily available at granular level



# Some Pertinent Questions



1. Do we have robust datasets?
2. Do we fairly capture the key trends and outliers?
3. Do we really have data at the required granular level?

## Weather Data - Challenges

- Missing blocks of weather data
- Needs to be cleaned up usually in the context of manual recording

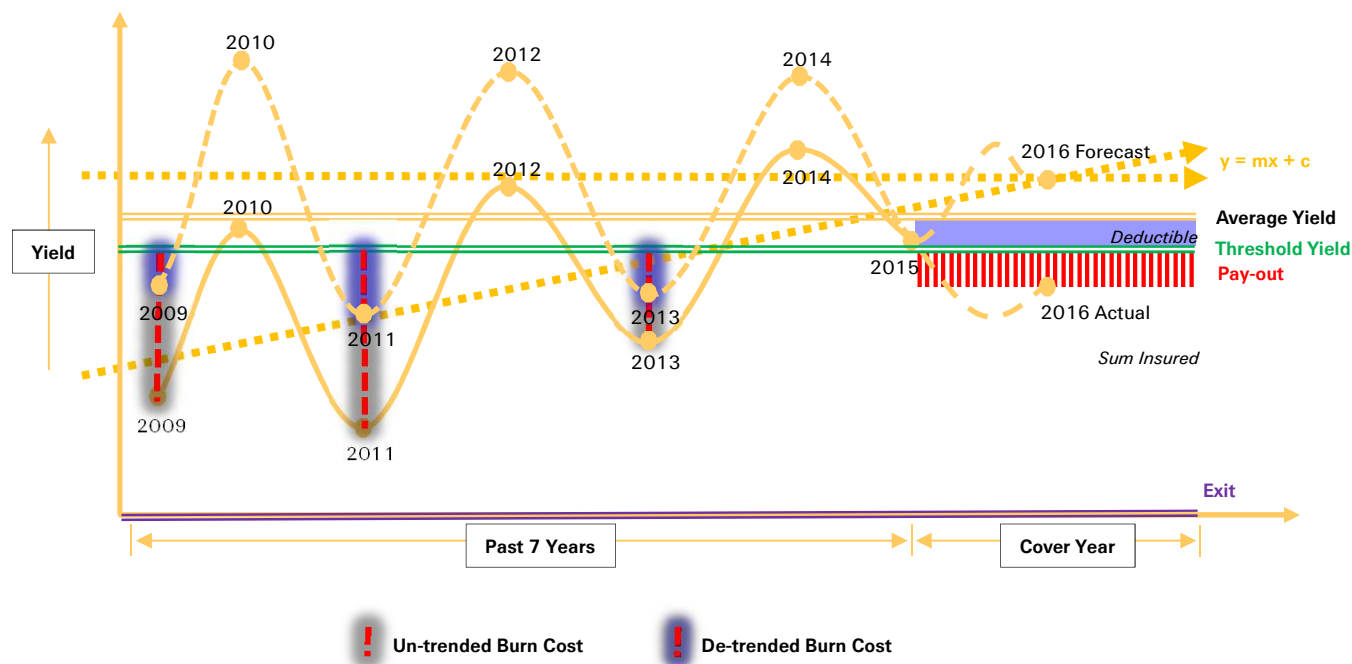
Negative rainfall	Same values being repeated continuously
Minimum temp more than Maximum temp	Extraordinarily high or low values of parameters
Maximum temp less than minimum temp	Non numerical values or missing values of parameters

- Manually recorded datasets may require conversion into soft copies from hard copies
- At times, nearest alternate reference weather station is hundreds of km away!

## Yield Data - Challenges

- Most of the times, received in hard copies. Tremendous QC required while converting to soft copies
- Not much data available at the 'insurance unit' level. i.e. most of the times, the threshold is merely applied as it is (without taking into consideration the variability) from a higher unit to a lower unit
- Repetitive yields
- Missing yield data points
- Multiple calamity years
- Calamity years with seemingly good yields

# Importance of De-trending



- Various methods of detrending are prevalent, with each having its own pros and cons
- Generally – positive trend is seen in the yields
- Key question:
  - Whether detrending can be applied for all granular yields?
  - Whether detrending needs to be applied fully?
  - Whether the slope/trend is emanating partly from data accuracy issues?

# Need for Heterogeneity Load - Volatility Due to Granularity



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Indemnity	Threshold Yield	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average Bun Cost	Actual Yield of 2015	Payout	
<b>Bengal Gram, Medak District</b>																										
Mandal	1227	1138	985	967	1332	1350	1074	1492	1461	1023	80%	1007.28	0.0%	0.0%	2.2%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	994	1.3%	
																								801	20.5%	
																									965	4.2%
																									776	23.0%
																									856	15.0%
																									1201	0.0%
																									1210	0.0%
																									1120	0.0%
																									1010	0.0%
																									1321	0.0%
																									889	12.0%
																									931	7.6%
																									903	10.4%
																									1003	6.71%
<b>Average</b>																									<b>1003</b>	<b>6.71%</b>

A single historical yield series is given - without giving 'Mandal' level details.  
However, the actual settlement of the insurance policies is done at Mandal level. i.e. the Yield Index is supposed to be determined at Mandal level.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Indemnity	Threshold Yield	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average Bun Cost	Actual Yield of 2015	Payout	
<b>Bengal Gram, Medak District</b>																										
<b>MANDAL/TALUKA</b>																										
/001-Kangti	1227	1138	985	967	1441	1135	949	1637	1284	896	80%	947.04	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	0.5%	994	0.0%
/002-Kalher	1227	1138	985	967	1441	1135	949	1637	1284	896	80%	947.04	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	0.5%	801	15.4%
/003-Narayankhed	1227	1138	985	967	1441	1135	949	1637	1284	896	80%	947.04	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	0.5%	965	0.0%
/004-Manoor	1227	1138	985	967	788	1162	1121	1395	1400	651	80%	892	0.0%	0.0%	0.0%	0.0%	11.7%	0.0%	0.0%	0.0%	0.0%	0.0%	27.0%	3.9%	776	13.0%
/005-Regcde	1227	1138	985	967	1441	1135	949	1637	1284	896	80%	947.04	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	0.5%	856	9.6%
/006-Shankarampet near Alladurg	1227	1138	985	967	1441	1135	949	1637	1284	896	80%	947.04	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	0.5%	1201	0.0%
/007-Alladurg	1227	1138	985	967	1808	1783	1335	1484	1597	1256	80%	1133.92	0.0%	0.0%	13.1%	14.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	1210	0.0%
/008-Pulka	1227	1138	985	967	1119	1186	1373	1405	1595	1325	80%	1036.48	0.0%	0.0%	5.0%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	1120	0.0%	
/009-Andole H/q Jogipet	1227	1138	985	967	1846	1876	1416	1215	1324	1593	80%	1116	0.0%	0.0%	11.7%	13.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%	1010	9.5%	
/010-Tekmal	1227	1138	985	967	1808	1783	1335	1484	1597	1256	80%	1133.92	0.0%	0.0%	13.1%	14.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	1321	0.0%	
/011-Papannapet	1227	1138	985	967	1118	1358	926	1430	1631	949	80%	1013.6	0.0%	0.0%	2.8%	4.6%	0.0%	0.0%	8.6%	0.0%	0.0%	6.4%	2.2%	886	12.6%	
/012-Rangampet or Kuicharam	1227	1138	985	967	1118	1358	926	1430	1631	949	80%	1013.6	0.0%	0.0%	2.8%	4.6%	0.0%	0.0%	8.6%	0.0%	0.0%	6.4%	2.2%	931	8.1%	
/013-Medak	1227	1138	985	967	1118	1358	926	1430	1631	949	80%	1013.6	0.0%	0.0%	2.8%	4.6%	0.0%	0.0%	8.6%	0.0%	0.0%	6.4%	2.2%	903	10.9%	
/014-Ramayampet	1227	1138	985	967	1118	1358	926	1430	1631	949	80%	1013.6	0.0%	0.0%	2.8%	4.6%	0.0%	0.0%	8.6%	0.0%	0.0%	6.4%	2.2%	1003	0.0%	
<b>Average</b>	1227	1138	985	967	1332	1350	1074	1492	1461	1026			0.00%	0.00%	3.88%	4.85%	0.83%	0.00%	2.47%	0.00%	0.00%	5.68%	1.77%	1003	5.66%	
<b>Standard Deviation</b>	0%	0%	0%	0%	21%	20%	18%	9%	11%	24%															16%	

## Cat-load and Handling Yield+ Components of PMFBY



- Most yield datasets are limited to 10 to 15 years: Return period computation remains tricky
  - Major droughts in 2009, 2012, 2014 and 2015 in the Northern part of the country
  - Major drought in 2016 in the Southern part of the country (North East Monsoon)
  - Recurrent cyclones seen since 2013 (Phailin)
  - Limited data available on pre-2000 droughts/rainfall events
  - Hindcasting can be used at a broad level to better understand the risk
- No systematic datasets available for post-harvest coverage
- Conjectures could be made for sowing-failure and prevented sowing conditions, but more transparency is needed in conditions
- Hardly any data for localized risks like hailstorm and landslide at district level, whereas such perils are expected to be covered at field level



# Claims/ Reserving



- Seasonal vs Annual policies of other lines
- Parametric vs Indemnity approach
- Flexible commencement dates for cover for crops
- Does not lend itself much to preventive measures
- Usually losses very widespread as compared to other lines
- Lack of availability of experts etc.
- City-centric Insurance professionals have less experience of rural claims issues

