

Crop Insurance Pricing Aspects & Pool as a Risk Sharing Mechanism

6th Seminar on Current Issues in General Insurance (CIGI)

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Agriculture Re/Insurance - Sublines



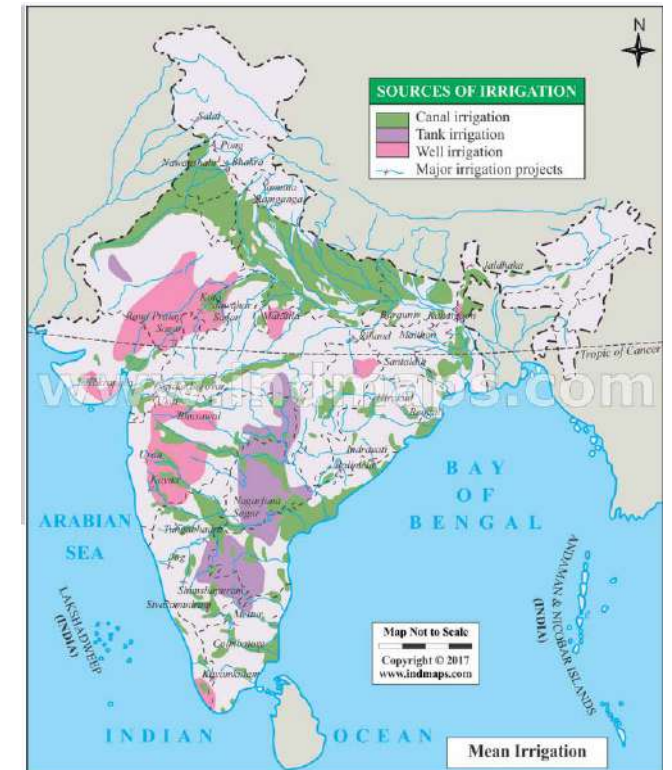
Agriculture and Crop Insurance in Indian Context

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:

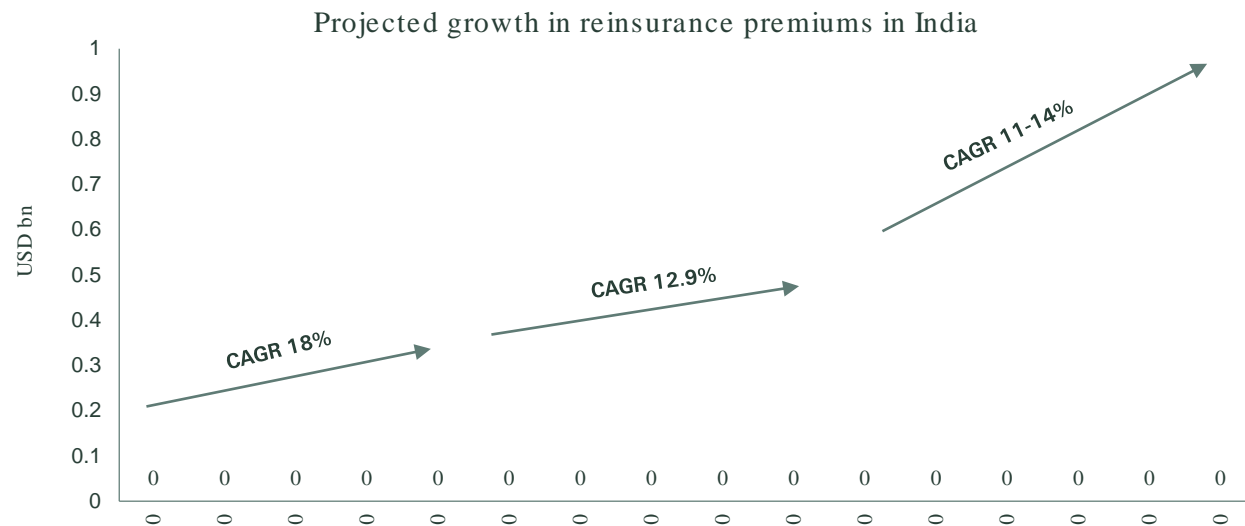
- Biggest index market – both yield index and weather index insurance products are prevalent
- Third largest agriculture insurance market after USA and China
- Covers mainly limited to crop domain, focusing on 'production' rather than 'revenue'



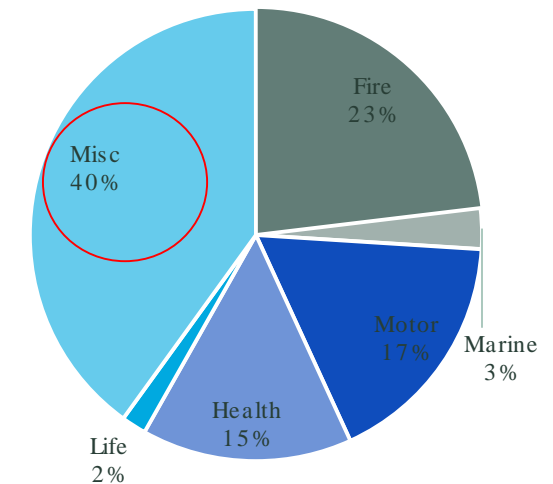
Source - <http://www.indmaps.com>

India: high projected growth rate for reinsurance market

- **Reinsurance market** has grown strongly in India in the past 10 years and is **projected to grow at a CAGR of between 11% to 14%** in the next five years to 2022.
- Until FY2016, the **largest segments** in terms of premium ceded were **fire** and **motor**, with increasing importance of health.
- In FY2017, the volume of **crop insurance** premium quadrupled to estimated USD 3.2bn, accounting for the jump in premium. This was driven by Government crop insurance schemes (mainly, **PMFBY**) which are likely to continue to increase in coverage over the next few years.
- **Health**, especially public health, is likely to see considerable volume expansion under the new **Public Health Scheme (Ayushman Bharat)**.



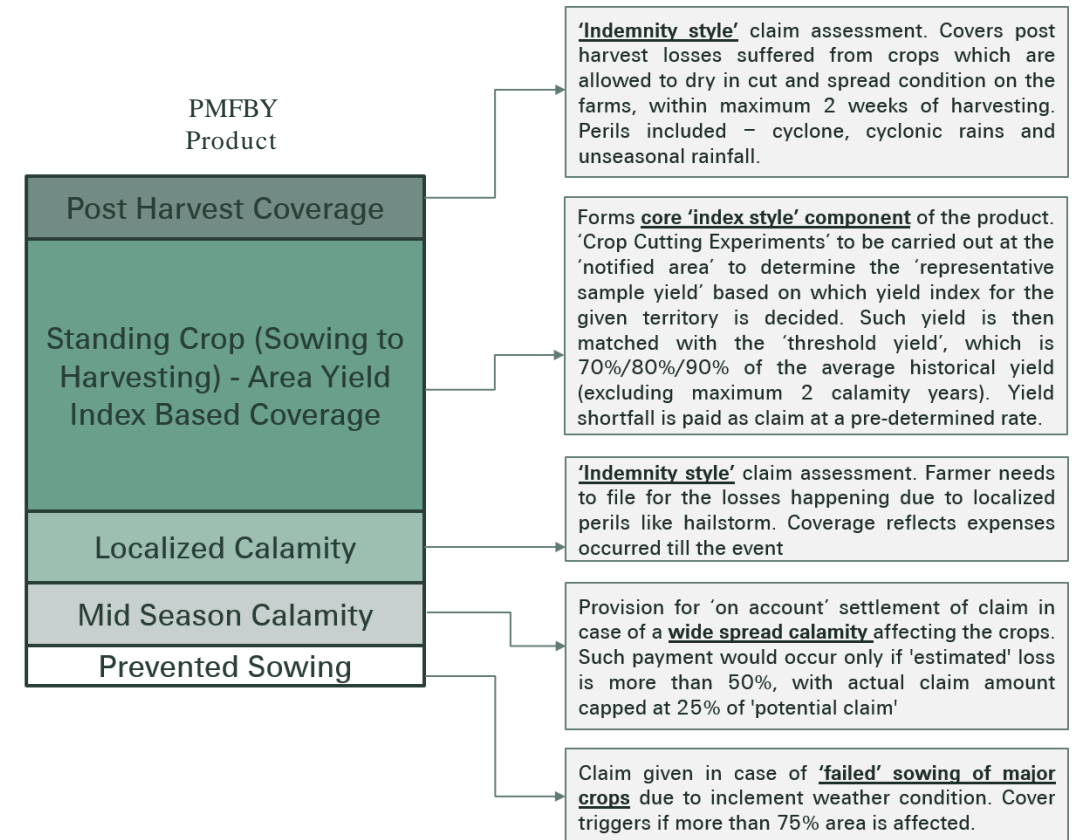
Source: GIC Re Draft Red Herring Prospectus, quoting CRISIL research;
USD 1 = INR 65



Segment wise premium on reinsurance accepted for FY2017-18
Source - IRDA

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.

Performance of PMFBY+RWBCIS (post 2016)

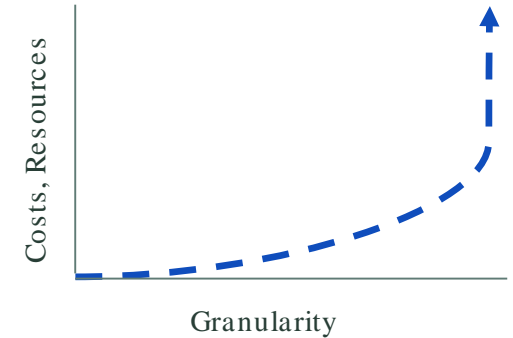
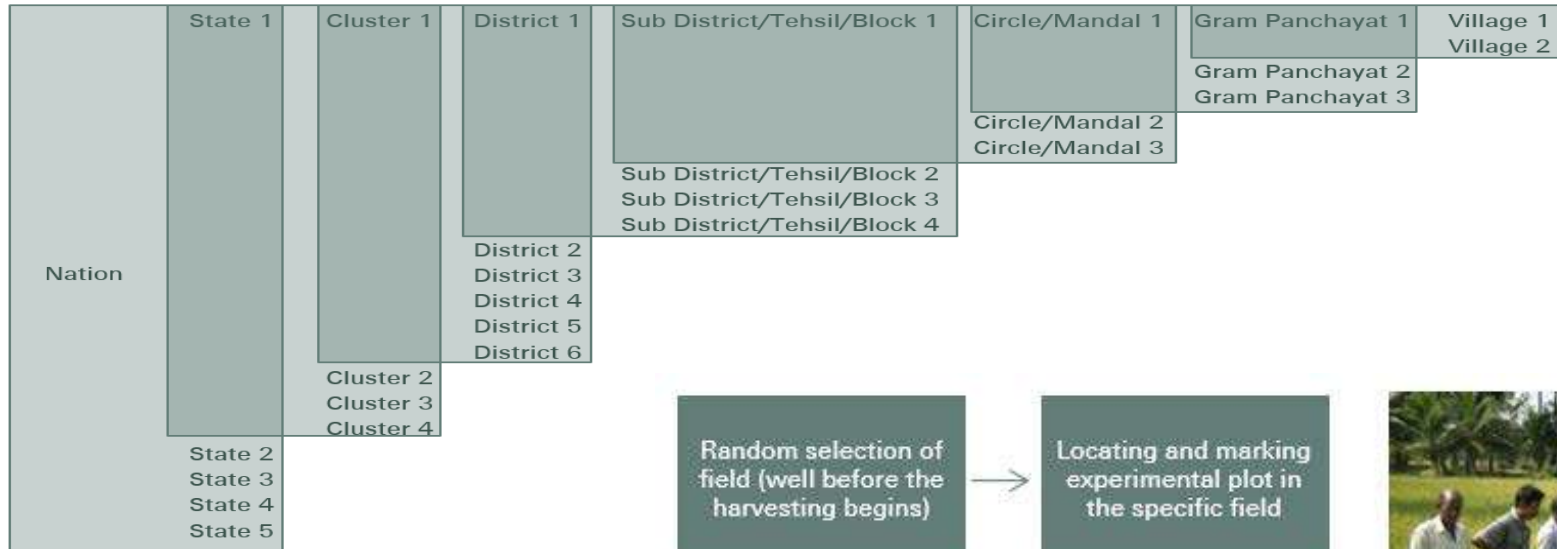
Year	Premium INR cr	Claim INR cr	Claim Ratio %
2016	22,345.51	16,177.72	72.4%
2017	25,307.80	21,511.63	85.0%
2018	28,000.00	25,200.00	90.0%

Results remain volatile in the last ten years:
droughts, cyclones, unseasonal rainfall.

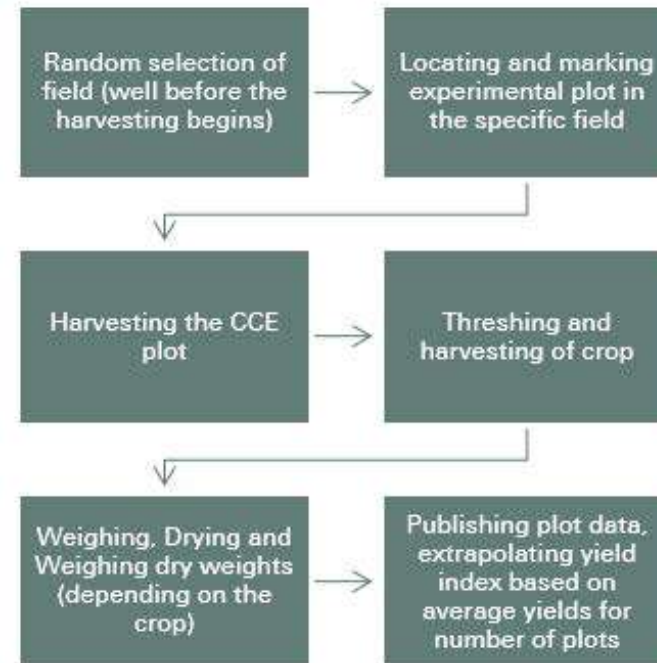
Check point : Sustainability/claim ratio in a
CAT year

- PMFBY – Yield Index - dominant product, RWBCIS – Weather Index - minor product
- Primary 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



Primary Insurance Pricing

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?

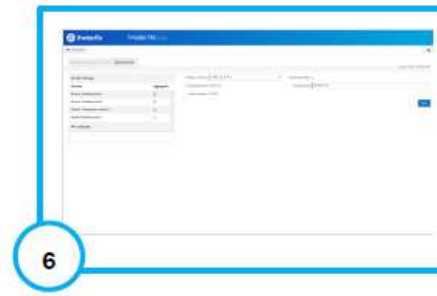
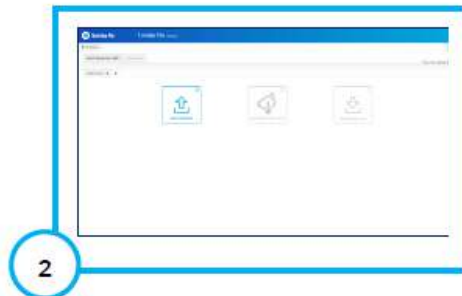
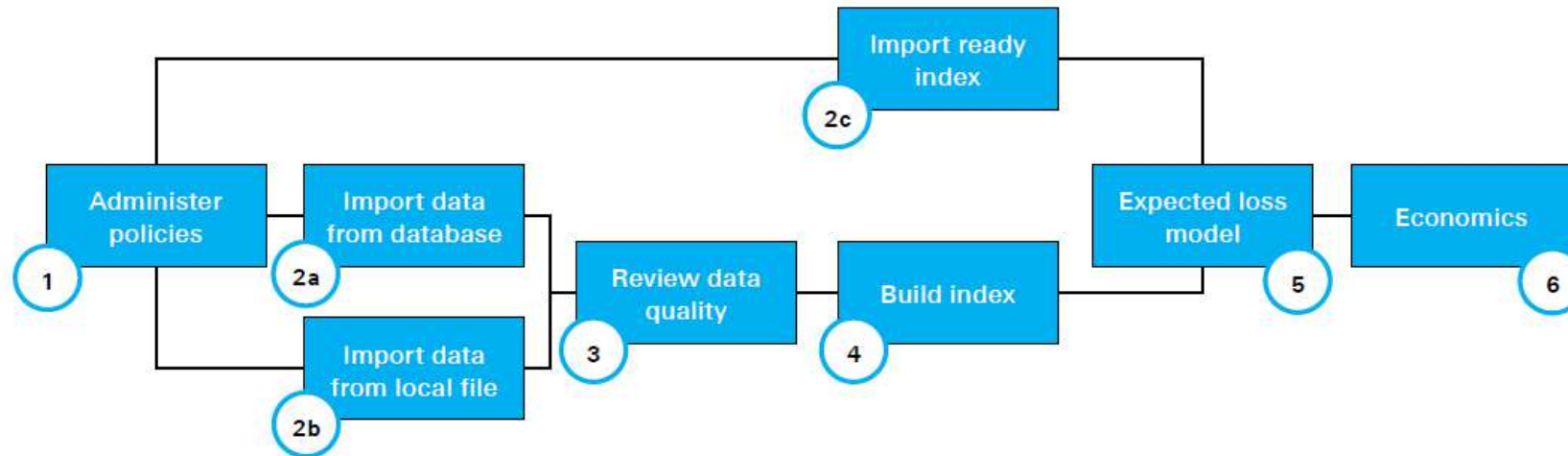
Weather Data - Challenges

- 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!

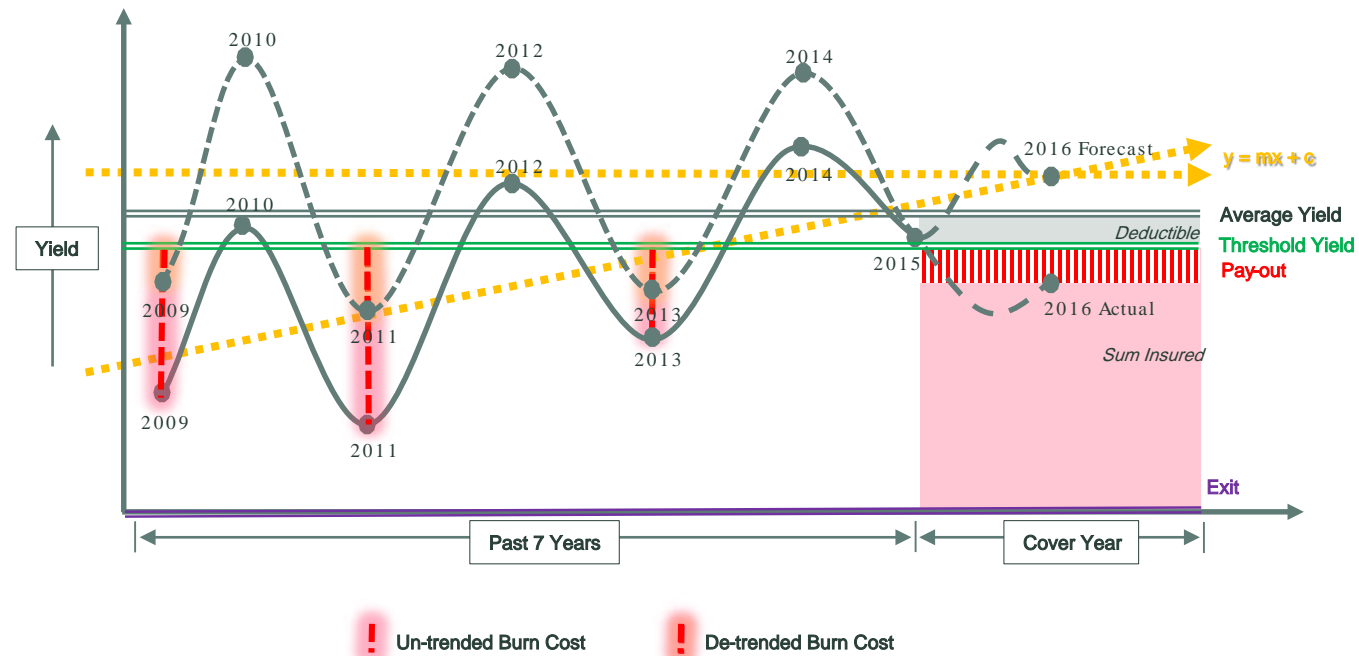
Yield Data - Challenges

- 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

Weather index pricing through Twister Re: end-to-end workflow



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		
Bengal Gram, Medak District																											
Mandal	1227	1138	985	967	1332	1350	1074	1492	1461	1026	80%	1007.28	0.0%	0.0%	2.2%	4.0%	0.0%	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%
																										886	12.0%
																										931	7.6%
																										903	10.4%
																										1005	0.0%
Average																										1003	6.71%

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	
Bengal Gram, Medak District MANDAL/TALUKA																										
/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-Regode	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	1608	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%	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%	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%	2.5%	1010	9.5%
/010-Tekmal	1227	1138	985	967	1608	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%	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%	2.2%	886	12.6%
/012-Rangampet or Kulcharam	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%	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%	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%	2.2%	1005	0.0%
Average	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%	0.00%	5.68%	1.77%	1003	5.66%
Standard Deviation	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

Agriculture Pool

Definition of a Governmental Insurance Pool

- Governmental risk pools are generally formed under state -specific legislation allowing for joint “pooling” of risks, such as for instance property loss from natural disasters or loss of crop yield due to a drought
- Pools are usually non-profit and mission -driven, with the goal to increase society’s resilience. This provides budgetary stability and predictability for the member entities and, ultimately, their constituents and taxpayers
- Pools can be owned and governed collectively by their member entities, who share the costs and savings that derive from their activity
- A government can be involved in various ways
 - Depending on the scheme the government is involved to a certain degree in a publicly owned entity, public -private entity
 - The government can just be involved in setting up the scheme and then be an advisory or even let the scheme run independently
 - Government can also be involved in subsidising the policy holders in terms of premiums or implementing other take - up incentives such as tax benefits
 - Government can incentivize the involvement of primary insurers by obtaining reinsurance at attractive terms

Public vs. Private vs. Public-Private Partnerships

A government can help out to establish an insurance pool in different ways and decide on its level of involvement. A decision is strongly dependent on the state of the domestic insurance market.



Public

- Insurance market is not developed
- Informational asymmetries in terms of availability of data exist
- Infrastructure and expertise for insurance is limited
- Limited access to global reinsurance market (constraints)
- Demand-supply disparity exists



Private

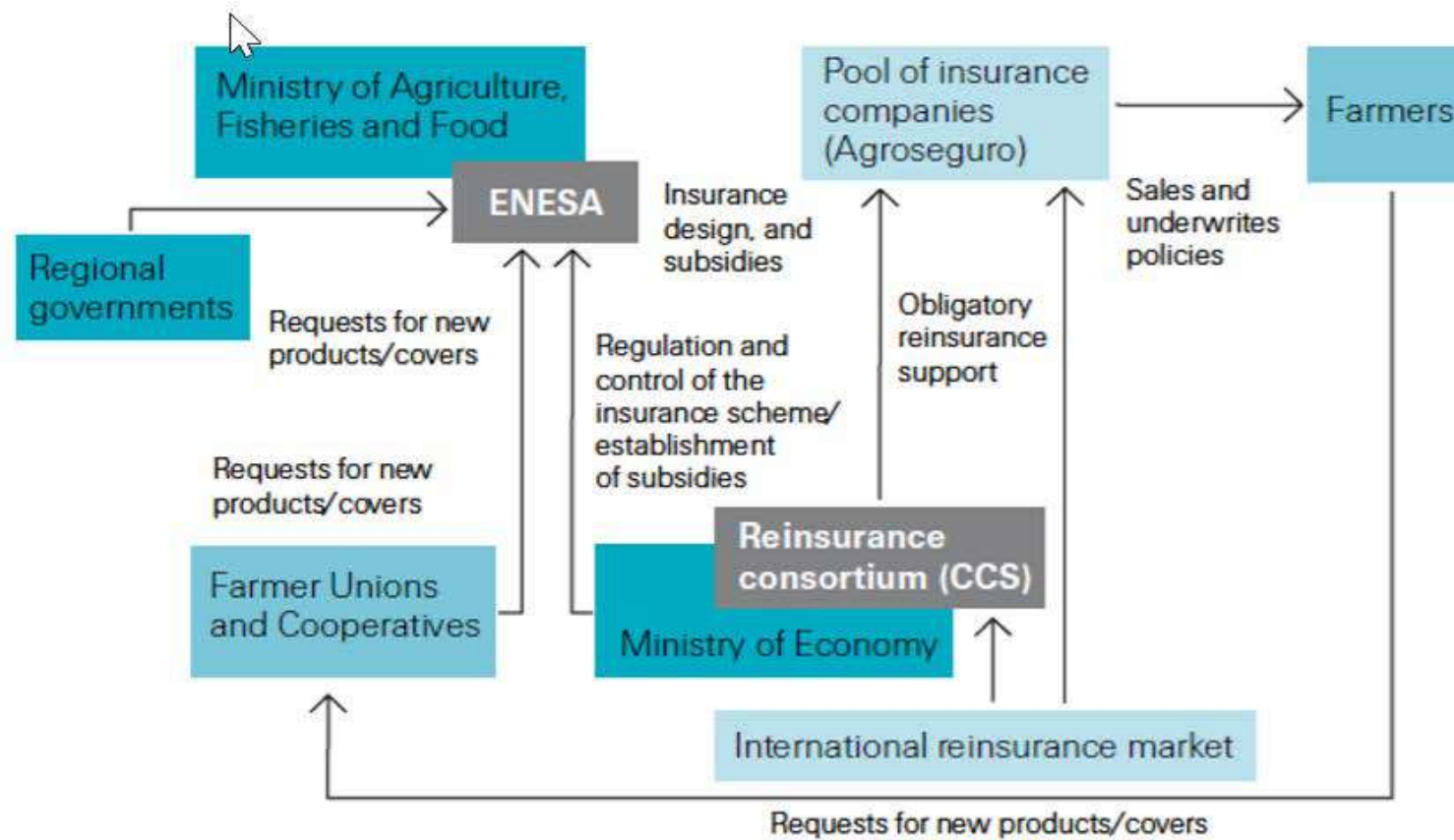
- Insurance market is mature with fair penetration
- Large amount of data is easily accessible to private insurers
- Infrastructure and expertise for insurance isn't utilized to its full potential
- Access to global reinsurance markets
- There is enough demand for supply to increase



Partnership

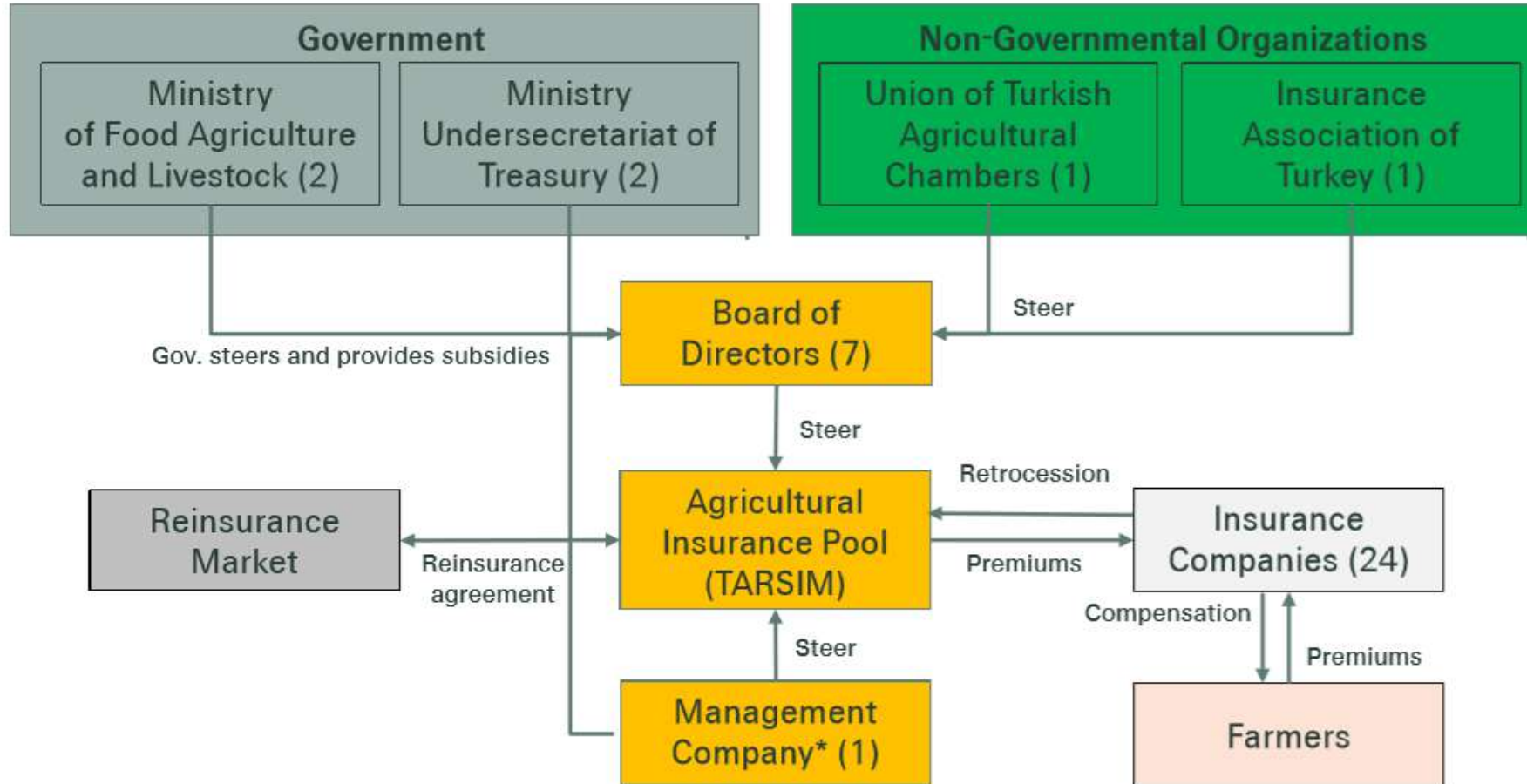
- Insurance market is in the developing stage
- Data is easily acquired (either by government or private insurers)
- Government is willing to invest in infrastructure/expertise via private insurers
- Access to global reinsurance market via government or private insurer
- Demand hasn't been exploited to its full potential

Spain – an example of private public partnership



Source: Swiss Re Economic Research & Consulting

Turkey: Turkish Agricultural Insurance System (TARSIM)



The pool is administered by a Board of Directors formed of 7 representatives; 4 from government ministries, 2 from NGOs and 1 management company.

Agriculture Insurance Pool for India?

- Can tenders and pool co exist?
- Will making scheme voluntary benefit formation of a pool?
- Who will steer and control best practices in UW and Claims
- Alignment of interest amongst insurers?
- Who will be the ultimate risk taker and how will this body be regulated?



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