

AGRICULTURE INSURANCE

Estimate,
Guestimate,
Guess.

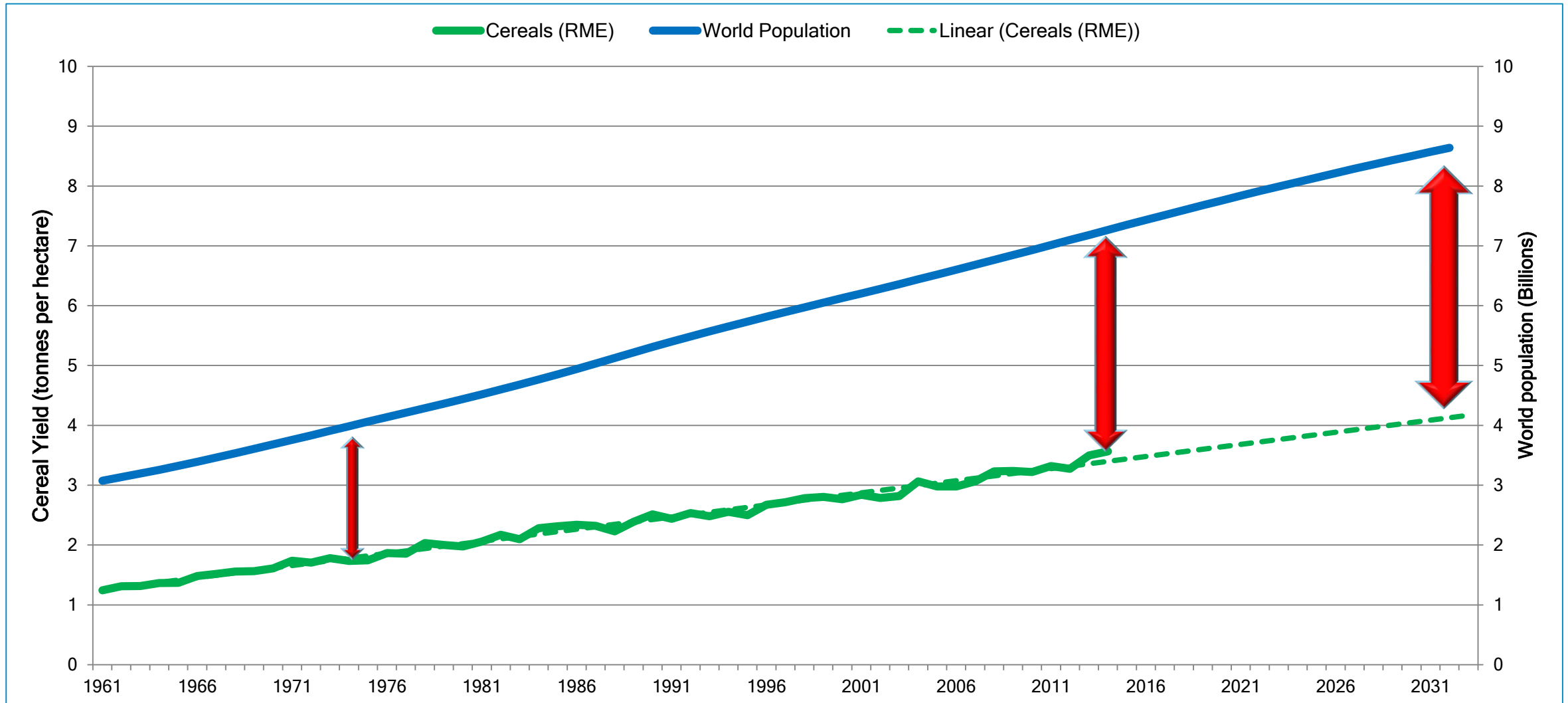
Peter Book, Allianz Re Singapore

Singapore, June 2018





CEREAL YIELD GAP (FAO STAT)



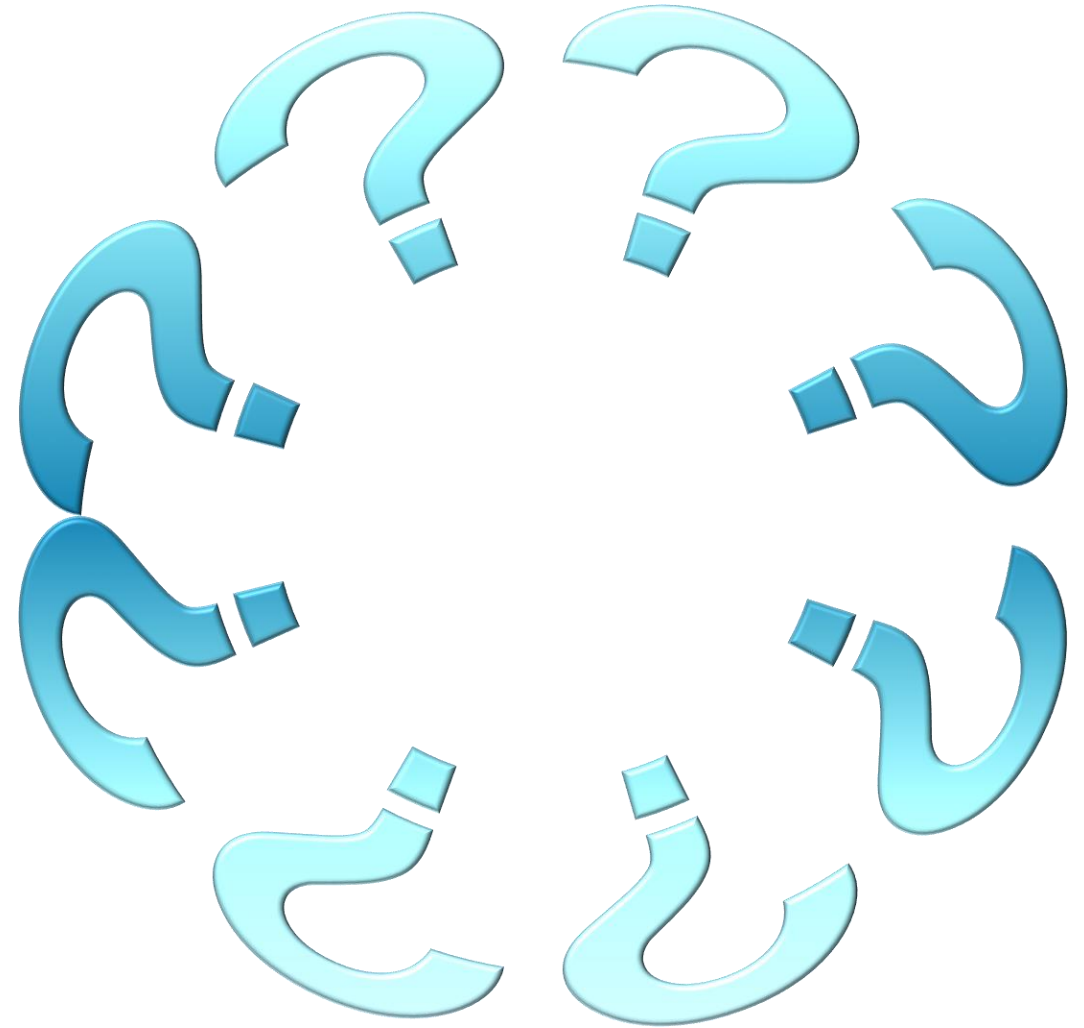
RISK VS REWARD – WHY INVEST

- **Risk management:**
 - The identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities.
 - Risk management's objective is to assure uncertainty does not deflect the endeavour from the business goals.



AGRICULTURE INSURANCE

- What is it trying to do
- What can it do
- Why is it used
- Attitude to risk
- Growing pains





WHAT IS THE TASK OF AGRICULTURAL INSURANCE?

Food Security - the 'Ultimate Objective'

But what is Food Security?

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. (Source: World Food Summit, 2001, FAO)

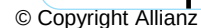
Hence the allied objectives of agricultural insurance as a medium of risk transfer are:

Reducing Poverty

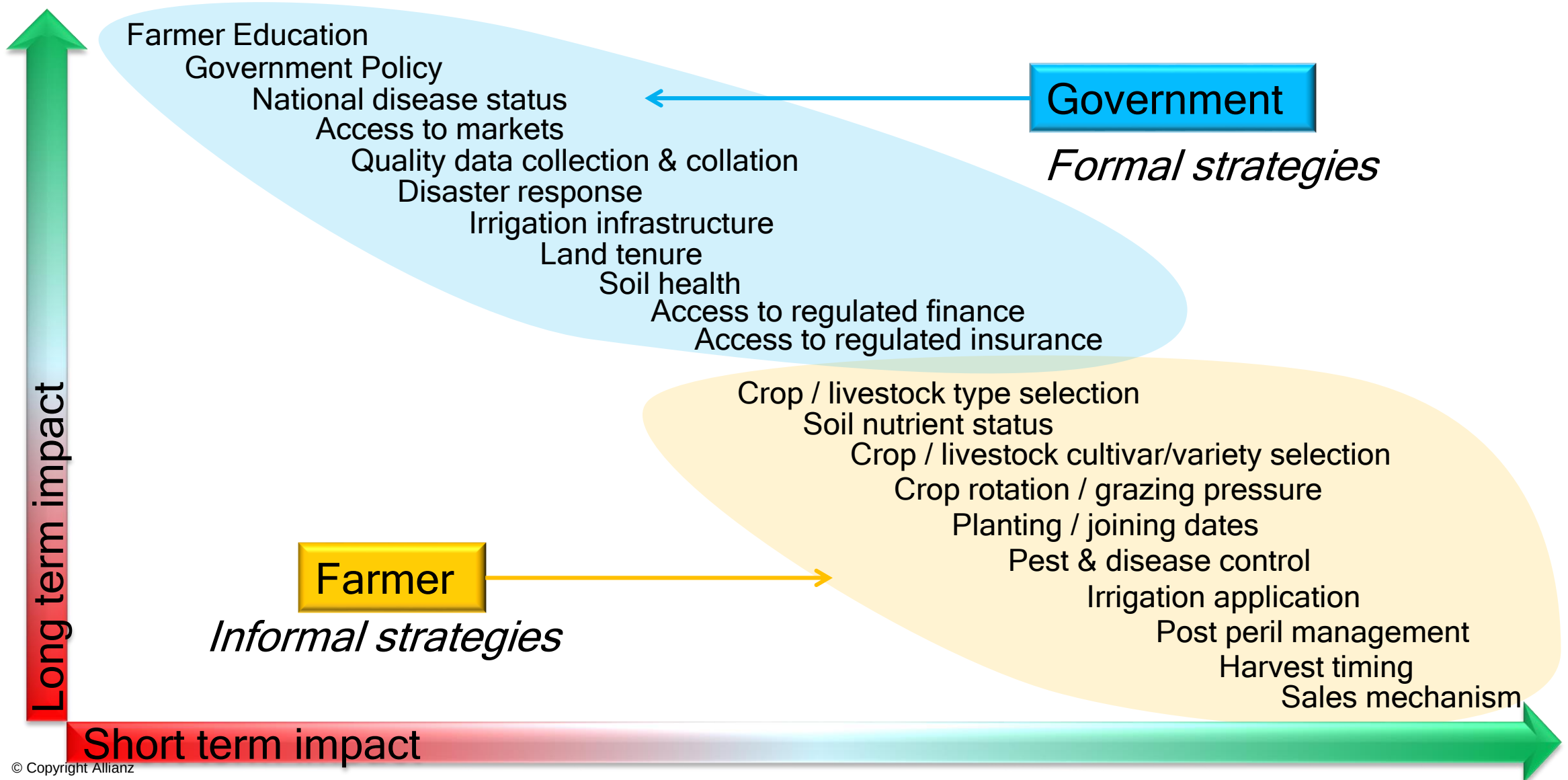
Reducing the Severity of
events

Ecologically sustainable
production of food

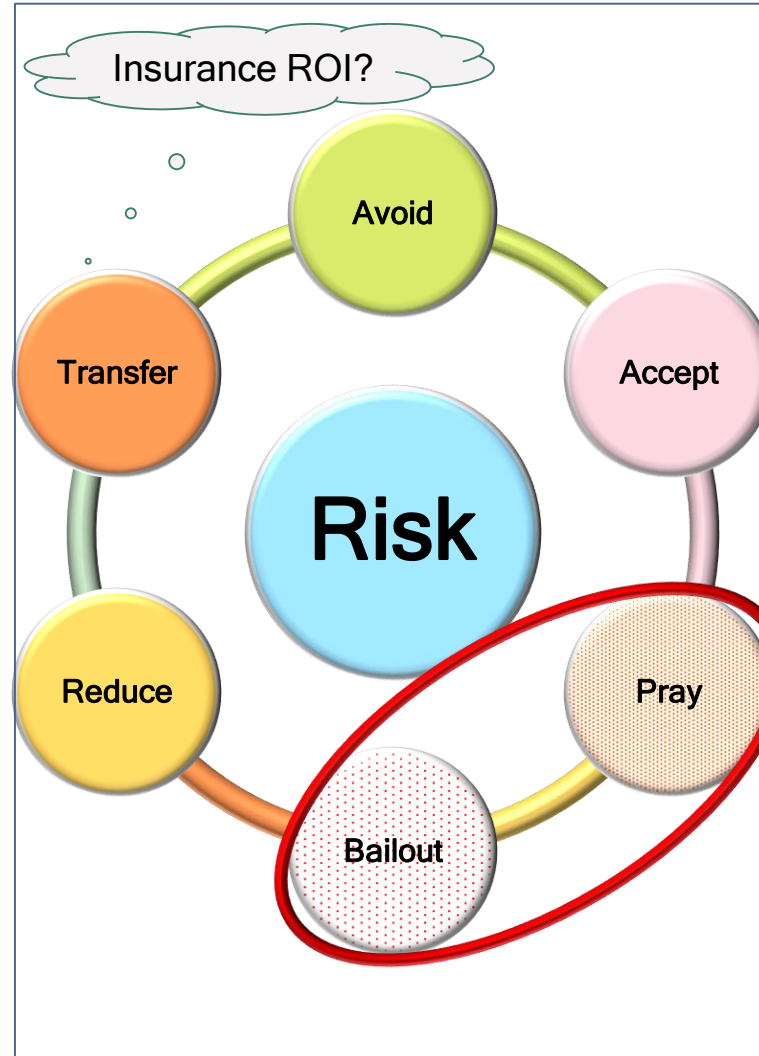
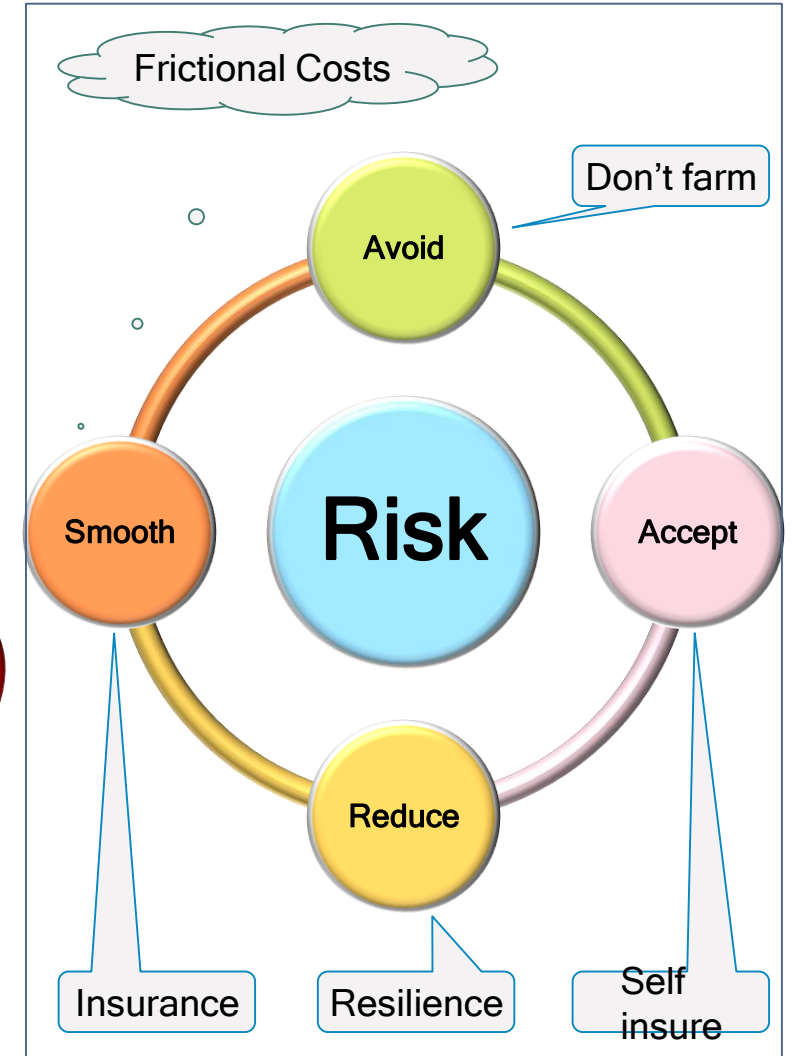
Agricultural Insurance plays an important role in reducing the vulnerability of the global food system to acute food shocks thereby contributing to resilience and sustainability



WHAT CAN BE MANAGED, AND BY WHOM?

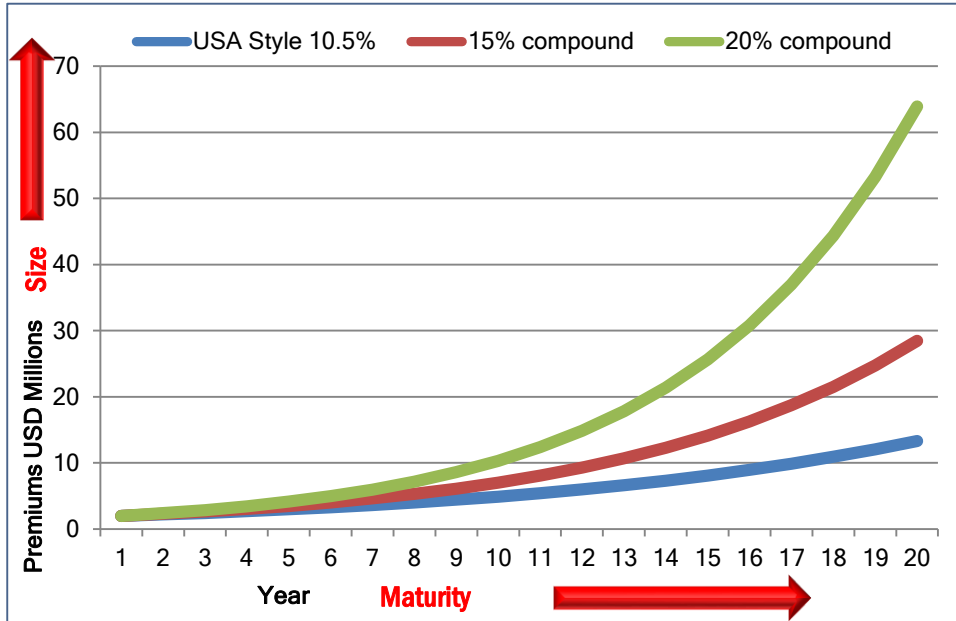
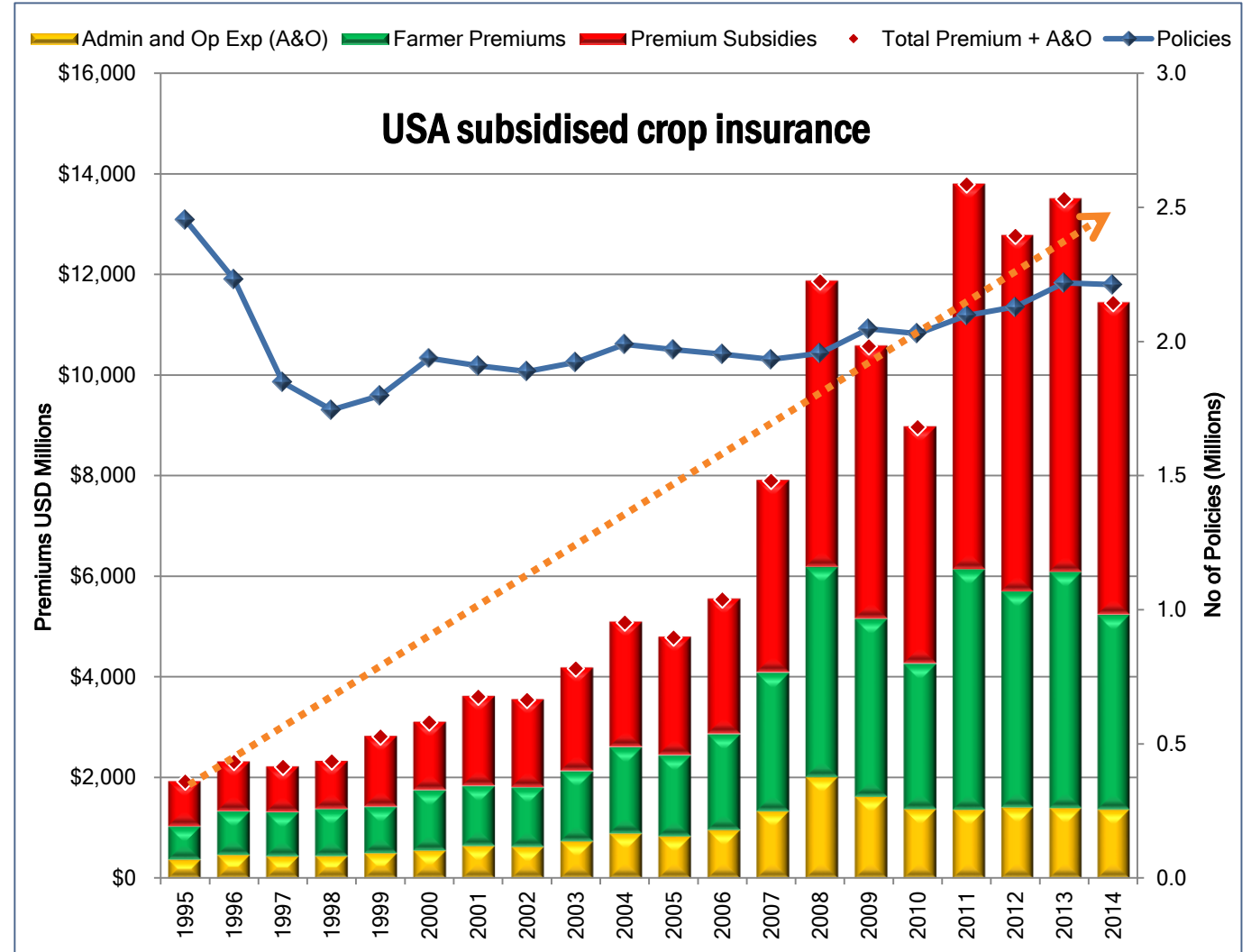


RISK MANAGEMENT – THEORY & PRACTICE





THE GROWTH DILEMMA – MATURITY VS SIZE



Maturity:

- Culture: insurance vs investment
- Role: volatility smoothing or political/social
- Data: historical and current, creates knowledge, calculated risk or a gamble?
- Processes: Distribution, loss assess & settle

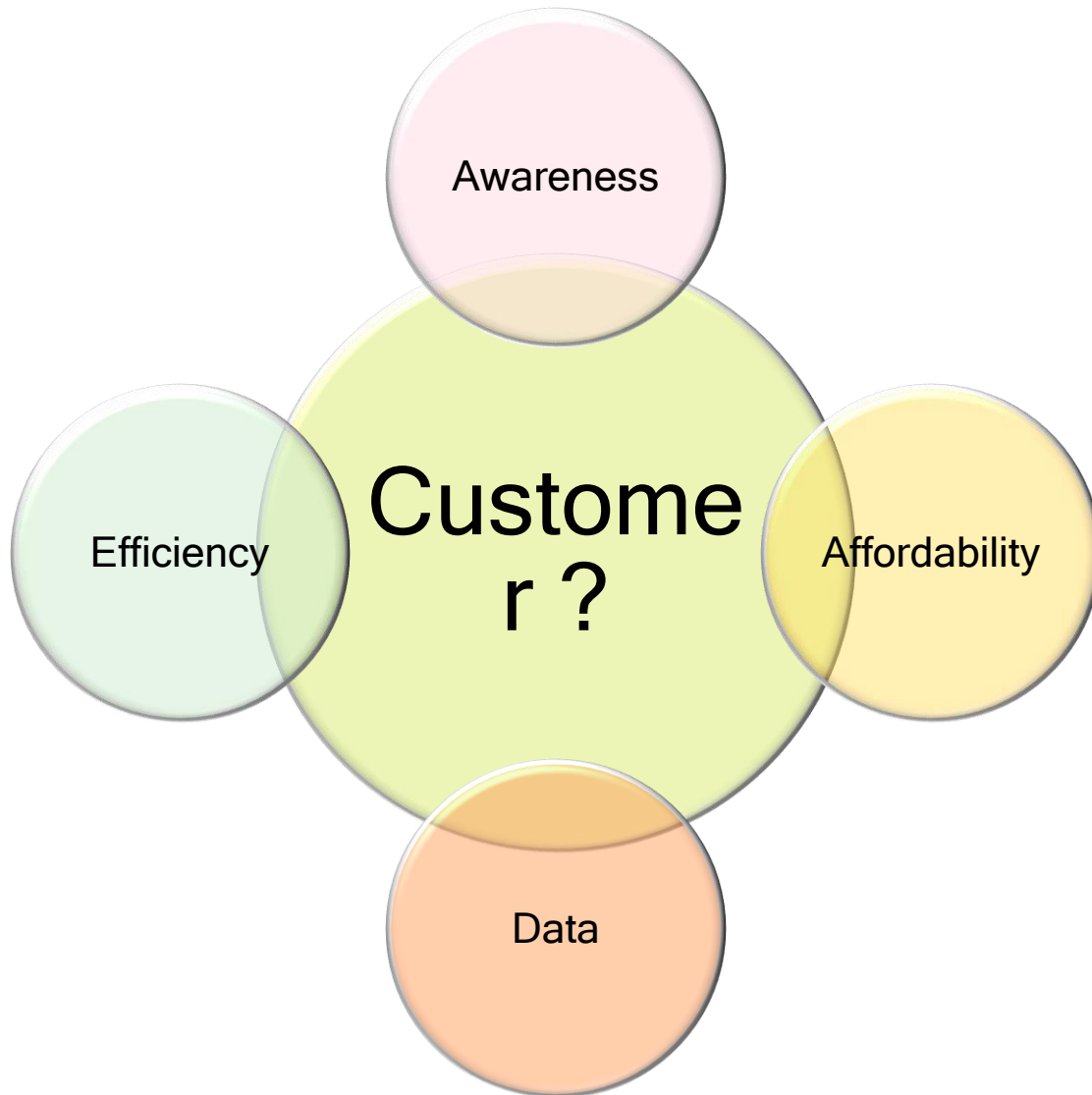
- Governance: legislative oversight

EMERGING MARKETS – COMMON CHALLENGES

- Product development
- Product design
- Product types
- Basis risk



INDUSTRY/SCHEME/PRODUCT DEVELOPMENT



- Who is the customer:
 - Government, Banks, Farmers, Society, Aggregators.
- What role(s) is insurance being tasked with:
 - Reduce poverty, stabilise rural population, food security, protect credit, farm income volatility, gov't fiscal volatility.
- Awareness:
 - Do they know of insurance and how it works?
- Affordability:
 - What is their purchasing power? Subsidies?
- Data:
 - What can be measured for rates/indemnity calculation?
 - How severe is the basis risk, in both directions?
- Efficiency:
 - Cost, accuracy & timeliness of distribution and claims,
 - Avoid unique cost structures, leverage off existing.



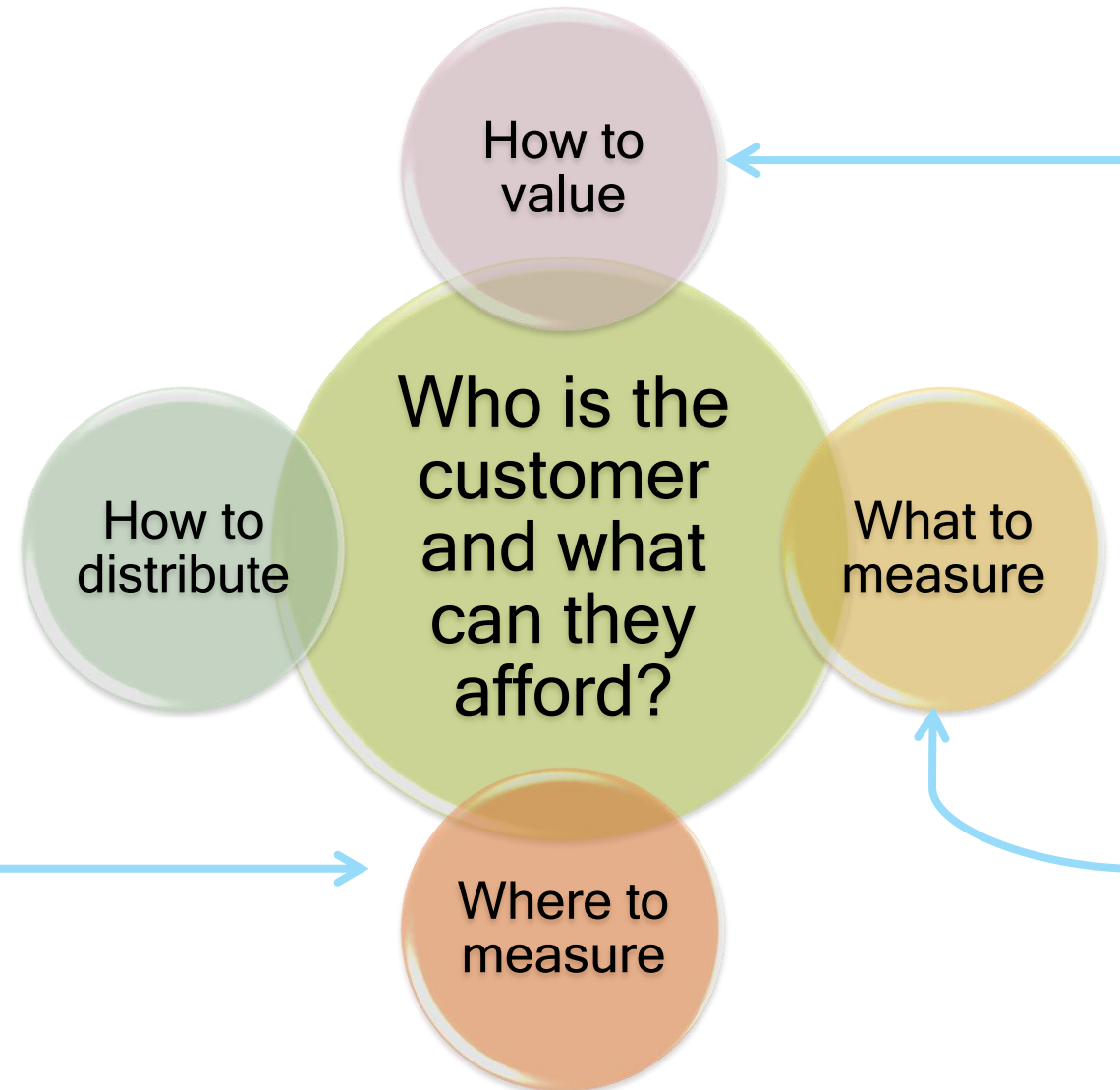
CONSIDERATIONS FOR PRODUCT DESIGN

- ❖ Direct to Farmer
- ❖ Credit/loans
- ❖ Input providers
- ❖ Markets/traders

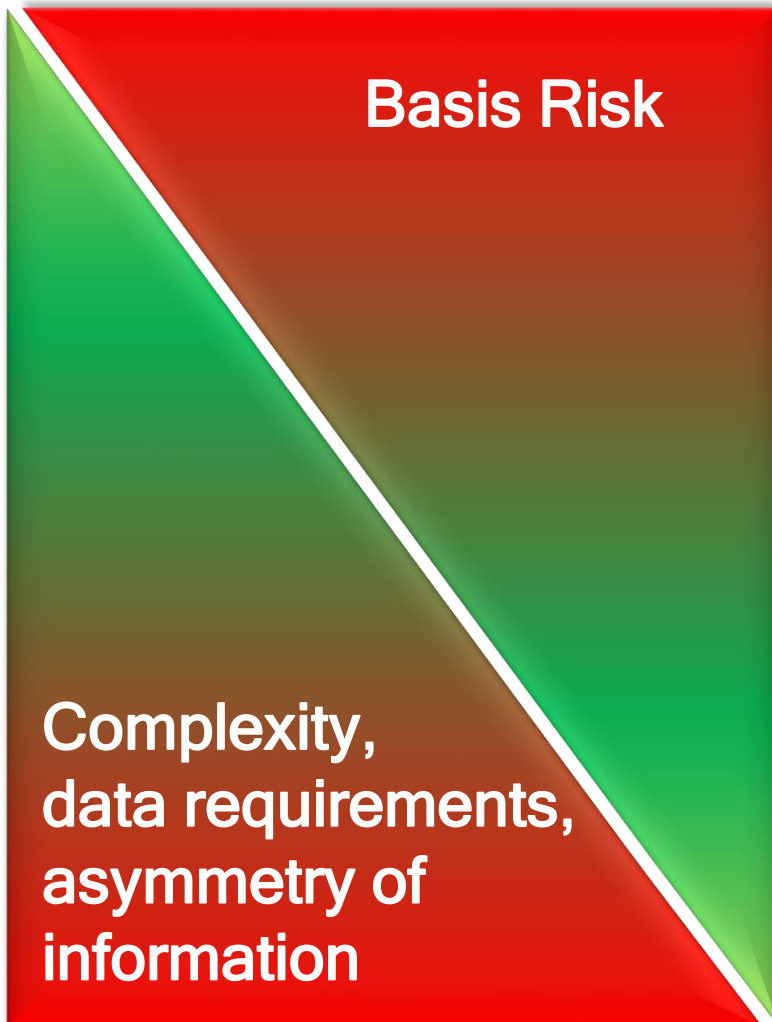
- ❖ Input value
- ❖ Gross margin
- ❖ Net Present Value
- ❖ Net Sale Value

- ❖ National
- ❖ Regional
- ❖ Local Area
- ❖ On-Farm

- ❖ Weather
- ❖ Growth
- ❖ Yield
- ❖ Revenue



AGRICULTURE INSURANCE PRODUCTS



Product example	i.e.: Country
Area Weather Index	India
Area Price Index	China
Area Simulated Yield/Pasture Index	Australia/USA/France
Area Disaster Index	Thailand
Area Mortality Index	Mongolia
Area Yield Index	India
Area Damage Index	China
Farm/Plantation Damage	Australia/USA/Canada
Farm/Plantation Yield	USA/Canada
Farm/Animal Mortality	Various
Farm Crop Gross Margin	USA/Canada
Farm Crop Revenue	USA/Canada
Whole Farm Revenue	USA/Canada

BASIS RISK – AREA YIELD MEASUREMENT



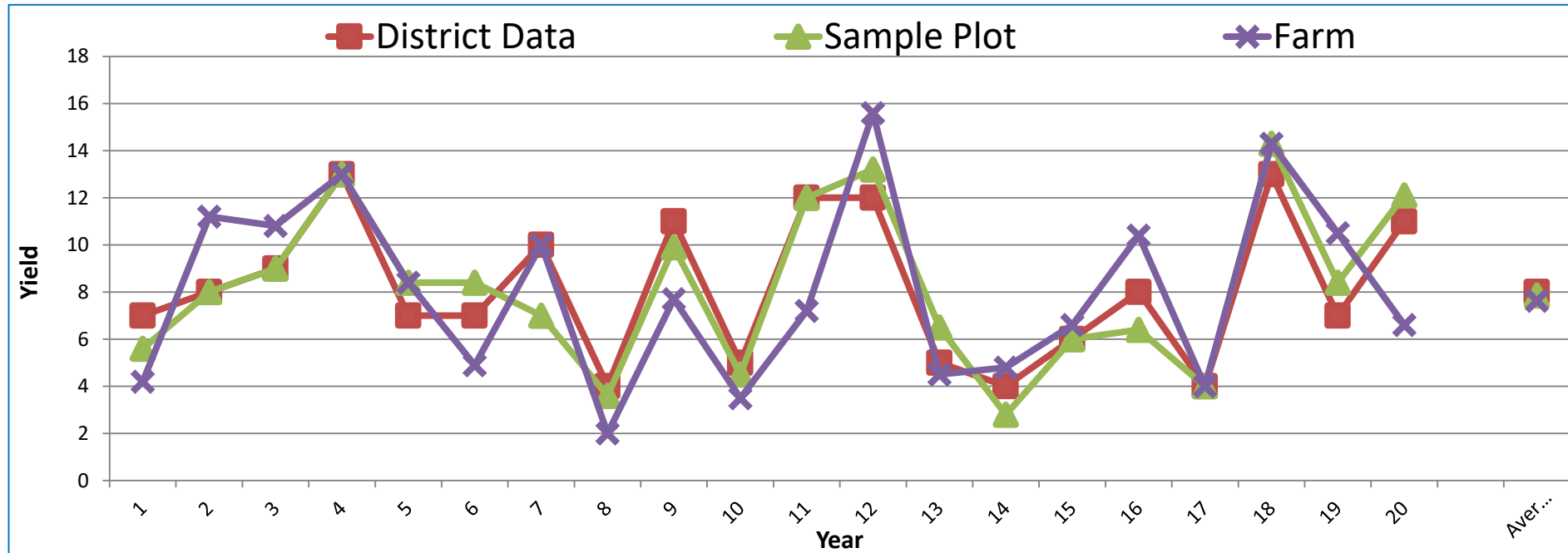
Historical yield data at District level – drives loss cost & rates



Current season indemnity yield data at Village level – drives loss settlement



Actual loss occurs at farm level – drives farmers income & livelihood



Loss Cost at 80% coverage

District	6.38%
Village	7.30%
Farmer	10.37%



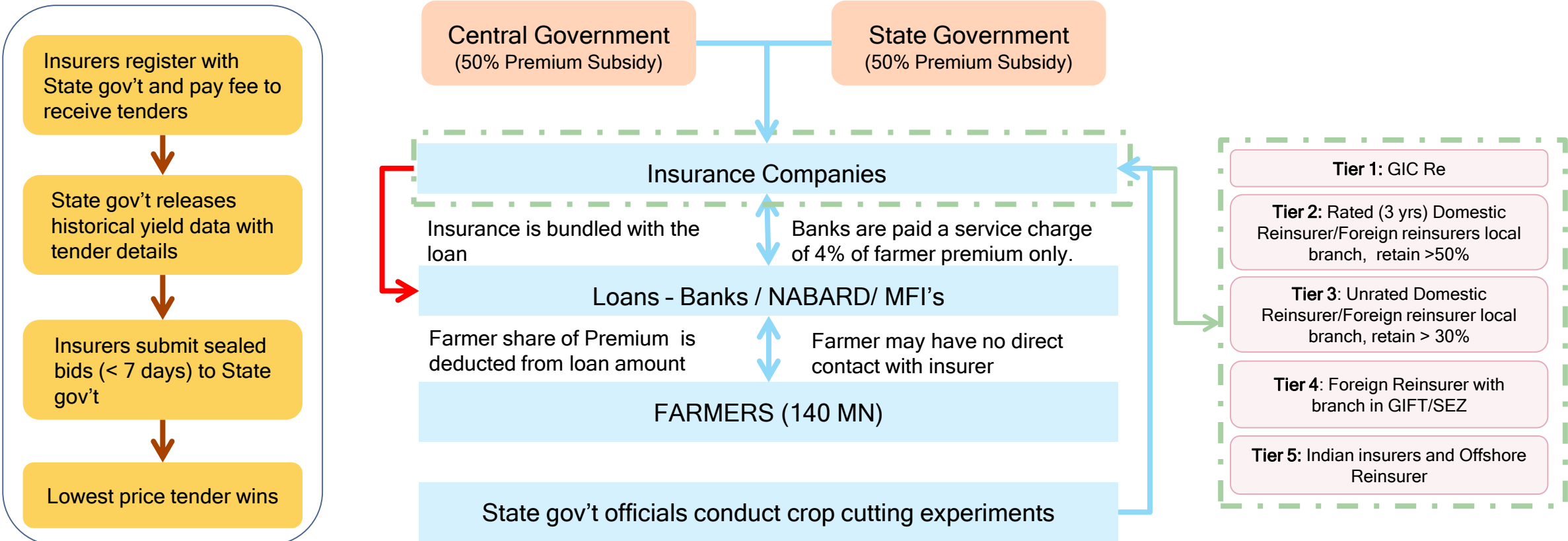
INDIA CROP INSURANCE – GROWING PAINS

- Structure
- Rate build
- Data quality
- Guessing.....





INDIAN CROP INSURANCE – PMFBY & RWBCIS





INDIA CROP INSURANCE RATE BUILD

Data origin

- Granularity as close to insured unit as possible

Data period – burning cost

- Min 10 & Max 15 yrs, Exposure from past 3 years

Data period - threshold yield

- Simple average last 10 yrs, exclude up to 2 calamity years

Detrending

- Only when 10 yr + slope (excl calamity years) is positive including forecast year

Adjustments

- Minimum loadings for catastrophic risk and non-parametric losses, circa 15% at portfolio level

Commercial loadings

- Minimum loading to achieve final commercial premium, circa 20% at portfolio level



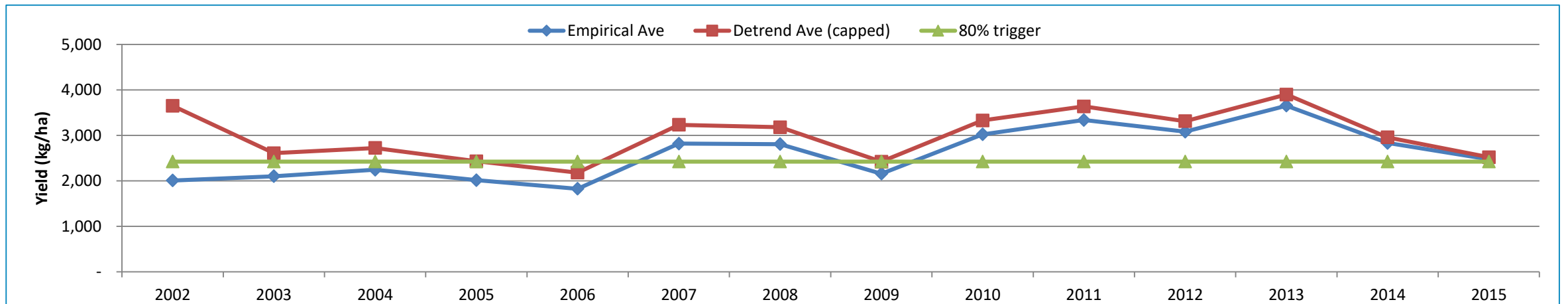
INDIA SAMPLE DATA – ODISHA, PADDY

Cluster	Crop	District	Tehsil	Block	Gram Panchayat	Yield Data									
						2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	ASARADA	2,581	2,255	1,812	1,655	1,639	2,792	3,983	4,741	1,529	3,912
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	BABANDHA(BABANDH)	2,581	2,255	1,812	1,655	2,043	3,347	3,899	4,587	2,027	4,836
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	BAMPA	2,581	2,255	1,812	1,655	1,906	3,376	3,551	4,351	1,798	3,562
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	BAUNSAPOKHARI	2,581	2,255	1,812	1,655	1,713	3,156	3,855	4,389	3,857	4,837
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	BUHALIPAL	2,581	2,255	1,812	1,655	1,339	3,316	3,400	4,771	2,066	4,418
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	CANDANALI(GANDANALI)-(GANDANALI)	2,581	2,255	1,812	1,655	1,718	3,880	2,216	4,193	1,371	4,093
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	CHITALPUR	2,581	2,255	1,812	1,655	2,360	3,949	2,369	4,206	1,704	4,157
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	DANDIRI	2,581	2,255	1,812	1,655	2,079	2,750	2,025	4,014	2,300	3,635
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	DUDURUKOTA	2,581	2,255	1,812	1,655	1,017	4,321	3,359	3,747	2,924	4,702
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	GALAPADA	2,581	2,255	1,812	1,655	851	3,578	3,971	5,002	1,751	2,483
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	GIRIDHARIPRASAD	2,581	2,255	1,812	1,655	2,400	3,903	3,798	4,992	2,434	3,558
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	GULEHI	2,581	2,255	1,812	1,655	682	3,574	3,866	4,897	1,512	3,236
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	JORADA	2,581	2,255	1,812	1,655	1,811	4,302	2,826	4,458	2,231	4,329
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KADALA	2,581	2,255	1,812	1,655	613	4,138	3,266	4,055	1,511	4,430
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KALINGA	2,581	2,255	1,812	1,655	2,087	4,644	2,676	4,543	1,810	4,205
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KANSARA(KANDASAR)	2,581	2,255	1,812	1,655	1,833	3,003	3,476	5,210	2,434	2,769
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KANTAMILLA(HQR.DHANDAR)	2,581	2,255	1,812	1,655	2,807	3,661	3,111	5,209	2,293	4,363
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KANTIMILI	2,581	2,255	1,812	1,655	1,243	3,432	3,779	4,694	1,483	4,341
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KARANDA	2,581	2,255	1,812	1,655	2,017	3,205	3,751	4,308	2,028	4,434
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KHALIBOREI	2,581	2,255	1,812	1,655	2,208	4,121	2,865	4,303	1,904	4,823
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KOKAR(THOKAR)	2,581	2,255	1,812	1,655	1,135	3,087	3,814	5,273	1,864	3,964
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KUKUTI	2,581	2,255	1,812	1,655	1,656	3,340	3,913	4,566	1,876	4,034
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KUNUA	2,581	2,255	1,812	1,655	1,374	3,466	3,946	4,020	1,363	4,334
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	KUTUNIA	2,581	2,255	1,812	1,655	1,703	3,123	2,945	4,860	2,027	4,428
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	MADHAPUR	2,581	2,255	1,812	1,655	1,817	2,825	3,209	4,481	1,525	1,864
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	MAHALUNDA	2,581	2,255	1,812	1,655	1,235	4,134	2,711	4,806	1,816	2,379
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	MATURA(HATURA)	2,581	2,255	1,812	1,655	1,339	3,567	2,047	4,504	2,611	3,621
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	NABAKISHOREPUR	2,581	2,255	1,812	1,655	1,432	3,616	3,310	4,404	2,090	3,335
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	NIJIGARH (HINDOL NAC)	2,581	2,255	1,812	1,655	1,860	3,018	3,544	4,904	1,515	4,987
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	NUABAGA(NUABAG)	2,581	2,255	1,812	1,655	1,424	3,746	2,598	4,331	1,813	3,103
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	NUAGAON	2,581	2,255	1,812	1,655	805	2,679	3,489	3,806	1,794	3,571
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	PAIKAPURUNAKOTA	2,581	2,255	1,812	1,655	1,236	3,860	3,322	4,521	1,565	4,522
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	PANJAGOL(RANJAGOLA)	2,581	2,255	1,812	1,655	1,362	2,843	4,223	5,495	1,516	3,802
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	PATALA	2,581	2,255	1,812	1,655	610	3,119	3,856	4,721	2,786	4,494
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	RASOL	2,581	2,255	1,812	1,655	2,876	3,301	2,413	5,372	2,194	3,665
Cluster 1	PADDY	DHENKANAL	HINDOL	HINDOL	SANJAPADA	2,581	2,255	1,812	1,655	792	3,451	2,922	4,799	1,462	4,201



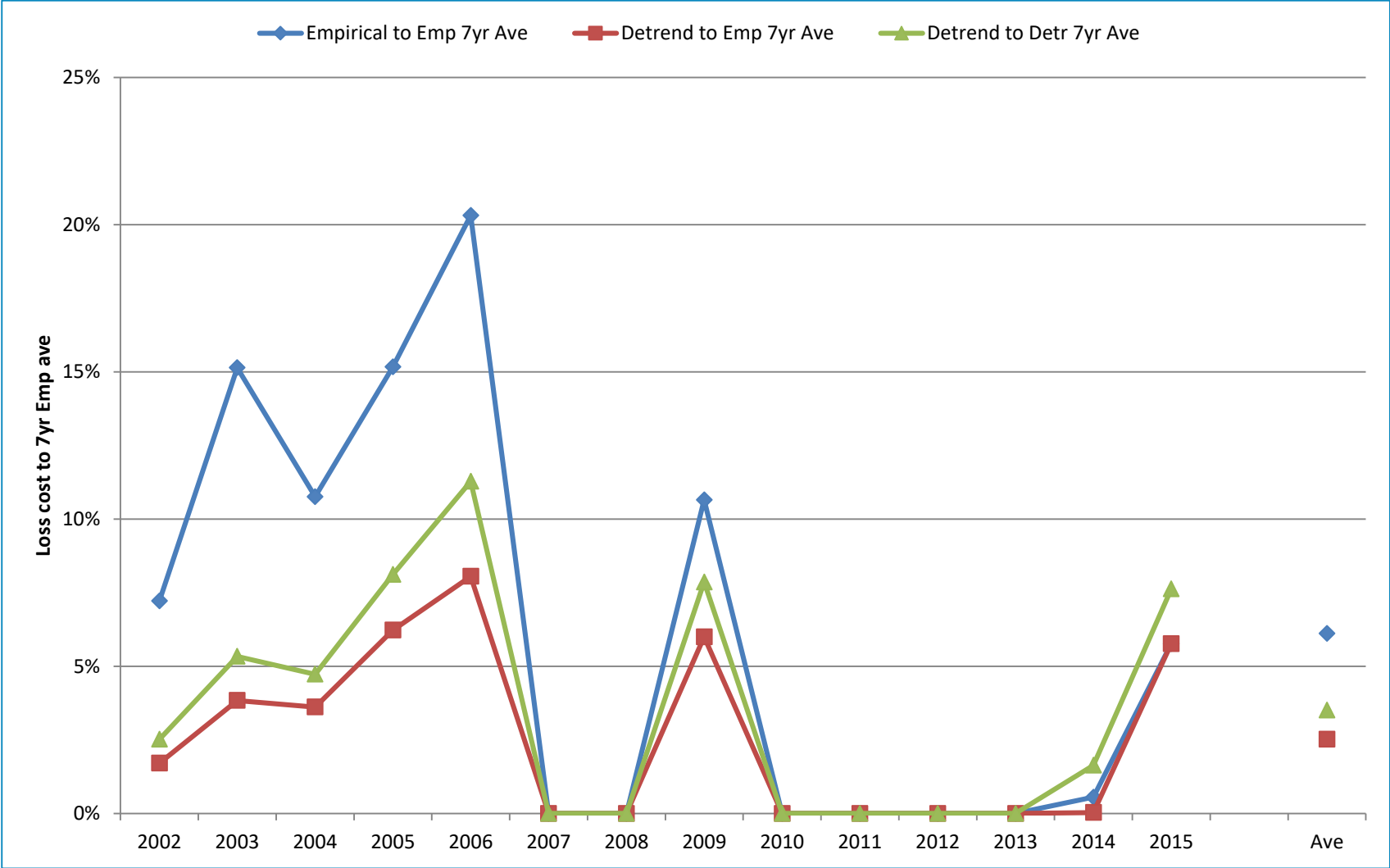
MAHARASHTRA – NAZIK MAIZE

Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
DINDORI	1425	2474	1450	2015	1807	2899	2886	1892	3577	4422	3975	3638	2503	2187
NIPHAD	2643	1963	1313	1561	1807	2899	2886	1892	3577	4422	3975	3638	2503	2187
SINNAR	2500	1963	2226	1505	1807	2899	2886	1892	3577	4422	3975	3638	2503	2187
YEOLA	2775	1388	2600	1900	1807	2899	2886	1892	3577	4422	3975	3638	2503	2187
CHANDVAD	3925	2061	2205	2033	1807	2899	2886	1892	3577	4422	3975	3638	2503	2187
MALEGAON	2006	1247	2083	2275	1807	2899	2886	2452	2664	2514	2395	3991	3323	2851
BAGLAN	3649	2439	2954	1855	1807	2899	2886	2452	2664	2514	2395	3991	3323	2851
KALWAN	2307	3638	2332	1870	1807	2899	2886	2452	2664	2514	2395	3991	3323	2851
NANDGAON	1573	1963	3273	2645	1807	2899	2886	2452	2664	2514	2395	3991	3323	2851
DEVALA	2500	1963	2226	2494	1807	2899	2886	2452	2664	2514	2395	3991	3323	2851
Empirical Ave	2530	2110	2266	2015	1807	2899	2886	2172	3121	3468	3185	3815	2913	2519
Detrend Ave (capped)	3069	2607	2722	2430	2180	3230	3176	2420	3328	3634	3309	3897	2954	2519
80% trigger	2422	2422	2422	2422	2422	2422	2422	2422	2422	2422	2422	2422	2422	2422





DETRENDING MAHARASHTRA

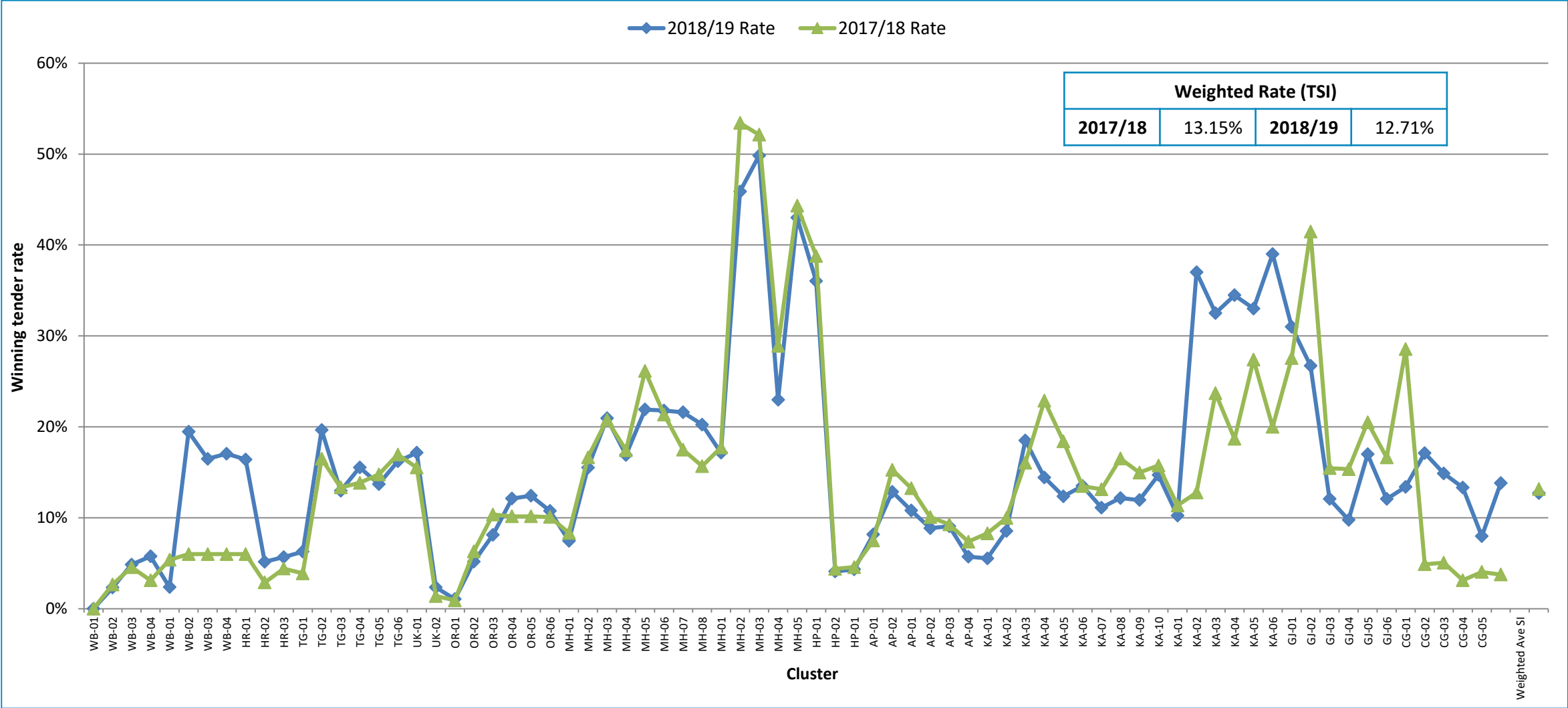


	Ave	StDev	CV
Empirical to Emp 7yr Ave	6.11%	7.15%	1.169
Detrend to Emp 7yr Ave	2.52%	2.97%	1.181
Detrend to Detr 7yr Ave	3.51%	3.93%	1.120

Non parametric loadings (examples):	
Cat Loading	5%
Data Uncertainty	10%
Data Heterogeneity Loading	10%
Loading for Margin and Expenses	5%



INDIA YEAR TO YEAR RATE MOVEMENTS

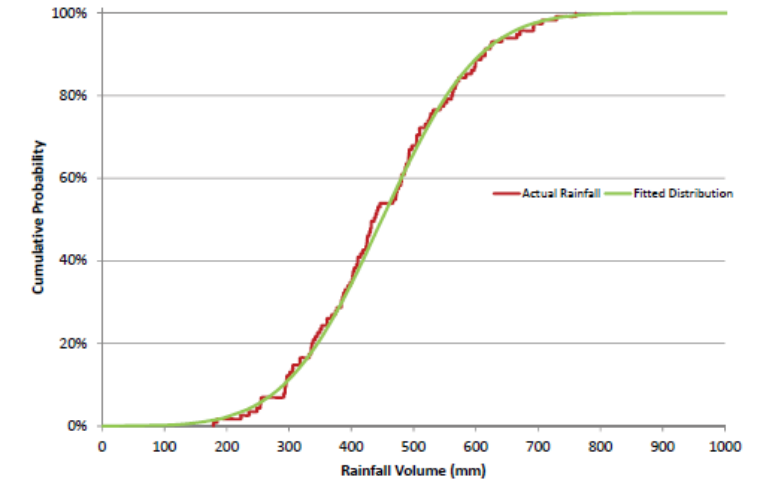
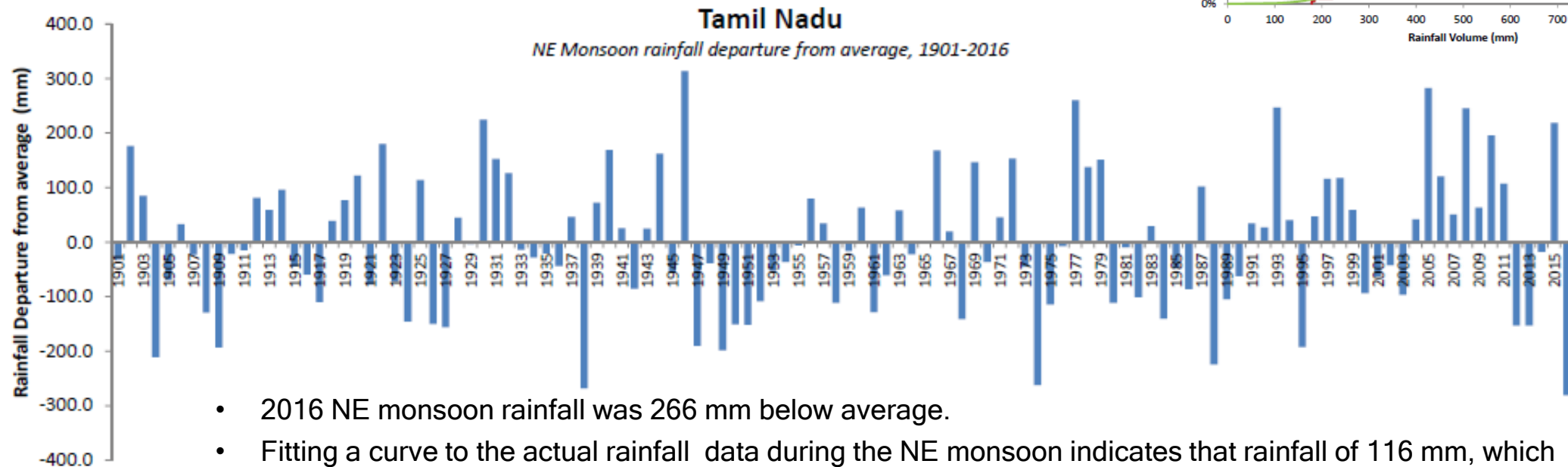




TAMIL NADU - RAINFALL

❖ CAUTION:

- ❖ Rainfall may have a variable correlation with yield:
 - ❖ Quality vs quantity, irrigation, temperature, daylight hours, pest and disease
- ❖ Yield may have a variable correlation with loss:
 - ❖ Accuracy & consistency of measurement, tampering, political forces
- ❖ Explore options for testing the correlation of different data sets/sources



- 2016 NE monsoon rainfall was 266 mm below average.
- Fitting a curve to the actual rainfall data during the NE monsoon indicates that rainfall of 116 mm, which corresponds to rainfall levels in 2016, happens about 1.11% of the time (1 in 90) years.

SOFT FACTORS HIDE HARD HITTING FACTS

Criteria for assessing quality of cedent

In Agricultural Insurance since?

Present in how many states for 2017/18

Largest state as % of total EPI

Present in how many clusters for 2017/18

Largest cluster as % of total EPI

Retention Levels

QS Commissions - Best Estimate

L/R Cap at

Stop Loss Attaching at

Stop Loss Layer

Rate of SL layer

Pain Point for Cedent

Protection for top layers (50% xs 250%)

Total Score for 'Alignment of Interests'

Primary Pricing Adequacy (PPR/APPR/QPR)

Quality of the UW team

Use of proprietary systems / models

Management team (RI-UW collaboration)

Contribution of agriculture to overall GWP

Claims Management Resources

Quality of RI panel

Industry Best Practices/ reputation

Placement History

Feedback from Lead Reinsurer

Market evolving at a very fast pace:

1) Sharp drop in commission levels for 2018-19

2) 2 “treaty standards” : GIC Re led and “open market” placement

Changes in UW strategy / team need to be assessed: high turnover at some cedents, recycling of talent and past underwriting approaches.

Differences in L/R operating in same cluster can be dramatic due to Crop Cutting Experiment (CCE) rigor:

Madhya Pradesh – 3 adjoining clusters with three different insurers – drought hit for 2017-18

L/R are 130%, 180% and 220% +

Suggested that main differentiator in results in is the on-ground efforts on CCE’s made by cedents.

Economics might indicate profitability but on-ground reality might reveal unethical practices to ‘manage’ L/R

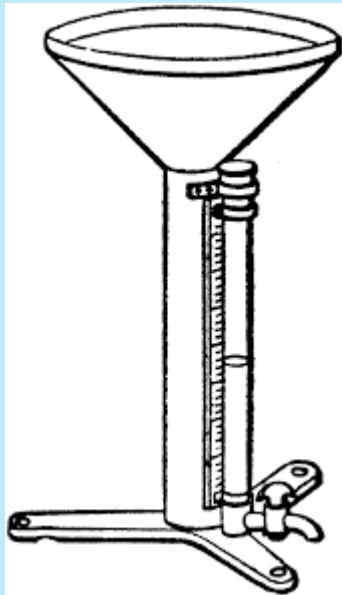
Facultative Placements:

Important to know why ‘facultative’ placements are being offered – pricing inadequacy or violation of treaty conditions.

Important to understand various viewpoints – viz., treaty leader, government view, cedent perspective , reinsurer appetite

Can underpriced opportunistic business balance out adequately priced business where inverse (or at least weak) correlations exist. How bad is the pricing?

FIJI RAINFALL INDEX EXAMPLES





Fiji Meteorological Service
RSMC Nadi-Tropical Cyclone Centre
"Official Source of reliable "first-level" information on tropical cyclones occurring in the South-West Pacific Ocean. All products on this site are on Fiji Standard Time = (UTC + 12HRS)
Fiji Daylight Saving Time(DST) = (UTC + 13HRS)
ISO 9001:2015 certified provider of Aviation Meteorological Services



Winner - Fiji Business Excellence Award 2014

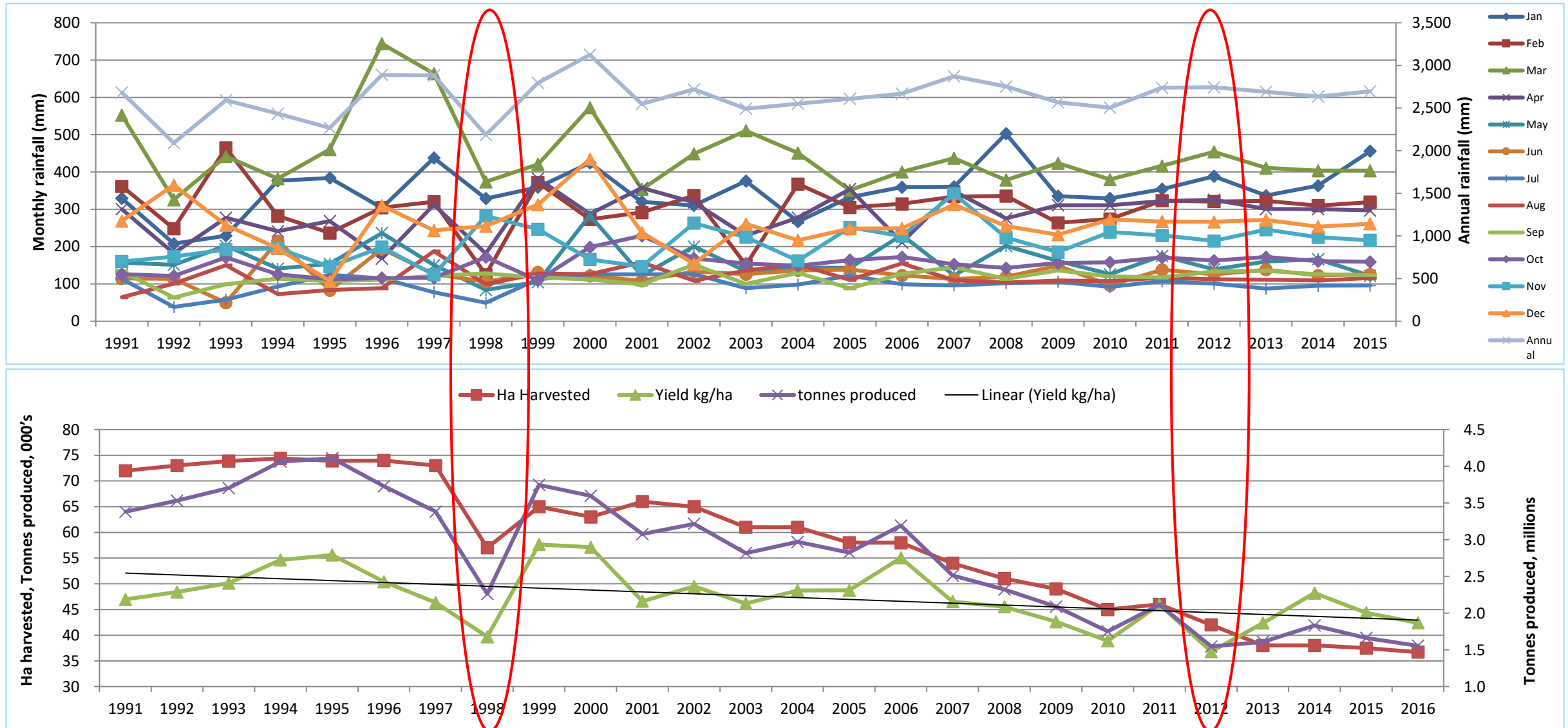


THE WORLD BANK GROUP

Climate Change Knowledge Portal
For Development Practitioners and Policy Makers

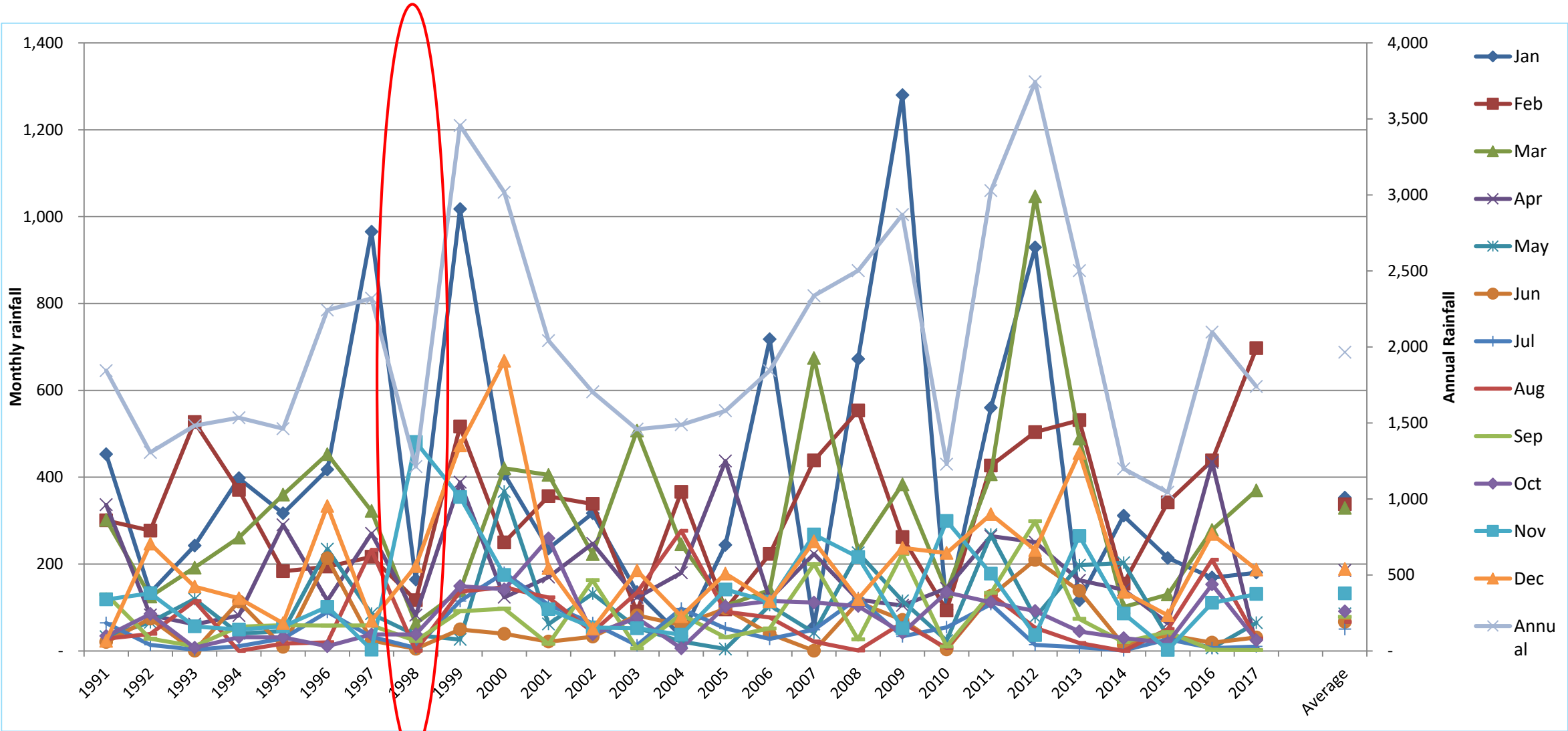


NATIONAL RAINFALL & SUGAR CANE — WORLD BANK & FAO DATA





LAUTOKA MILL RAINFALL – FIJI METEOROLOGICAL SERVICE



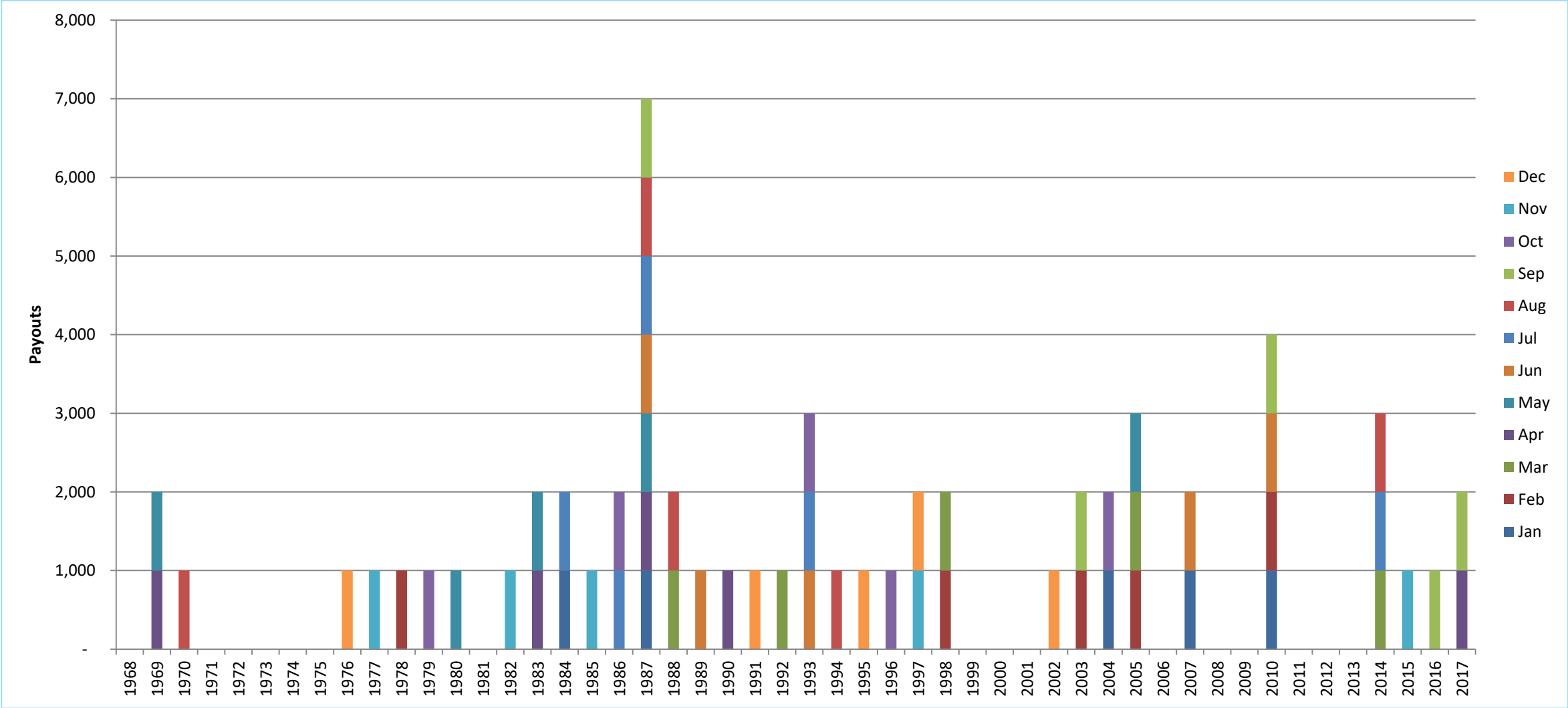
LAUTOKA RAINFALL VALUES – 10TH PERCENTILE TRIGGER



Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Benefit	1,000	Average Loss Cost	10% TLR	67% Rate	15.00% Premium	150.00	Annual	Loss Cost	Loss Ratio		
1968	303.70	226.40	481.50	120.60	33.00	88.80	64.60	38.90	35.60	104.40	44.50	83.80	1968	-	-	-	-	-	-	-	0.0%	0.0%		
1969	115.60	204.00	132.80	50.40	0.80	6.60	41.10	6.40	41.00	67.30	156.40	73.90	1969	-	-	1,000	1,000	-	-	2,000	16.7%	111.1%		
1970	137.30	589.50	232.40	215.60	152.50	156.30	152.00	-	107.20	67.60	184.30	263.30	1970	-	-	-	-	1,000	-	1,000	8.3%	55.6%		
1971	237.50	273.10	720.40	64.00	112.70	60.70	22.70	42.40	125.10	287.90	181.40	345.90	1971	-	-	-	-	-	-	-	0.0%	0.0%		
1972	434.80	215.80	178.50	151.40	146.10	50.00	13.30	31.30	17.60	341.30	121.30	183.80	1972	-	-	-	-	-	-	-	0.0%	0.0%		
1973	152.10	206.00	691.10	75.00	6.20	297.70	206.80	62.30	154.10	32.60	179.30	197.50	1973	-	-	-	-	-	-	-	0.0%	0.0%		
1974	560.00	627.40	547.70	482.00	80.30	45.90	80.60	263.10	98.90	325.30	275.90	162.60	1974	-	-	-	-	-	-	-	0.0%	0.0%		
1975	283.00	271.50	139.50	170.20	45.30	58.40	32.80	13.50	17.50	222.10	401.90	161.00	1975	-	-	-	-	-	-	-	0.0%	0.0%		
1976	421.20	176.40	280.40	440.50	34.10	35.10	33.80	82.40	345.90	80.60	127.30	59.40	1976	-	-	-	-	-	1,000	1,000	8.3%	55.6%		
1977	558.00	388.60	476.70	50.70	37.60	8.60	8.90	51.90	42.10	33.60	27.70	78.30	1977	-	-	-	-	-	1,000	-	1,000	8.3%	55.6%	
1978	173.10	101.20	146.90	174.30	62.00	36.30	55.30	21.80	39.60	203.00	68.90	86.60	1978	-	1,000	-	-	-	-	-	1,000	8.3%	55.6%	
1979	562.80	162.00	237.90	193.40	74.50	46.60	18.60	23.40	221.40	9.40	55.00	89.70	1979	-	-	-	-	1,000	-	1,000	8.3%	55.6%		
1980	216.00	373.60	163.30	129.40	1.20	66.50	84.60	41.70	78.00	157.10	236.20	79.40	1980	-	-	1,000	-	-	-	1,000	8.3%	55.6%		
1981	652.40	250.80	142.90	266.60	141.20	144.40	26.30	122.40	31.60	58.90	118.60	183.60	1981	-	-	-	-	-	-	-	0.0%	0.0%		
1982	461.30	293.60	371.30	86.60	24.80	217.20	81.00	84.90	15.90	65.30	32.80	86.50	1982	-	-	-	-	-	1,000	-	1,000	8.3%	55.6%	
1983	124.10	170.90	173.80	24.60	4.90	19.50	37.10	113.70	43.00	61.20	118.20	331.80	1983	-	-	1,000	1,000	-	-	2,000	16.7%	111.1%		
1984	111.50	290.20	377.60	134.30	201.00	78.50	0.70	16.60	18.10	44.40	81.20	107.80	1984	1,000	-	-	-	1,000	-	2,000	16.7%	111.1%		
1985	644.50	286.80	522.00	79.30	57.00	54.80	123.90	26.00	71.00	96.60	30.40	210.40	1985	-	-	-	-	-	-	1,000	-	1,000	8.3%	55.6%
1986	117.00	230.00	462.80	616.10	32.00	186.20	-	51.30	44.20	-	84.50	102.00	1986	-	-	-	1,000	-	1,000	-	2,000	16.7%	111.1%	
1987	45.60	437.10	140.60	38.20	1.20	1.60	4.60	0.40	1.00	21.50	157.00	104.80	1987	1,000	-	-	1,000	1,000	1,000	1,000	7,000	58.3%	388.9%	
1988	343.30	409.40	118.20	256.00	60.20	7.30	60.90	-	15.90	215.80	48.10	554.60	1988	-	-	1,000	-	-	1,000	-	2,000	16.7%	111.1%	
1989	342.10	795.10	169.60	297.00	310.70	4.40	10.10	106.20	95.90	204.30	42.80	172.60	1989	-	-	-	1,000	-	-	1,000	1,000	8.3%	55.6%	
1990	170.50	127.50	520.90	24.80	10.00	178.70	21.30	208.10	75.90	32.80	203.30	152.50	1990	-	-	1,000	-	-	-	1,000	1,000	8.3%	55.6%	
1991	453.00	300.60	301.80	336.50	32.70	20.50	64.40	28.50	130.20	34.20	118.60	23.10	1991	-	-	-	-	-	-	1,000	1,000	8.3%	55.6%	
1992	134.30	277.00	125.20	82.50	66.20	74.40	14.20	39.20	28.10	85.00	132.90	246.80	1992	-	1,000	-	-	-	-	-	1,000	1,000	8.3%	55.6%
1993	242.30	527.10	191.90	61.50	119.40	0.30	2.90	114.50	11.10	7.40	56.40	148.10	1993	-	-	-	1,000	1,000	-	1,000	3,000	25.0%	166.7%	
1994	397.60	370.70	260.80	81.50	40.20	114.00	11.20	-	56.00	31.80	49.30	121.20	1994	-	-	-	-	1,000	-	-	1,000	1,000	8.3%	55.6%
1995	316.70	183.80	359.60	290.30	45.40	9.40	28.60	16.90	59.30	31.40	56.50	64.00	1995	-	-	-	-	-	-	1,000	1,000	8.3%	55.6%	
1996	417.30	194.00	453.00	116.20	234.10	213.20	89.80	20.00	58.20	11.00	101.60	333.80	1996	-	-	-	-	-	1,000	-	1,000	1,000	8.3%	55.6%
1997	965.40	216.80	322.20	270.40	85.60	23.80	32.90	232.80	59.00	38.00	2.90	69.50	1997	-	-	-	-	-	-	1,000	1,000	2,000	16.7%	111.1%
1998	164.00	117.00	63.40	82.00	36.50	5.00	7.00	0.60	23.10	38.20	481.10	195.30	1998	-	1,000	1,000	-	-	-	-	2,000	16.7%	111.1%	
1999	1,017.50	516.50	138.60	388.20	26.30	49.60	115.00	136.70	91.60	149.20	354.40	473.30	1999	-	-	-	-	-	-	-	-	0.0%	0.0%	
2000	407.50	250.00	420.50	123.50	367.40	39.60	180.10	146.50	97.30	141.90	174.80	667.90	2000	-	-	-	-	-	-	-	-	0.0%	0.0%	
2001	235.80	356.20	405.30	170.00	61.90	21.50	106.10	123.00	16.10	259.00	95.90	190.60	2001	-	-	-	-	-	-	-	-	0.0%	0.0%	
2002	317.10	338.50	222.80	247.30	131.90	32.80	63.80	43.40	163.00	38.50	54.00	51.00	2002	-	-	-	-	-	-	1,000	1,000	8.3%	55.6%	
2003	135.60	91.10	507.00	123.00	53.30	81.90	12.80	134.40	5.90	76.20	52.30	185.20	2003	-	1,000	-	-	1,000	-	2,000	16.7%	111.1%		
2004	34.10	366.00	245.40	179.70	21.90	59.80	97.50	276.60	84.10	5.90	37.30	80.00	2004	1,000	-	-	-	-	1,000	-	2,000	16.7%	111.1%	
2005	244.10	95.80	104.40	437.40	4.40	97.50	52.10	90.50	31.40	102.70	141.50	178.10	2005	-	1,000	1,000	-	1,000	-	3,000	25.0%	166.7%		
2006	717.50	223.10	140.40	119.30	105.40	39.60	27.60	76.90	51.70	114.90	113.10	114.50	2006	-	-	-	-	-	-	-	-	0.0%	0.0%	
2007	56.50	438.50	674.10	223.50	41.90	0.50	48.80	21.60	200.20	111.40	268.00	252.10	2007	1,000	-	-	-	1,000	-	-	2,000	16.7%	111.1%	
2008	672.20	553.50	231.80	117.90	112.30	121.80	1.10	26.40	103.30	216.20	119.30	-	2008	-	-	-	-	-	-	-	-	0.0%	0.0%	
2009	1,279.90	262.00	383.60	104.80	115.50	71.60	33.60	64.90	223.40	41.80	52.00	237.20	2009	-	-	-	-	-	-	-	-	0.0%	0.0%	
2010	94.80	93.20	137.50	144.00	23.60	3.40	54.60	6.80	10.40	134.90	299.30	225.60	2010	1,000	1,000	-	-	1,000	-	4,000	33.3%	222.2%		
2011	559.80	426.80	406.50	264.20	267.60	126.50	107.80	130.50	133.30	112.30	177.90	314.70	2011	-	-	-	-	-	-	-	-	0.0%	0.0%	
2012	929.10	503.80	1,046.60	250.50	77.70	209.60	14.00	53.20	298.60	91.90	36.30	232.20	2012	-	-	-	-	-	-	-	-	0.0%	0.0%	
2013	116.30	531.20	488.90	162.80	197.20	138.60	8.50	18.30	73.80	45.20	264.90	455.40	2013	-	-	-	-	-	-	-	-	0.0%	0.0%	
2014	311.30	154.60	101.10	141.00	203.00	13.80	1.30	-	20.20	29.60	86.40	136.20	2014	-	-	1,000	-	-	1,000	1,000	-	3,000	25.0%	166.7%
2015	213.90	342.10	130.00	63.70	33.40	36.90	26.60	50.30	43.40	18.50	2.40	82.20	2015	-	-	-	-	-	1,000	-	1,000	8.3%	55.6%	
2016	169.00	438.50	278.50	434.40	6.60	18.90	6.40	210.00	2.60	153.20	110.70	269.00	2016	-	-	-	-	-	1,000	-	1,000	8.3%	55.6%	
2017	180.20	697.00	369.80	12.80	64.80	31.00	10.20	28.70	2.10	24.50	131.00	187.30	2017	-	-	-	1,000	-	1,000	-	2,000	16.7%	111.1%	

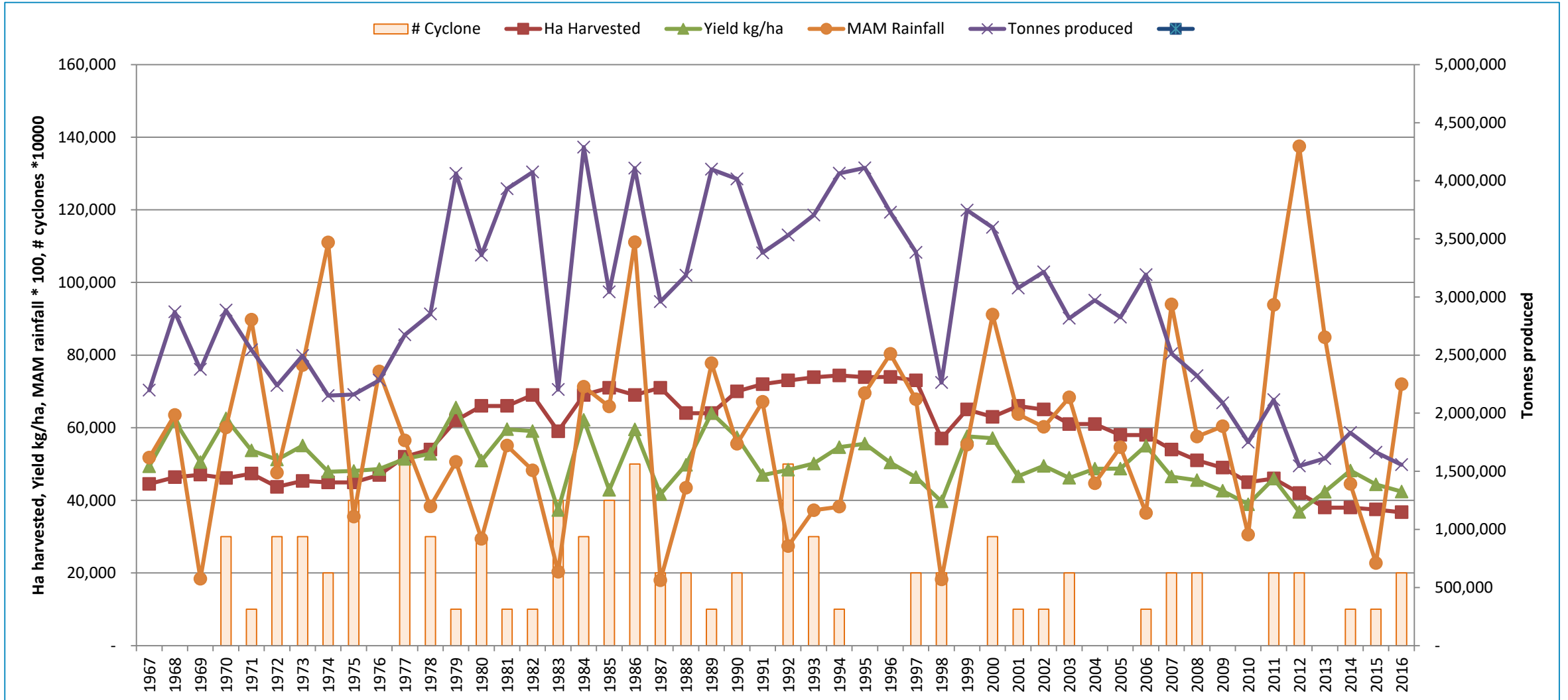


LAUTOKA RAINFALL VALUES – 10TH PERCENTILE TRIGGER



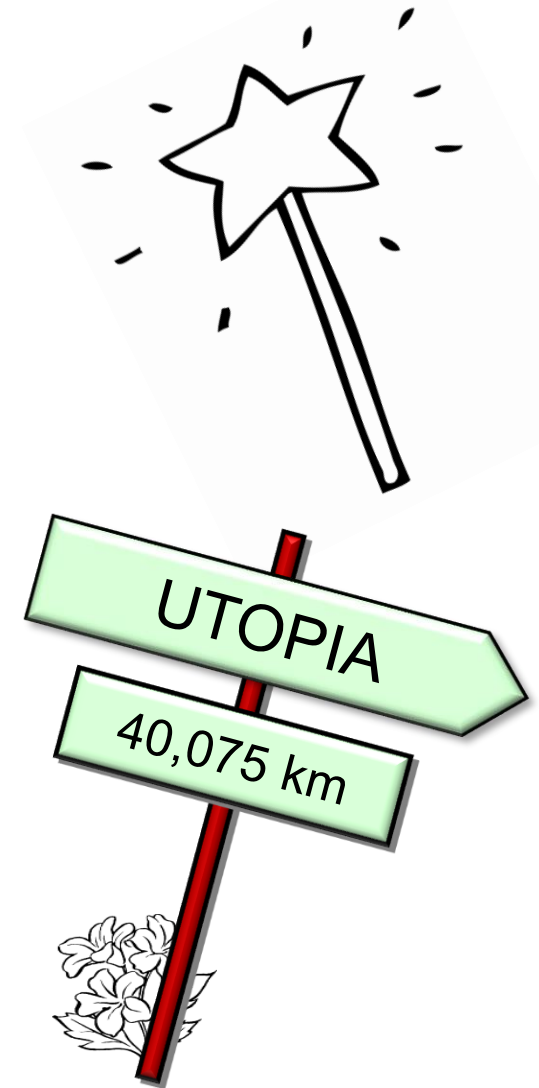


LAUTOKA RAINFALL TO NATIONAL SUGAR



IN CONCLUSION.....

- Agriculture insurance, its far more than numbers
- Insurance is what you do with what's left after management and resilience have done all they can
- Don't trust the data until you know its source
- Loss measurement can be highly subjective
- Basis risk can (& often does) bite both ways
- We are selling a promise to pay – make it a good one
- Agriculture insurance landscape is littered with the corpses of well intentioned but failed insurance schemes.





Thank you



AGRICULTURE INSURANCE PRODUCTS

Type	Single/ Spot peril	Area Damage Index	Area Weather Index	Area Yield Index	Farm yield MPCl	Revenue Insurance
Perils	Loss of potential yield due to hail, fire, loss of quality/grade	Various as specified	Deviation to historical weather, i.e.: rain & temp	Deficit to rolling average yield	Deficit to rolling average yield due to multiple perils	Deficit to rolling average accrual revenue
Unit	Field or Farm	Village +/- at farm level	Weather station or grid	Village or other statistical unit	Farm or other statistical unit	Farm
Rating	Empirical burning cost, analogue data	Government yield records	Empirical or gridded weather data	Government yield records	Government yield records	Empirical burning cost
Assess-ment	% loss potential yield	Qualitative assessment	Mathematical calculation	Sample harvests from within area	Area or farm deficit to average yield	Farm accrual revenue
Settlement	% loss X agreed value per unit	% damage X agreed value per unit	# deviation units X value per unit	% deviation to rolling average X value per unit	Deficit yield X fixed or market price	Deficit to rolling average accrual revenue
Issue(s)	Rating and assessment data	Rating and assessment data, basis risk	Accuracy of weather data, temporal & spatial basis risk	Rating and assessment data, basis risk, claim life	Rating and assessment data	Data privacy & availability, assessment cost
Countries	Australia, USA, Canada	China	India	India	USA, Canada, Australia	USA, Canada, Australia



INSURER CHALLENGES – DEVELOPING MARKETS

Role of insurance

- Not a profit centre, volatility smoothing only – at a cost
- Not equate to resilience and capacity building

Affordability

- What can farmers afford? Subsistence versus surplus
- 3rd party affordability – banks, aggregators, subsidies

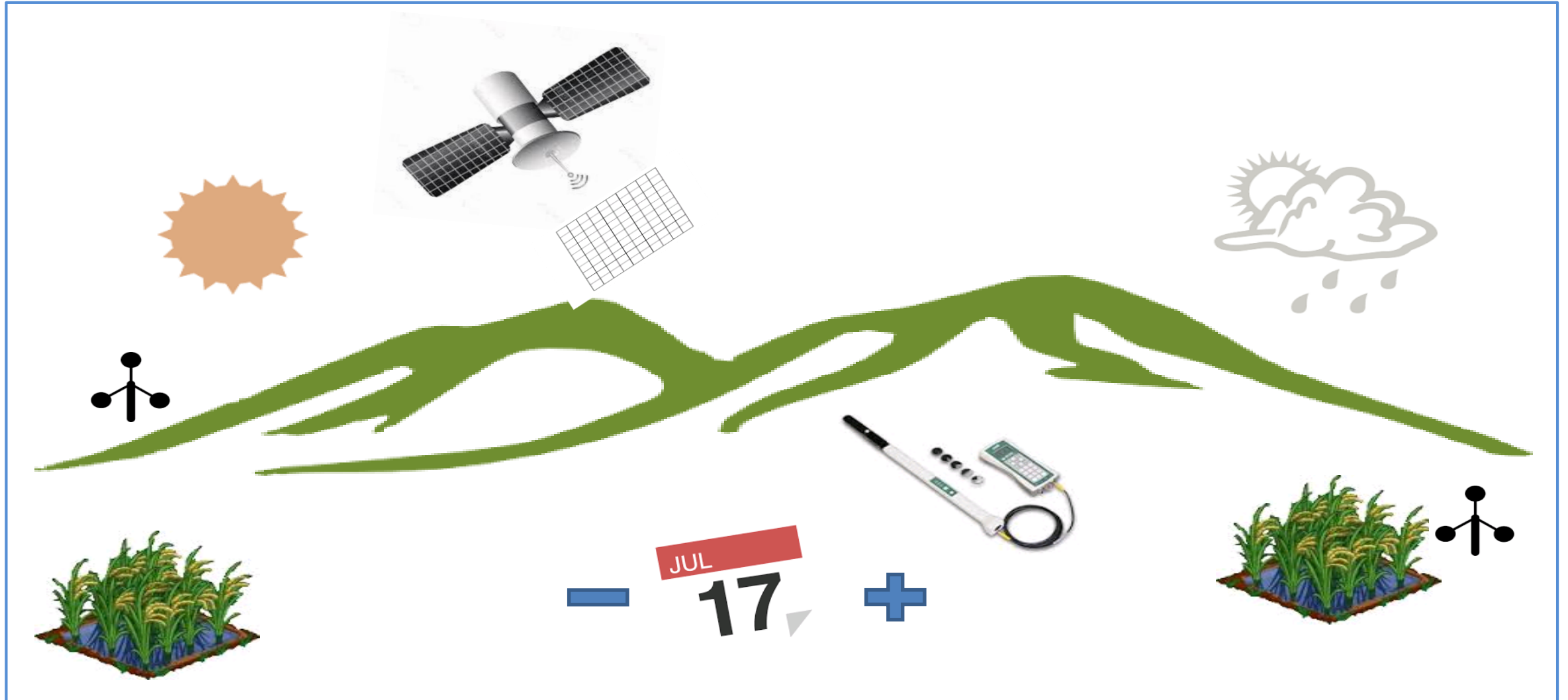
Data

- Generally poor at adequate granularity or time series
- Impact on affordability, need to create/innovate with/for data

Efficiency

- Small policy size requires new economies of scale for distribution
- Basis risk in claim settlement, value of money over time.

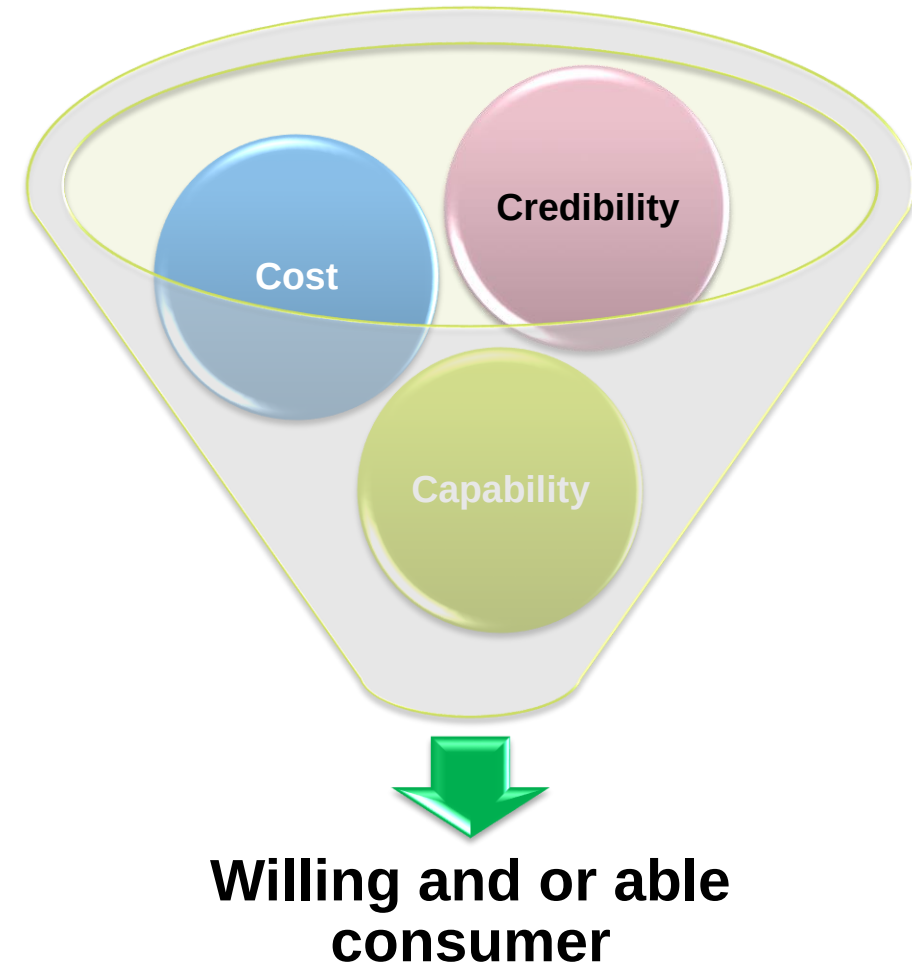
BASIS RISK – REMOTE MEASUREMENT



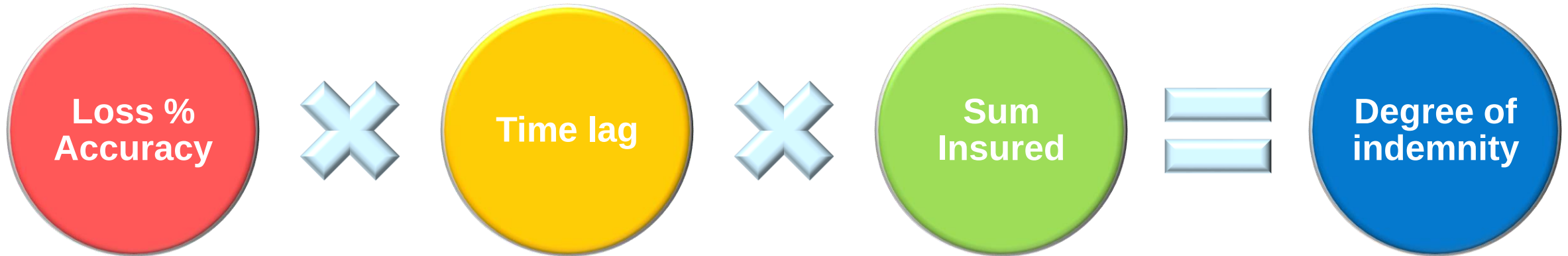
DISTRIBUTION – REACHING THE CUSTOMER

Don't reinvent the wheel:

- Agriculture sector not a big buyer of “insurance”
- Partner with existing distribution methodologies and networks
 - Banks, input providers and output merchants
- Education and transparency critical to minimise reputation risk
- Leverage off extension services, co-ops and adviser networks
- Every dollar of distribution cost reduces the farmers (or taxpayers) buying power



CLAIMS: NOT JUST THE DOLLARS



- Accuracy of loss assessment is critical but not sacrosanct
- Farmers need confidence in and transparency of loss assessment process
- Ideally claim settlement period should mirror cash flow from undamaged/harvested crop or sold animals (temporal indemnity)
 - If cash crops – in time to replant/plant next season
 - If subsistence farming – quick enough to put food on table
- Sum insured should be meaningful – ability to rebound from losses and continue farming



REINSURER CHALLENGES – DEVELOPING MARKETS

Cedent risk appetite

- Top line focus, “next big thing”, focus on parametric solutions
- Arbitrage against reinsurers, lack of cost transparency

Cedent competence

- Focus of internal resources, approach to risk
- Poor regulatory environment, soft pressure from government

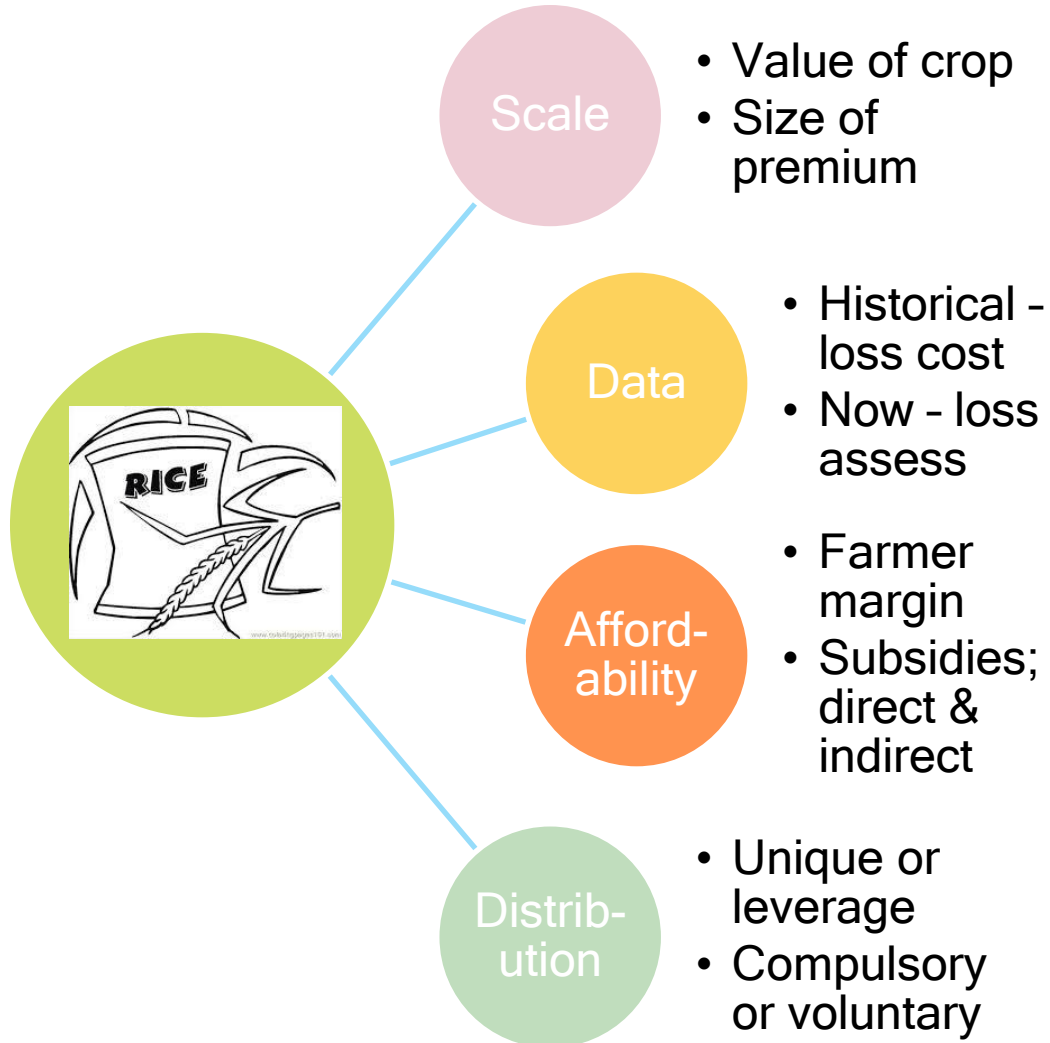
Role of Government

- Short term view of insurance, data quality low
- Lack of regulatory oversight, political involvement

Local knowledge

- Devil in detail in data, does past reflect the future?
- Influence of local officials in determining results

DIFFERING APPROACHES

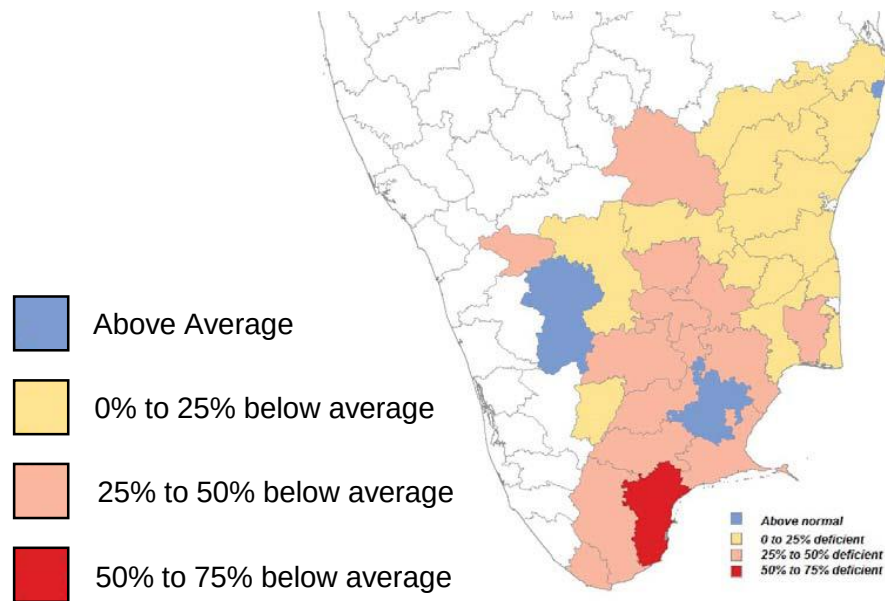


USA	<ul style="list-style-type: none"> • Large farms, & premiums • Scope for on farm loss assessment • Complex products • Long data sets • Centralised rate setting (RMA) • Farmer pays approx. 43% • Fed gov't reinsurance • Voluntary, qualifies for disaster relief • Private sales force 	South Korea		
		<ul style="list-style-type: none"> • Medium sized farms • Commercial production, On farm loss assessment • Centralised rate setting (KIDI) • NongHyup Crop insurance monopoly • Farmer pays approx. 25% • Gov't stop loss (charged) • Voluntary for farmers 	China	
			<ul style="list-style-type: none"> • Medium to small farms • Smaller premiums • Area damage, adjustment per farm • Shorter data sets, • Rates negotiated by gov't & insurers • Farmer pays approx. 20% • Group purchase • Sales volume guaranteed 	India
				<ul style="list-style-type: none"> • Nearly all are small farms • Small premiums • Poor data: length, quality and granularity • Area yield index or weather index • Issues on data sampling • Farmer pays <15% • >90% sales compulsory via finance channel

INDIAN WEATHER – TAMIL NADU

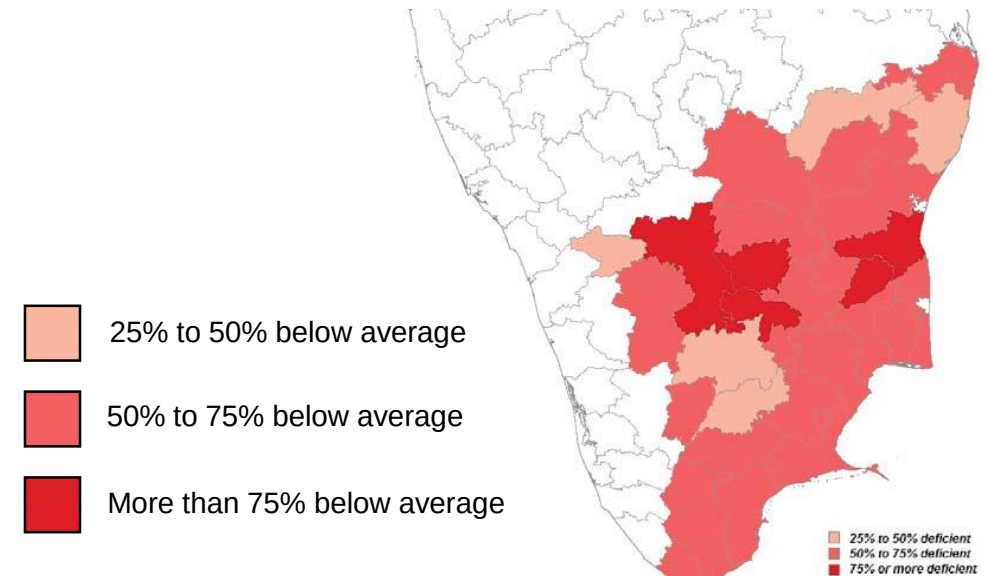
Average annual rainfall in Tamil Nadu is 920 mm with 83% coming during the monsoon season which occurs from June through December.

2016 Southwest Monsoon Season Rainfall Deficit



In 2016 on a Statewide basis, rainfall in Tamil Nadu during the southwest monsoon (June through September) was 258mm compared to the historical average of 321mm.

2016 Northeast Monsoon Season Rainfall Deficit

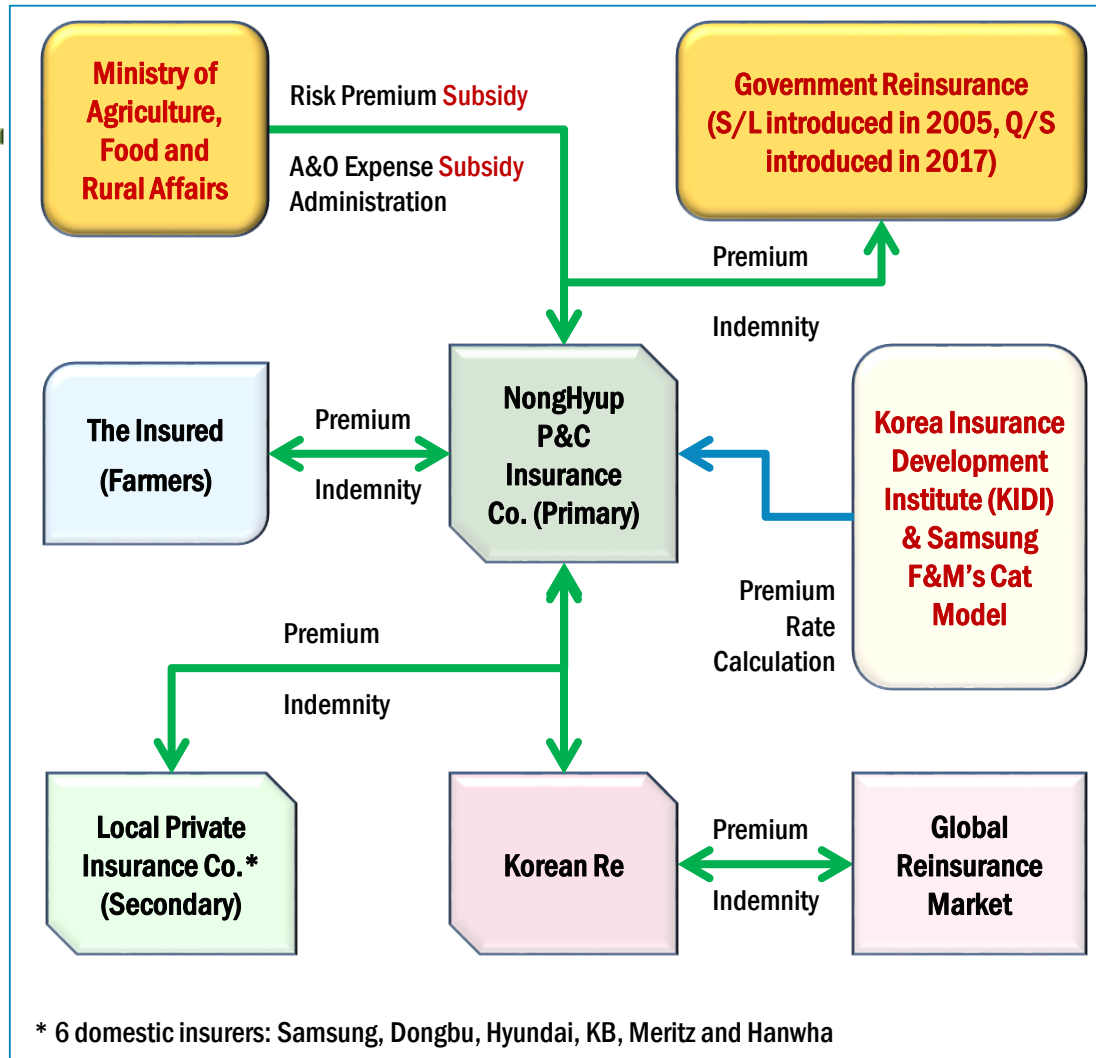


Rainfall during the northeast monsoon (October through December) was the lowest in the past 116 years with only 166mm compared to an average 440mm, a deficiency of 62%.

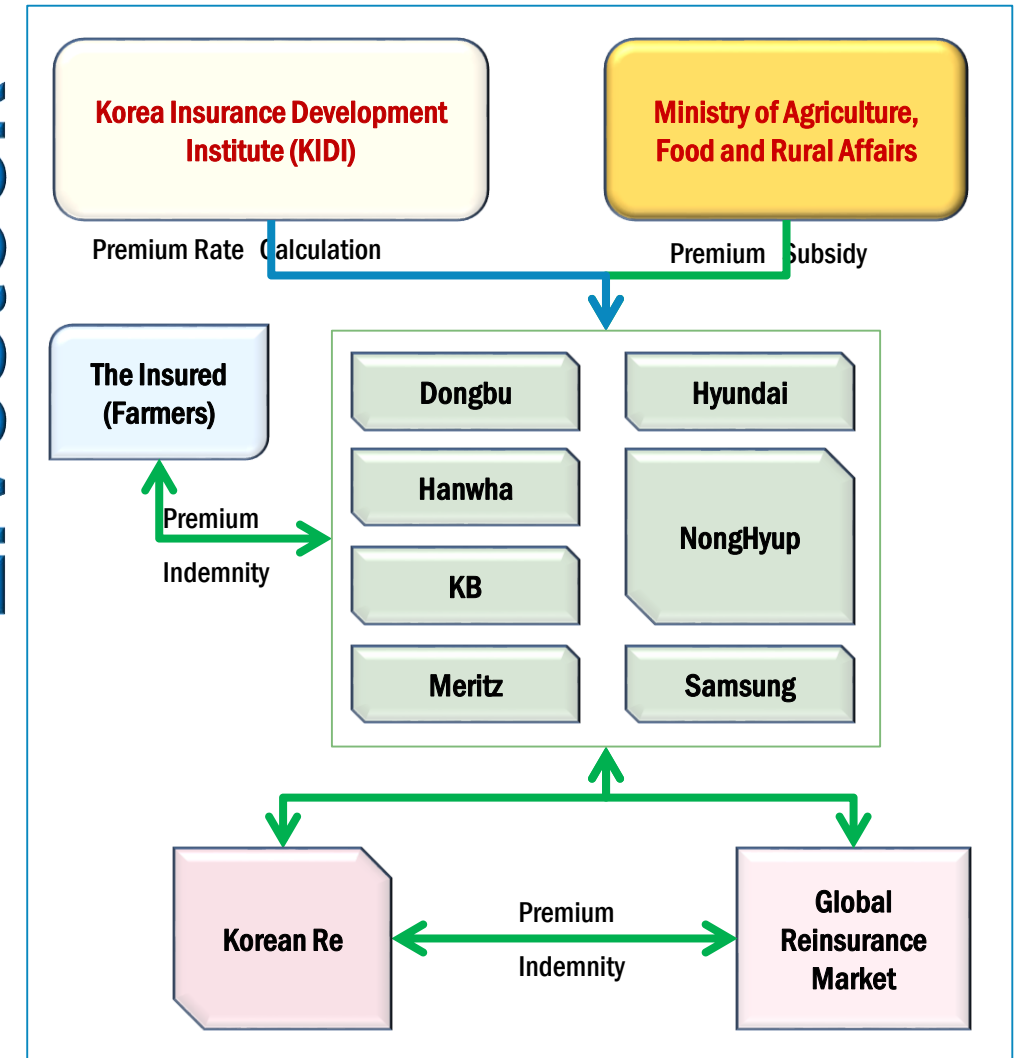


SOUTH KOREA MARKET STRUCTURE

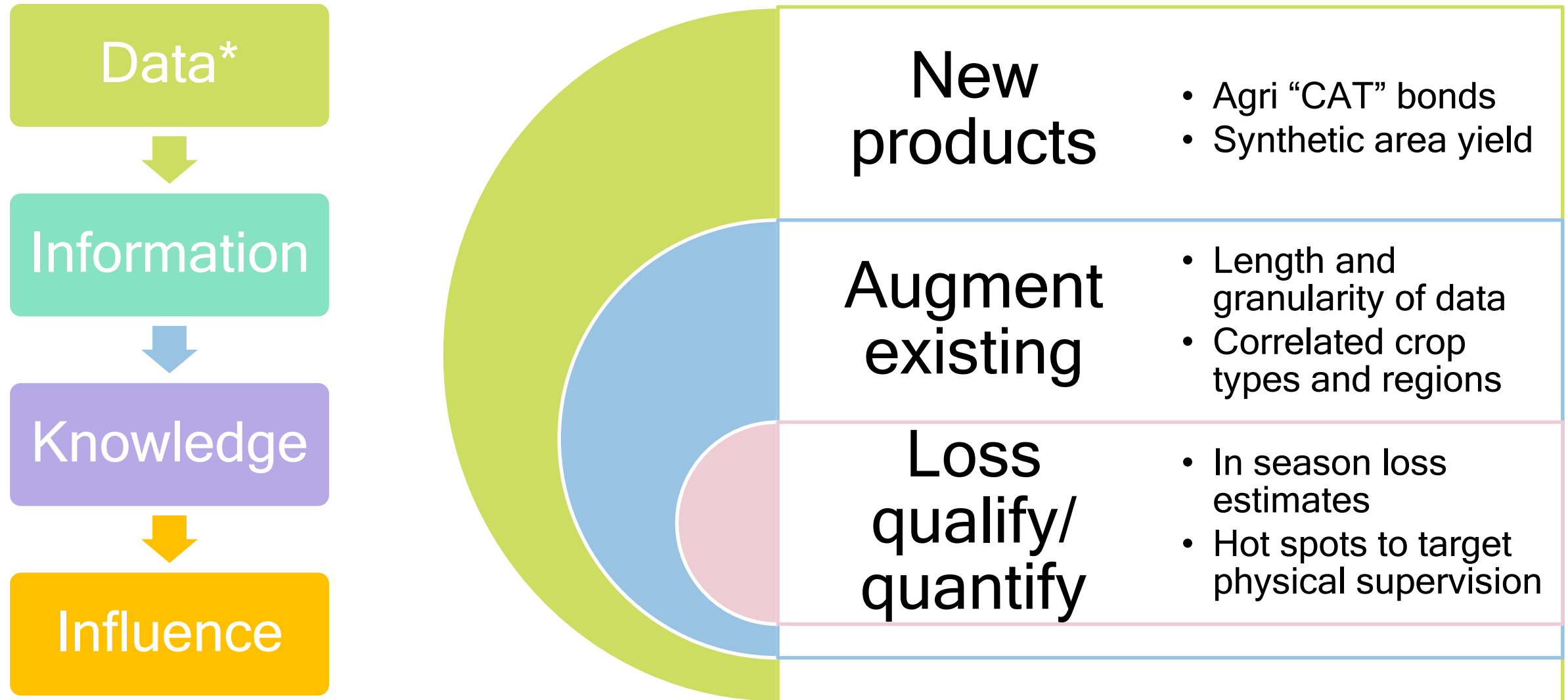
Crop



Livestock



DATA – NEW AND IMPROVED?



DATA – NEW AND IMPROVED?

Loss qualify/quantify

- Change in forecast yield/harvest failure
- Identify where losses are likely to occur
- Create mid/end of season loss estimates in front of primary carrier
- Direct primary resources to supervise empirical counts
- Unbiased source to challenge tainted empirical data

Augment existing products

- Extend empirical data sets with synthetic data
- Utilise volatility evident in synthetic data to contextualise shorter empirical data
- Examine correlations between regions, crop types and seasons
- Identify weather induced trends in production
- Short term pre-planting forecast of crop failure

New products

- Grid or area based parametric yield products
- Single or basket area yield shortfall of catastrophe trigger
- Rapid loss assessment and settlement
- Rate-able off verifiable data
- Greater flexibility for counterparty
- Short tail, rapid close off



YIELD DATA – EMPIRICAL VS ACTUAL

