Agriculture/Food (re)insurance solutions using applied science and new technology

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Agriculture Production Challenges

Major production risks

Weather
- **Drought, Flood**
- **Hail, Frost**
- **Rain**

Mortality
- **Accident**
- **Disease**
- **Epidemics**

Market
- **Supply/Demand**
- **Price**
- **Trade Agreements**

1. Controllable Risks = On Farm Risk Management
2. Risks difficult to control on Farm level = transfer to private insurance industry
3. Catastrophe Risks = Transfer to Financial or Insurance Markets with Government Support

Future growth drivers

- The anticipated growth of world population
- Globalisation of markets in combination with improved income in emerging markets
- Sophisticated farm practice
- Strategic importance to Governments

Emerging Risks

- Access to clean water
- Desertification / urbanization
- Availability of fertilizer (demand for phosphate is expected to exceed supply in 2030)
- Use of pesticides (health, environment)
- Cyber Risk
- Political environment / stability

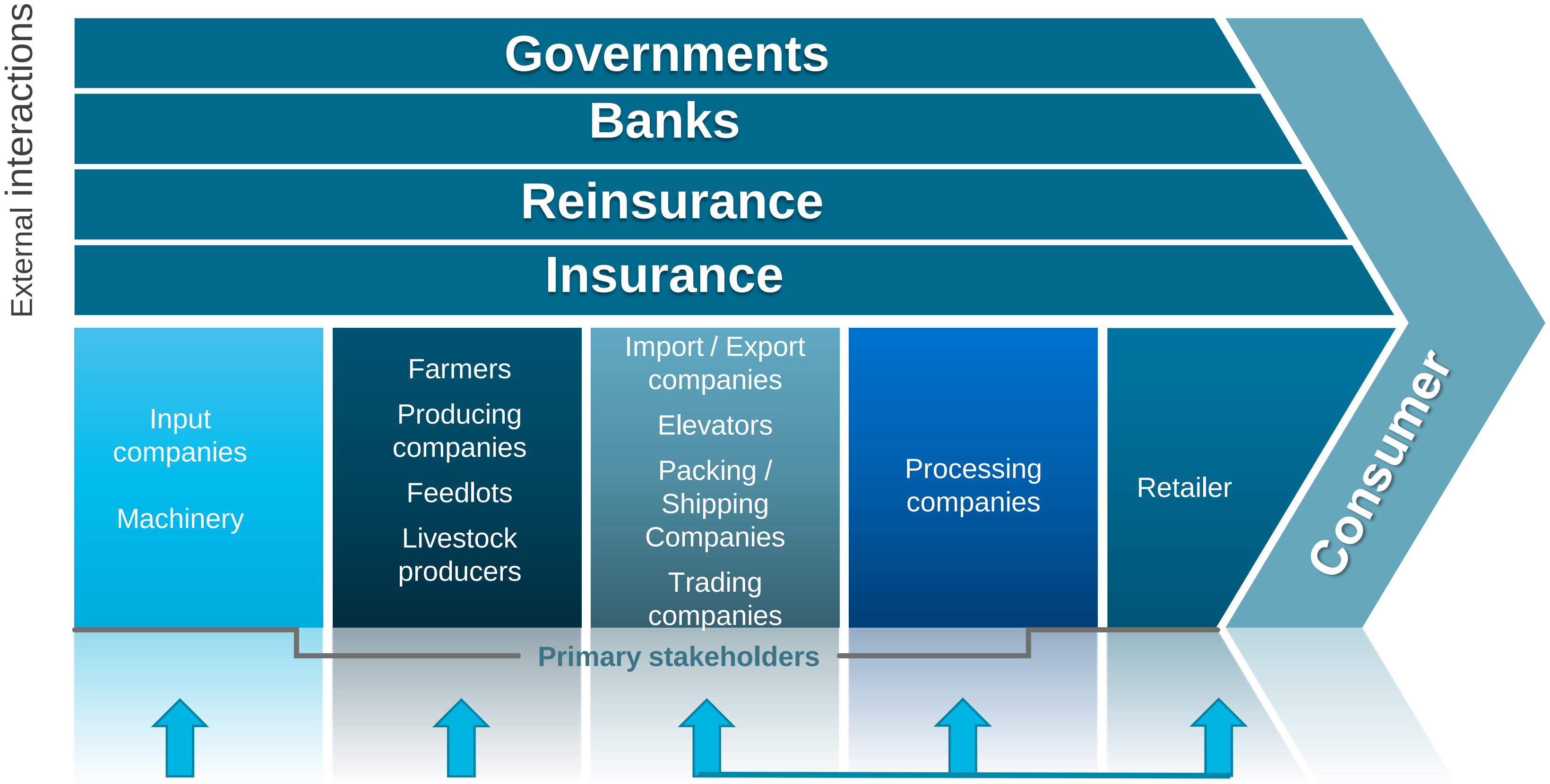
The management of existing and emerging risks requires significant investments into sophisticated farm practice/technology. The key role of the (re)insurance industry is to protect the insureds income or investment to contribute to livelihood and well-being by adequately:

- Defining/assessing the risk
- Bringing data, creating models to price risk
- Designing products and solutions to prevent/mitigate/transfer risk

Who is exposed to crop shortfall risk?

Emergency pay-out
Social issues

Increased default risk
-> Loss of revenue



Risks

Reduced demand
-> Loss of revenue

Loss of revenue (crops)
Lack of supply (Livestock)
-> Increased Costs
-> herd reduction
-> livestock price decrease
-> Loss of revenue over several cycle

Loss of revenue
Lack of supply
-> Increased Prices / Costs
-> Loss of revenue

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Requirements for new solutions/products

To develop solutions for farmers, food processors or risk aggregators, we need to be able to underwrite and manage risks in a fast, accurate and cost efficient way.

Key challenges to develop appropriate solutions are often:

- Lack of access to historical data (not available / subject to data protection laws / big data volume etc.)
- Lack of infrastructure
- Costs and time to set up an underwriting and loss adjustment infrastructure

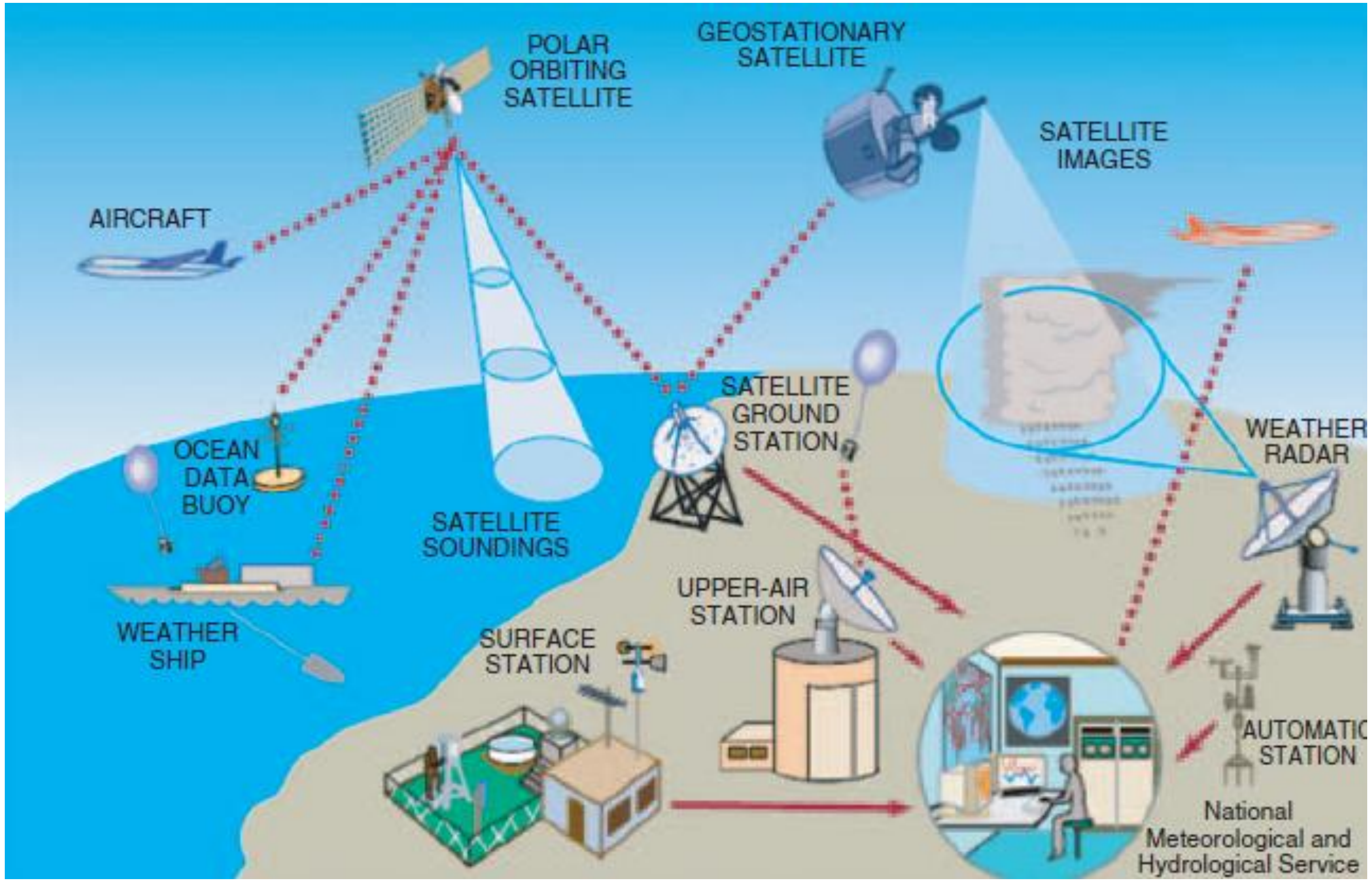
How to overcome these challenges?

By making use of today's available technology (computing power, satellites, crop modelling, fertilizer modelling, weather stations, radar etc.), the industry is in the process of collecting, analyzing and modelling the potential impact of the above factors on a given crop production. The output is used to build a tailor-made index or model for structuring new insurance solutions / products.

Technology available for developing new solutions

The collection of “big data” requires the application of new technology and computing power for cleansing, analyzing and modelling.

- In order to do any kind of assessment of weather conditions in the past, present or future one needs observations
- Two types of observations:
  - In situ (= on site, locally)
  - Remote
- Each station measures various variables (temperature, pressure, wind speed, humidity, precipitation, etc)



1) A global observing system. Inness and Dorling, 2013

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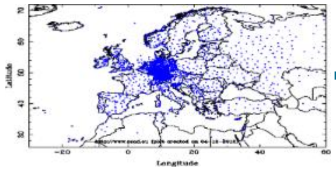
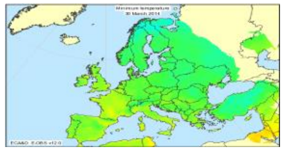
Weather Based Index

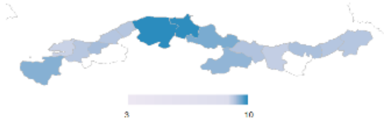
Use in cases where one single peril during a defined time period is the clear loss driver. Example: Frost on Hazelnuts

E-OBS: gridded data set, interpolated from surface (land-only) observations.. ~25km resolution

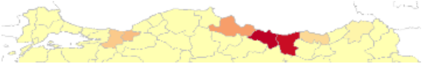


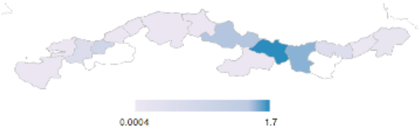


Number of days with temperature < -2 °C



Exposure





Severity index combining T° and exposure

Advantages

- Straight forward
- Timely Pay-out
- Data availability to build the index

Challenges

- Does not work in cases of multiple loss drivers
- Cover only a pre-define time exposure, some event might not be covered by the Index (season delayed..)

Area Yield Based Index

- Example yield shortfall cover for Wheat in South Australia
- Cover all perils during the whole season
- Data sources: officially published data

Based on historical yield data of the State a yield trigger is defined.

In case the yield of the current year is below the trigger a pay-out is made

Advantages

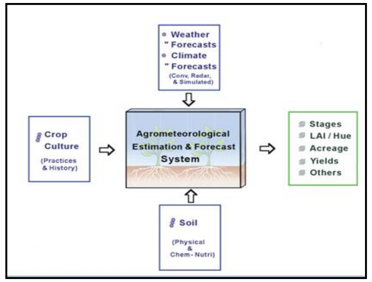
- Cover the whole season
- Cover all perils
- Straight forward

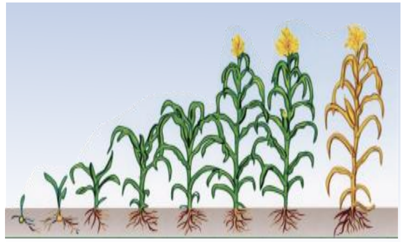
Challenges

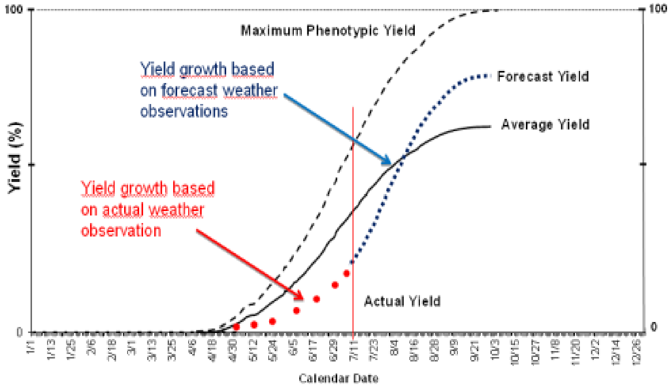
- Data availability
- Data reliability
- Delayed pay-out
- Data trend (technology trend, farm practices..)

Crop Model Based Index

- The model simulates the actual plant growth to produce a yield estimation for a specific crop type
- Cover all perils during the whole season







Same approach as the yield index cover
Based on modeled yield data a yield trigger is defined.
In case the yield of the current year is below the trigger a pay-out is made

Advantages

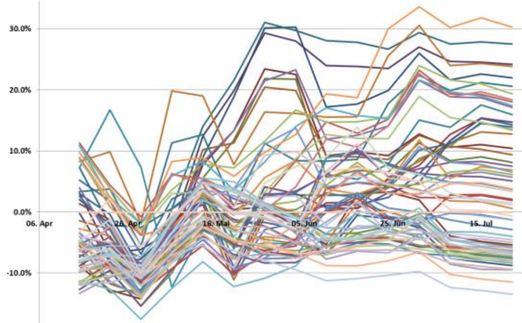
- Cover the whole season
- Multi peril approach
- On time pay-out
- Independent source
- Applicable when yield data are missing
- Yield estimation based on today's technology

Challenges

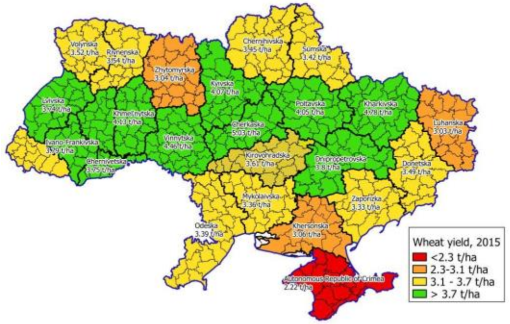
- Technicality and acceptance
- Quality of the weather data input

Combined Yield and crop Model Based Index

- Example : Wheat yield estimation during the 2015 season in Ukraine
- Cover based on Yield Index
- Advance pay-out based on Crop model estimation



Estimated Yield development from April to August 2015 compare to the mean



Final Yield national statistics compared to the mean

Advantages

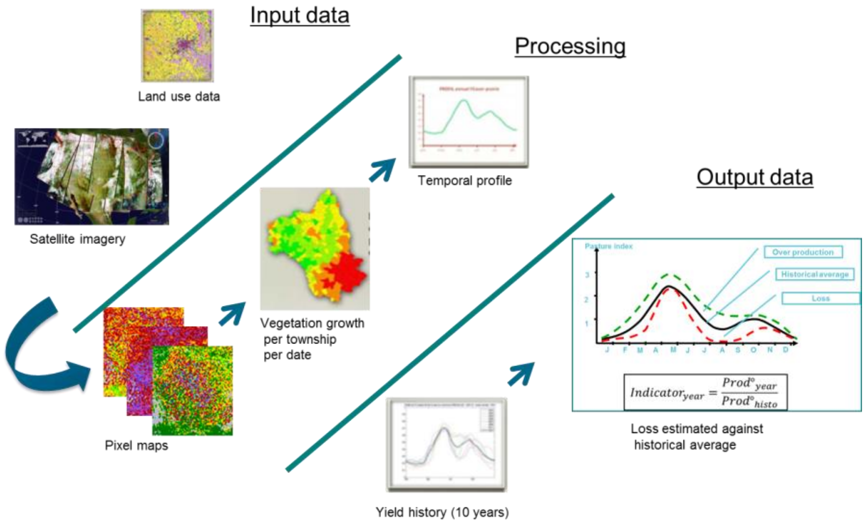
- Cover the whole season
- Multi peril approach
- On time preliminary pay-out
- Independent source

Challenges

- Quality of the weather data input
- Quality of national statistics

Satellite Based Index – Pasture

- Capture the Annual profile of vegetation growth for one grid cell using Biophysical Parameters Technology
- Cover all perils during the whole season



The final pasture indicator corresponds to the relative value of an annual production compared to the historical production.

In case the yield of the current year is below the trigger a pay-out is made.

The model was developed by Airbus D&S.

Advantages

- Traditional solutions are not suitable for Pasture
- Adaptable to customer needs
- 15 years of historical data
- Multi peril approach
- On time pay-out

Challenges

- Technicality and acceptance

SCOR’s motivation

A competent partner for our clients when it comes to the application of new technology and innovative products.

This requires an understanding of the potential use of new technology, its limitations and the ability to select the most appropriate tool for a specific transaction (i.e. tailor-made solutions). To achieve our target, we have

- Implemented a dedicated modelling team to support the underwriting and risk analysis.
- Entered into co-operations with Crop Modelling Companies / Weather Station and Satellite Imaging Providers
- Universities and Research Entities / Production Associations and Governments

In addition to providing services to the market, the access to and ability to make use of weather-related information will improve our view of the risk, including:

- Qualitative estimation of hazard
- Estimation of return period of extreme events
- PML estimates
- Monitoring of current conditions

Thank you for your attention

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