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Big Data Approach for Weather Based Crop Insurance

K.P. Mangani[1*] , R. Kousalya[2]

[1]Dr.N.G.P Arts and Science College, Tamilnadu, India
[2]Dr.N.G.P Arts and Science College, Tamilnadu, India

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Abstract- In Agriculture sector where the government and their supporting agencies need to make numerable decisions based on the adverse weather factors and the reports submitted to them. One of the essential issue is the crop insurance based on weather factors. Data mining and analytics techniques are necessary approaches for accomplishing practical and effective solutions for this problem. In addition to adverse weather conditions, variability in crop yields, input levels and damage statistics for a pre-identified crop or variety of crops information which are more relevant for farmers to make use of critical farming decisions. This paper focuses on the analysis of categories of data in agriculture and provides the bigdata approach for crop insurance data base on the background of insurance industry reform combined with the analytics technologies and to create the awareness of crop insurance scheme through online self-service weather insurance for farmers .Big Data involves the Multi criteria decisions involving spatially identifying the affected areas,Weather data, Farmer interviews, dry and wet management areas, Expert opinion of local extension officers, historical weather data, website data would help insurance companies to select the crop insurance products.

Keywords- Bigdata , Crop insurance, Agriculture, Data mining.

I. INTRODUCTION

Crop insurance is purchased by agricultural producers, including farmers and others to protect themselves against either the loss of their crops due to natural disasters, such as hail, drought, and floods, or the loss of revenue due to declines in the prices of agricultural commodities Farmers have shown significant interest in Weather Index Insurance (WII)[6,7] basis risk remains a key challenge for making it effective and scalable. Correlations between critical parameters of weather and yield hold the key for the development of the market. Many developing countries lack the infrastructure or density of established weather stations for long term historical data. Instead of using only rainfall based index, an agro-meteorological indexes such as temperature humidity that takes into account that impact crop growth should be considered. In the case of drought or flood which affects a wide area, insurance payments can be a valuable component in supporting the farmers. However, index covers have an inherent challenge of representing individual risks, also called basis risk. For weather index covers, there could be considerable spatial and temporal variations in certain weather variables like precipitation. Farmers may not receive payment for the risk coverage premium they are paying, merely because of the distance between the reference weather station and their farm, which can lead to significant personal hardship. Conversely, there could be instances where the farmers obtain reasonable harvests, and still qualify for insurance pay outs. Yield indices pose an additional challenge, as the sample yields are usually measured manually, leaving a lot of subjectivities in the process. .Multi criteria decision involving spatially identifying irrigated and non-irrigated areas, drought resistant rice variety areas, and alternate dry and wet management areas would help insurance companies to select appropriate target markets for offering crop insurance products. Satellite derived index for monitoring vegetation like Normalized Differential Vegetation Index (NDVI) can be used to validate and if required inspect vegetation status prior to releasing claims. This would reduce the fear of farmers exploiting crop insurance. Incorporating Geo-spatial technologies and Hybrid Satellite Agriculture Drought Indices (HySADI)[9] current weather index insurance processes can be improved and will be able to assist farmers in decision-making

II. LITERATURE REVIEW

Thecrop insurance scheme would be providing insurance coverage and financial support to farmers in the event of failure of any of the notified crop as a result of natural calamities, pests and diseases. This would also stabilize the income of farmers to ensure their continuance in farming. Accordingly, farmers will be encouraged to invest in the innovative and modern agricultural practices, and get available subsidies from the government, agricultural insurance has not reached the poorand the most vulnerable in many developing countries [2].

Kentaro Kuwata, Faizan Mahmood utilized remote sensing data and climate data to find the relationship between crop yield and different indicators, like EVI, crop stage at flooding, inundation period, and other climate factors to reduce the basis risk.MODIS and PALSAR imageries are analyzed for flood detection using SVM in Illinois state[3] .Mayuranagar and ,mukesh kumar discuses about problem in distribution channel and storage of food product, and precession farming decision making whicht gives real time analyzer report about weather, soil, and current status of market and storage capacity using Big Data[4]

III. CATERGORIES OF DATA

In Agriculture many categories of data are needed to predict the crop insurance.as shown in Table 1. The Meteorological Data: daily rainfall data along with 10 year and rainfall data from Automatic Weather Station (AWS) in all districts for tamilnadu and Satellite Data to determine the seasonal crop calendar. Crop and Yield data to determine the loss ratio and geo spatial data to determine the distance of land from automatic weather stations.

Table:1 Categories of Data

Category of data	Technology	Innovative Technology Providers
Weather and climate	Earth observation satellites Drones Automatic weather stations	Fertilizer Calculator Crop Water Needs Estimation Yield models
Soil and geo-spatial	Mobile Apps Location-based datasets Ground Sensors/ Base Stations Drones	Soil Indicators for Scottish Soils, SoilInfo, SoilWeb mKrishi (India), CI-Agriculture (China), Fujitsu (Japan) Batian (China), RedBird, etc.
Crop and yield	Fertilizer Calculator Crop Water Needs Estimation Yield models	BaiKhao

IV. BIGDATA ENVIRONMENT IN CROP INSURANCE

Technology will impact the crop insurance value chain at various levels. It is hard to make exact predictions how the business will be reshaped. However, certain trend sare already becoming obvious.With better knowledge of the near-term weather forecast, insurers coulds tart experimenting with dynamic policy commencement, waiting periods and portfolio composition. Insurers will need to strike a balance between farmers' needs and managing risk in their portfolio, but ultimately everybody could benefit. Farmers would have access to insurance even in times of higher individual risk exposure, and insurance companies could avoid anti-selection and will be able to improve their operational readiness as well as reduce the level of fraudulent claims. For example, before sending a loss adjuster to a client's field, an insurer can check whether the reported fields were indeed hit by a hail storm or not by calculating the distance from nearby weather stations. Finally, discussions were held with crop farmers and agriculture experts in and around the study area. A number of companies are offering advanced sensor, drone, satellite and remote monitoring technology to provide an increasingly detailed picture of weather and climate risks for agriculture. A few examples are listed below

Skymet gathers data using drones ,satellites and the largest network of automatic weather stations across all states in India. The company claims strong capabilities in measuring and predicting yield accurately at the village level for any crop as well as forecasting weather particularly monsoon trend – with high accuracy.

Spire aims to become the world's largest constellation of weather satellites to provide high fidelity weather data, especially very precise profiles of temperature,pressure and precipitation.

Niruthi specialises in micro-weather forecasts and weather as well as yield data by leveraging hundreds of weather networks and orbiting satellites. Ituses Terrestrial Observation and Prediction (TOPS) technology to provide location-specific crop monitoring and yield prediction from satellite and ground based crop mapping.

aWhereprovides high resolution daily meteorological information combining public and proprietary data of weather, rainfall, precipitation, minimum and maximum temperature, humidity, solar radiation and wind speed[8]

A. Bigdata for analyzing the Weather Risk Factors

The existence of a weather risk affects crop yields in a targeted area. A risk assessment of an enterprise, or a farming system, aims to identify and quantify the risks faced by farmers. It can be extended to include other factors in the agricultural value chain, such as buyers, processors, packers, service providers, and marketers. The assessment can be carried out on a macro, meso, or microlevel, depending on the intention of the insurance scheme. Spatial basis risk was found with the Local variations in the rainfall within the area surrounding a weather station. Preliminary existence of weather risk can be assessed through a combination of the following by applying Big Data

- ➢ Analysis of yield data;
- ➢ Damage statistics for a pre-identified crop or variety of crops
- ➢ Weather data
- ➢ Farmer interviews
- ➢ Expert opinion, especially of local extension officers.
- ➢ Historical Weather Data for 10 years
- ➢ Website data

B. Analytical Challenges

♣ High quality agricultural data with respect to each district of Tamilnadu is critical for sustainable agricultural insurance programs.

♣ For agriculture insurance in low or middle income countries, coordinated investments in agriculture data as a public good may be the best solution.

♣ Combining yield, weather, and satellite data in sensible ways can lead to higher quality, more cost-effective products than just using one type of data.

♣ Data sources are continually improving with technological and operational advancements. Agriculture insurance programs need to be responsive to these innovations

♣Classify Drought Resistant Areas and Farm Detection areas with alternate dry and wet management Areas.

♣ Integrating Yield ,Satellite and Weather datas

Several portals have already been developed for the implementation of crop insurance; however, none of them include approaches covering all processes from customer enrolment to claim settlement. The portals also lack connectivity with banking, and the payment gateway is still to be integrated. ICT can help to reach the farmers at the grass roots and assist them in overcoming the challenges currently posed in the manual registration process. Mobile/tablet based applications can ensure ease of registration, payment of premium and issuance of e-receipts. A mobile App for dissemination of crop insurance has already been developed.[1] The mobile App facilities should be extended to enrol non-loanee farmers with payment gateways. Further, the enrolment process with banks and national portal should be available. To address these Challenges we Propose the bigdata Approach for online self-service weather Insurance for farmers and companies in Fig 1.

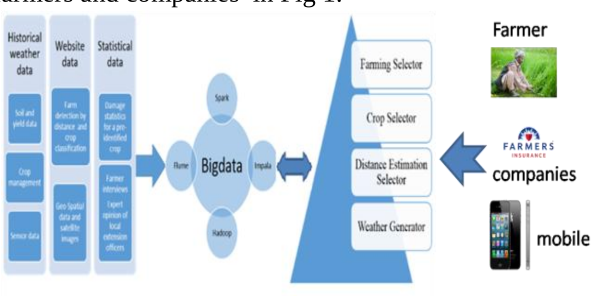

Fig-1: Bigdata Approach for Online Self-Service Weather Insurance

Insurance companies can access the categories of data for online weather insurance through online analytical applications like Apache Flume and Impala which are a distributed, reliable, and available service for efficiently collecting, aggregating, and moving large amounts of streaming data into the Hadoop Distributed File System (HDFS).Farmers can register for insurance through mobile phones and know the status of insured details and can receive the details through smartphones.If the observed weather conditions trigger a pay-out,a cheque is automatically generated and arrives within days of the end of the policy coverage period..index insurance can not only be a profitable industry, it can aid governments to make better choices about poverty and disaster management.

V. Analysis of Reports

High quality agricultural insurance data is critical for agricultural insurance programs to develop sustainably. Without high quality data, insurance will not offer reliable and cost-effective protection, which is particularly critical for poorer, more vulnerable farmers. Image mining and data mining approach of classification and clustering of crops and farmer lands are used for identifying the Geo-spatial details such as Farm-edge detection and crop health Monitoring[5] through satellite images as shown in Fig2

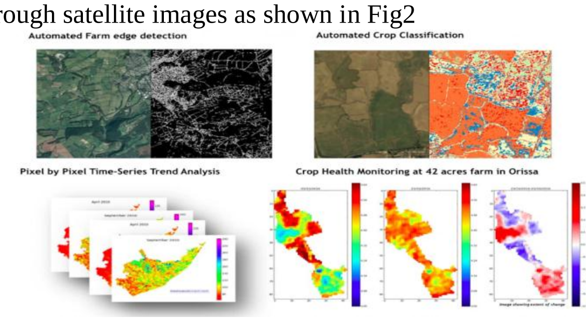

Fig 2: Satellite Images

Government have a key role in developing the agriculture insurance infrastructure due to the fact that the collection of data can be a natural monopoly. This can be overcome by coordinated investment in data as a public good. Indices can be based on a combination of yield, satellite and weather data. The data types each have advantages and disadvantages, and combining different types of data can lead to products that offer both speed and reliability cost effectively which is shown in fig 3. Data quality needs to be high with robust audit mechanisms in place due to the high standards reinsurance companies have for data verifiability. The government can then offload the risk to reinsurance markets over time as data quality improves.

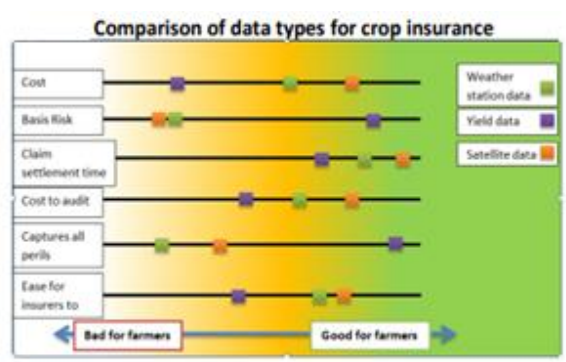

Fig 3: Comparision of data types for crop insurance

VI. CONCLUSION

This paper analyses the categories of data in agriculture and provides the bigdata analytical approach for handling the crop insurance data to create an awareness among farmers through online self-service weather insurance model .The proposed model will increase the percentage of insured farmers in our state to utilize the maximum government subsidies with the help of analytics technology and avoid farmer suicides due to crop loss and natural calamities.

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