USING BIG DATA IN THE U.S. AGRICULTURAL SECTOR

The large collections of farm and farmer data that are being used by companies and government agencies can be classified as "Big Data". Big Data is defined as data sets that are so large and complex that they require powerful computational capability to process. Technological advances in computation ability, data storage, sensing, and analytics are permitting extraction and manipulation of information on a scale not previously possible.

Use of these large data sets requires organized capture and collation for analysis and/or application purposes. Other requirements inherent in the use of Big Data sets are the ability to search, share, store, and transfer their information. Sectors important to agriculture that are increasingly using Big Data sets are meteorology, genomics and bioinformatics, biological and environmental research, precision agriculture, and information gathering, to name a few.

An increasing trend in the US agricultural sector is the accumulation of "Big Data" sets that are being used by Agriculture Technology Providers (ATP's). Collection of these data from producers in the agricultural sector has spawned growing concern about the privacy of these data and how they are used.

A coalition of farm groups published "Privacy and Security Principles for Farm Data", which provides principles that should be adopted and adhered to by each ATP. Prominent sponsors of this policy statement are American Farm Bureau Federation, American Soybean Association, National Association of Wheat Growers, National Corn Growers Association, and the USA Rice Federation. All of these organizations represent farmers and growers of prominent commodity crops in Mississippi and the Midsouth.

A summary of the basic tenets of this list of principles follow.
- Education is needed to ensure that ATP customers understand their rights and responsibilities when supplying data as per their contracts with ATP's.
- Farmers own the information and data generated from their farms. Farmers have the responsibility to 1) agree on data use and sharing guidelines with other stakeholders and ATP's, and 2) ensuring that only the data they own or control is included in the contract with other entities.
- ATP's collection, access, and use of farm data should be done only with the explicit consent of the farmer through contract agreements.
- Farmers must be notified that their data is being collected, and about how that data will be used.
- ATP's shall notify farmers about 1) the purposes of their data collection and use, 2) how farmers can contact the ATP with inquiries or complaints, 3) the third parties to which farmer data will be disclosed, and 4) how the ATP will limit data use and disclosure.
- ATP's should explain a farmer's options for changing the availability of data and services, offer farmers choices of options, and provide farmers a clear picture of what those choices will mean in terms of services and features that will be available.
- Farmers should be able to retrieve their individualized data at their discretion.
- Farmers should know the third parties with whom ATP's will be sharing their data, and have a clear explanation about and definitions of those third parties.
- Sale of data by an ATP to a third party shall not occur without a legally binding statement between the farmer and the ATP. Farmers must be notified of each proposed sale, and have the option to opt out of that sale. Any sharing of farmer data must be consistent with the contract terms between the farmer and the ATP.
- ATP's shall provide for the removal, secure destruction, and/or return of original farmer data upon request from the farmer, or according to contract terms.
- Procedures for termination of ATP services should be defined in the contract between the ATP and the farmer.
- Farmer data shall not be used for anti-competitive or speculative activities.
- Farm data should be protected with reasonable safeguards against loss and unauthorized access, use, modification, and/or disclosure. ATP liability and policies for notification if these events occur should be clearly defined in the contract.

Farmers have every right to expect that their farm data are private and not for dissemination to or used by outside entities without their explicit consent. As more and more "Big Data" from farmers are collected and stored, it is prudent that the above principles be adopted by all collectors and users.

To provide further information on the subject of Big Data use in agriculture, the Plant Management Network posted a webinar entitled "Big Data and Implications at the Farm" presented by Dr. John Fulton, Associate Professor at The Ohio State University. Dr. Fulton describes the current state of Big Data in agriculture, and provides recommendations to soybean producers and service providers to consider in their determination of how to use the options that are now available or soon will be available to them. He discusses:
*   Using Big Data to promote sustainability, which involves farm profitability, accountability for water and nutrient applications, and crop yield;
*   Areas of investment and growth for digital agriculture;
*   Example application using planter technology that generates data to provide feedback to the operator;
*   Connectivity at the farm level to simplify data transfer and viewing;
*   Ensuring data quality and proper data cleaning and backup so that collected data are available and correct for use in making management decisions;
*   Generation of plant and machine data.

Dr. Fulton has produced another webcast entitled "Advances in Prescriptive Agriculture and Big Data" that is now available for viewing on PMN's Focus on Soybean site. In this presentation, he discusses:
*   Using digital agriculture to measure farm success;
*   Segments of digital agriculture–Precision Agriculture, Enterprise Agriculture, and Prescriptive Agriculture;
*   Use of bi-directional data exchange to obtain accurate prescription applications;
*   Public and private level Big Data;
*   Using Big Data to improve input efficiency and asset management;
*   Types of Big Data–Agronomic, Machine, and Production;
*   Bridging agronomic and machine data;
*   Lack of data quality and a list of common errors that contribute to it;
*   Yield data quality–mainly historical.

In the webcasts, Dr. Fulton provides example companies for data exchange, as well as website resources for additional detailed information.

The Council on Food, Agricultural, and Resource Economics (C-FARE) has published a report titled "Advancing US Agricultural Competitiveness with Big Data and Agricultural Economic Market Information, Analysis, and Research". The senior author of the report is Dr. Keith Coble, Vice President, DAFVM, Miss. State Univ. In this article, the authors discuss current challenges and potential opportunities for using Big Data, as well as creating multidisciplinary approaches to research and "looking forward" points that will affect change in the Big Agricultural Data environment in coming years.

Following are links to other resources that provide information about and insights into Big Data use in agriculture.
*   Journal of Big Data
*   Big Data for Greener Fields
*   How to Implement Big Data Analytics in Agriculture
*   The Many Practical Uses of Big Data in Agriculture
*   What is Big Data Storage? Definition Uses, and More

The above resources should provide a knowledge base that can be used by producers as they evolve into the use of new data technology to provide advancements in farm management.

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