ADVANCING U.S. AGRICULTURAL COMPETITIVENESS WITH BIG DATA AND AGRICULTURAL ECONOMIC MARKET INFORMATION, ANALYSIS, AND RESEARCH

Executive Summary

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The Council on Food, Agricultural and Resource Economics convened a 'Big Ag. Data Steering Committee' during 2015-2016 to identify a working definition of 'big Ag. data', opportunities, limitations of its use, and potential changes in data sources, and to define a set of research goals and priorities for publicly funded research. This report identifies answers that emerged during our investigation.

New data technology is radically changing the ag sector. Big Data permit the extraction and use of information to craft insights that were previously unobtainable. This data can be described in terms of volume, velocity, variety, and veracity. Many sources for this information are farmers or input suppliers, and private investment suggests widespread perception of data value. However, this data may be neither statistically valid nor high quality. In contrast, U.S. Department of Agriculture has a long history of collecting and disseminating data to equalize the information available to those in the ag sector. In future, greater complementation of government and various Big Data sources is feasible.

Private and public investments in research and development are the drivers of increased agricultural productivity. Investments in Big Data and big data analytics have the potential to fuel agricultural productivity into the future. Big Data is challenging traditional models of agricultural research where rigorous experimental designs are used. An interest in the power of coordinating international data is also growing; for example, the Global Open Data for Agriculture and Nutrition effort (GODAN, 2016).

Current Challenges

In the United States, it is clear that the value of Big Data in agriculture differs among various groups—farmers, retailers, manufacturers, and aggregators—and that the value to any one farmer is relatively small relative to the value to the aggregator. Many producers are choosing to wait to use big data for the following reasons:

- Lagged adoption because of limited connectivity
- Data ownership and confidentiality concerns
- Access and breach of data
- Asymmetric market information

Potential Opportunities

The rise of Big Data in agriculture will have fundamental impacts, some of which are unlikely to be fully understood at this point. This is especially true given today's increasingly integrated and globalized agri-food supply chain, together with public demand for more safe and affordable food from the system. Big Data may provide opportunities to advance several relevant goals:

- Farm management can become more refined and site-specific.
- Food safety may be more effectively tracked.
- Environmental sustainability will likely be enhanced.

Agricultural Economic Contributions to Multidisciplinary Research

By working together, agronomists, crop scientists, animal scientists, and agricultural economists can create multidisciplinary approaches to research and maximize disciplinary strengths. We suggest that economists are well prepared to address the following questions:

- What methods can draw valid answers from Big Data?
- What arrangements can ensure both data privacy and use?
- What is the potential benefit from the Big Data analytics?
- How can we adapt Extension and on-farm research to the new paradigm?
- What contractual approaches can be developed for data-sharing arrangements?
- What methods and institutions are most effective in managing data and allocating value?
- What resources and support tools can advance the new paradigm for farm management?
- What are the opportunities for extension training and curriculum development?

Looking Forward

Rapid change will occur in the Big Ag. Data environment in the next few years:

- Technological solutions may be found that address the limits to rural broadband access. Economists can estimate the value of addressing this infrastructure issue.
- In the developing world, smallholder farmers will increasingly utilize Big Data to reduce food insecurity and improve the efficiency of their agricultural systems.
- Farm management instruction, extension, and research will need to evolve to use precise agriculture data.
- Significant progress will be made in developing more sophisticated mechanisms to certify sustainability practices, as demanded by changes in private markets.
- Market and contractual issues regarding data ownership and privacy will need to be evaluated and best practices will need to be developed.
- Progress will be made to capitalize on USDA data collection and privacy standards; for example, USDA ERS coordinates with the US Census to ensure privacy for its ARMS product.
- Greater use of spatial and high-volume data analytical techniques in agricultural research. This will require changes in curriculum and a demand for applied economists trained in these techniques.
- Multi-disciplinary engagement by agricultural and applied economists with agricultural engineers, agronomists, computer scientists, and others to make scientific advancement.

The ability to conduct research in this arena will require access to volumes of data controlled by others. Researchers will need to have proven value to the gatekeepers of the data and be able to maintain the confidentiality of spatial data.