Data Farming In Agricultural Economics

Rabijita Buragohain

Research Scholar
Assam Agricultural University

Abstract: Accurate decisions can only be made when a reliable collection of data is available. Basically, collecting and organizing massive data cannot be done using a conventional way. Big data pave the way for making best decisions, precise predictions, and integrating a local with a global approach in both agricultural micro- and macro-economic possibilities. This article takes an approach to explaining how data farming might be used in agricultural economics to obtain a transparent, reliable, and well-organized data collection for further statistical analysis and making right decisions.

Key words: data farming, agricultural economics, simulation modelling

INTRODUCTION

Data farming is the practice of utilizing planned computing operations to "grow" data that can later be examined using statistical and visualization methods to gain insight into complicated systems. These methods can be applied to any computational model.

Agricultural economics is an area of applied economics that focuses on using economic theory to optimize the production and distribution of resources. Initially agricultural economics are studied under economics that focused on land utilization. Currently it is a different branch of study and it comprises of farm management, agricultural finance of rural banking and cooperative sector, marketing, trade affair to global policy making decisions.

The discipline grew over the 20th century, and its current focus extends to substantially broader. Agricultural economics currently covers a wide range of practical concerns and overlap traditional economics significantly. Economic, econometric, development, and environmental researchers have benefited greatly from the work of agricultural economists. Food policy, agricultural policy, and environmental policy are all influenced by agricultural economics.

Agricultural economics utilizes empirical applications of mathematical statistics and has made significant contributions to econometric methods. Agriculture economists have made substantial contributions to research in agro-economics, socio-economics, and the agricultural finance sector. It influences the management of resources for regulating supply and demand, posting prices, asset liability management, human resource management, predictive economic analysis, market-based resource allocation using price prediction and so on. To all these the main input is data. In agricultural sector it is hardly possible to get a big accurate data for concerned research study. Data variability is enormous in this sector. Basically weather influences much. Other causes *viz.* inappropriate management after proper planning, pest infestation in a particular growth phase of the crop, uneven application of fertilizer , lime, manure and irrigation, low literacy rates, and apprehension about providing information in questionnaires, are some major factors that ultimately impeded the ability to make the right decisions. In design of experiment missing value is one of the major problem. Generally mean value is considered in place of missing value. But for a larger approach computer intelligence is highly recommended which ensures proper weightage to the value. There are some geographical locations that are hard to reach for a researcher. In such a case, basic information regarding the location and previous data, simulation methods can grow data for the researcher. These simulation methods can reduce cost, time and field visit in case of big data generation.

APPLICATION OF DATA FARMING IN AGRICULTURAL ECONOMICS:

Data farmers manipulate the raw data to meet their objectives for further statistical analysis. Simulation modelling, high-performance computation, analysis, experimental design and visualization, iteration loop are some key applications in the subject of agricultural economics[6].

- **Simulation modeling**

Simulation is one of the most widely used techniques for decision-making [1]. The effectiveness of resource allocation and different operating policies can be assessed using this method. The purpose of input data in a simulation project is to power the simulation. This process involves the collection of input data, analysis of the input data, and use of the analysis of the input data in the simulation model [2]. Finding the theoretical distribution that best represents the input data is the main step of the analysis. The theoretical distributions must be written into the simulation software code in order for the input data to be used in the model.

Figure 1- data grow in simulation modeling

There are many crop simulation models used in agriculture, including the Decision Support System for Agro-technology Transfer (DSSAT) Models in which farmers can get information on crops and cutting-edge farming techniques through DSSAT , the Elementary Crop Growth Simulator (ELCROS) Model, Crop Estimation through Resource and Environment Synthesis (CERES), and the WOFOST Model. This model, created by WOrld FOod STudies in Wageningen (Netherlands), examines the effects of changing weather patterns, various sowing techniques, and crop production variability for various types of soil. Environmental Policy Integrated Climate (EPIC) Model, which was created for assessing the productivity of soil caused by soil erosion, is also used for agricultural yield prediction. By examining the output of these crop models, the decision makers would take right decisions. Another important simulation model is Monte Carlo simulation which is a method of risks analysis which is most frequently use in supply intake and production yield. It then identifies uncertainties and potential risks through probability distribution.

- **Design of Experiments**: There are four major ways of data collection *viz.* surveys, observation, computer simulation and experiment. In addition to laboratory and field experiment, computer model simulation also use as an experiment. In computer model simulation experiment various computer codes can be utilized to construct a model. One of them is Finite element code and another code is computational fluid dynamic. Using the FEM or CFD code to construct a model, a researcher will be able to control the various input parameters and study the output. In this case the quality and accuracy of the output data or observation is as good as the input data. In most computer numerical modeling, a realistic input data must be first obtained from laboratory and field experiment of the material involved. The models must be calibrated against known or previously recorded events or cases.

These models are basically used to study the economic questions. These uses controlled, scientific experiments to test what choices people actually make in specific circumstances.

- **High Performance computing**: High performance computing or supercomputing refers to the use of high performance computing (HPC) to analyze large data sets for patterns and insights. Its an indispensable asset in the global data ecomony. HPC systems run two types of workloads *viz.* parallel and tightly coupled workloads[5] Parallel workloads are intregated to small sized independent task that can run at a high speed. Examples of parallel workloads are risk simulations, contextual search, molecular modeling, and logistics simulations. On the contrary, when workloads are divided into smaller tasks and communicate continuously with each other as they perform their processing, they are said to be tightly coupled. This usually happens with workloads across different nodes in a cluster [5]. Some common examples of tightly coupled workloads use in ecomonics are, geospatial simulations, weather forecast modeling and trading. In agricultural economics one can utilized this high performace computing in asset-liability management.
- **Analysis and visualization in an iteration loop of loops**: The iteration loops come under the category of deep learning technology. These processes involve a continuous cycle of planning, analysis, implementation, and evaluation. Each loop produces a segment of development that forms the base for the next cycle of iterations. Initially, proper planning is necessary. The work architecture is built after the need has been determined. In this method, we can revise and improve based on feedback from the stakeholder. These new tools can identify non-linear relationships in datasets. "Smart farming" has been developed as a result of technological integration in agriculture. The productivity of the agricultural sector can be greatly increased, and farmers' workloads can be reduced, through the use of smart farming techniques. However, smart farming has a few issues, including difficulty in managing and monitoring various large farming datasets. The use of mobile applications and e-platforms facilitates data visualization ,allowing thousands of farmers to access the resources with only a single click.

Agriculture data farming is currently a global issue that needs attention. Even though nothing is completely error-free, data farming is achievable given a fundamental understanding of the relevant subject.

The history begins with the emergence of simulation models in design of experiments, pioneered by prof. R.A. Fisher for agricultural studies. The term data farming is coined in 1998, conjunction with the Marine Corp's [6] in which small agent-based distillation models (a type of stochastic simulation) were created to capture specific military challenges. This subject gains attention since 1998 and a series of international data farming workshops have been held since 1998 by the SEED Center for Data Farming [6]

CONCLUSIONS

Institutions engaged in agro-economic research and development are actively contributing to the overall growth of the agriculture industry. These data farming techniques redefine contemporary research and development, boosting agricultural productivity and bringing the industry closer to the ideal of sustainable agriculture.

REFERENCES:

1. Lucas, T. W.; Kelton, W. D.; Sanchez, P. J.; Sanchez, S. M.; Anderson, B. L. (2015). "Changing the Paradigm: Simulation, Now a Method of First Resort". Naval Research Logistics. 62 (4): 293–305. doi:10.1002/nav.21628.
2. Ungureanu, Delia, et al. "Simulation modeling. Input data collection and analysis." The 14th international scientific and applied science conference ELECTRONICS ET. 2005.
3. Gondzio, Jacek, and Roy Kouwenberg. "High-performance computing for asset-liability management." Operations Research 49.6 (2001): 879-891.
4. computing." Commercial Applications for High-Performance Computing. Vol. 4528. SPIE, 2001.
5. https://www.techtarget.com/searchdatacenter/definition/high-performance-computing-HPC
6. https://en.wikipedia.org/wiki/Data_farming