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IMPORTANCE OF BIG DATA ANALYTICS IN THE AGRICULTURAL SECTOR

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Abstract: Generation of data and processing of it has been increasing day by day and reached beyond the limitations of traditional data analyzing techniques almost in every sector including agriculture sector. Applying big data strategies for agriculture sector could contribute to economic growth in terms of improving productivity and reducing environmental impacts. Agricultural products include plant, livestock and fisheries. Genetics such as variety, age, sex, etc. and environmental factors such as climate, soil fertility, pest and disease attack etc. are affecting the agriculture production. The data generated from above are having high volume, velocity, variety and variability which are classic examples of big data sources. Further, stakeholders of agriculture, such as government, private organizations and researchers generate, preserve and exploit the huge amount of data related to agricultural production, weather and climate, marketing, supply chain, etc. which need the help of big data strategies for further analysis. The big data, combined from the above sources, are collected not only to predict the future events but also to interpret past events. Adoption of big data would help to decrease crop failure, suggest the soil sensing, and improve farmers' profits while reducing the excessive use of chemicals and their impacts on ecosystems. However, revealing hidden patterns by using big data strategies requires huge mobilizations of technologies, infrastructure, and expertise, which are much complicated for an individual farmer at the moment. Nevertheless adopting change on the farm in small level can lead to significant long-term success. Therefore, the authors suggested applying big data strategies at least in agricultural research fields found in Sri Lanka for the prospective development of agriculture in the future.

Keywords: agricultural production, big data, economic growth, environmental factors

Introduction

Agriculture could be identified as the wider industry involved in the making of plants and animals for human needs, provision of agricultural supplies and services, and processing, marketing and distribution of agricultural products (Herren and Donahue, 1990; Burton, 2010). Disciplines of agriculture study include crop science, animal science, soil science, agricultural economics, Agroforestry, agricultural engineering etc.

Development in agricultural technologies with the help of researches has had a significant effect on agricultural methods and the production of food. Scientific inventions with the technological innovations, together with the improvement of new varieties of plant through gene adaptations, have ended with new genetics of crops. Similar enhancements have taken place in research in livestock as well.

The agricultural expansion "involves the transfer of agricultural information and technology to the farmers and similarly transferring information from farmers to researchers" (Pazvakavambwa and Hakutangwi, 2006). Umali-Deininger and Schwartz (1994) stated that: "The backbone of all agricultural extension endeavours is the transfer of agricultural information to enhance the productive capacity of farmers." These authors observe that implementing new technologies and new approaches in production of farming practices are essential to overcome the challenges of the growing demands of the population and the reduce in availability of useful land for agriculture.

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Agricultural information systems (AIS) expected to guarantee that information gathered from agricultural agencies such as government and non-government departments, institutions, researchers etc are to be collated. Manda (2002) stated that "Unless agricultural research and extension institutions are transformed and infrastructure constraints removed, information will play a marginal role in the process of agricultural transformation." The consequence of research and extension is restated by Dulle (2000), that: "Information is one of the most important inputs for agricultural development because of this; agricultural research results constitute an important knowledge base that should be made available to farmers for increased food production."

Importance of information gathering

Buckland (Hjorland, 1997) proposed that: "The word information can be used about things, about processes and about knowledge, in which things can be informative, or in similar ways, anything might in some imaginable circumstances be informative." Buckland suggested to state information as a tangible entity - information is outlooked as a thing, data, document, recorded knowledge etc; and as an intangible entity, information is outlooked as knowledge. Tangible processes consist of information, data, document processing, and knowledge engineering. As an intangible entity, information becomes a process implies that becoming informed.

Wilson (2006) recognizes the key disputes associated with the definition of information, indicating that various definitions have been created seeking to McCreadie and Rice (1999) suggested four major assumptions of information:

1. "Information as a commodity/ resource, where information is seen as a physical commodity to be produced, purchased, etc.

2. Information as data in the environment, where it is viewed to include readily available data from an individual's environment.

3. Information as a representation of knowledge, where information is viewed as a representation of, or pointer to knowledge, in the form of printed documents, i.e. books, journals, etc.

4. Information as part of the communication process, in which meanings are seen to be inherent in people rather than in words.

5. Information is perceived as the process by which an informant's cognitive structures are encoded and transmitted to an information seeker who perceives the coded message, interprets them and learns from them."

Gorry and Scott-Morton (1971) explained in business environment information and categorize it into seven as given below:

1. Broad scope information: information that is broad in its representation

2. Timely information: information that is received quickly and on time

3. Current information: the age of the information and its appropriateness for decision making

4. Aggregated information: refers to the degree of summarisation, for example, the provision of raw marketing data to a variety of aggregations around periods of time and areas of responsibility such as products/ markets

5. Information accuracy: the correctness of the output information to sufficiently satisfy its intended use

6. Personal information sources, which involves direct contact with other individuals (e.g. face-to-face conversations, telephone conversations, meetings, etc.)

7. Impersonal information sources describe sources that are written in nature, such as computer-generated reports and market research reports.

Innovation in agriculture with the introduction of big data analytics

The amount of information on Agriculture has been reached the beyond analytical limits of the traditional data science techniques. Hence it is required to adopt new technologies such as big data analytics in Agriculture for the improvement of production. "Big Data" has been used for datasets which are so large and unable to deal with using traditional database management systems. Big data are data sets which are beyond the analytical capability of typical software tools and storage for capturing, storing, managing and as well as processing the data collected (Herodotou *et al*., 2011). Hence, big data sets can analysed using big data analytics.

New architectures, a way of analytics, and tools are required for analyzing Big data to determine new sources of value from data received. Three big data are volume, variety, and velocity. The volume of the data indicates the size of data. Velocity means the rate which data is created and, variety refers to the different types of data (EMC, 2012).

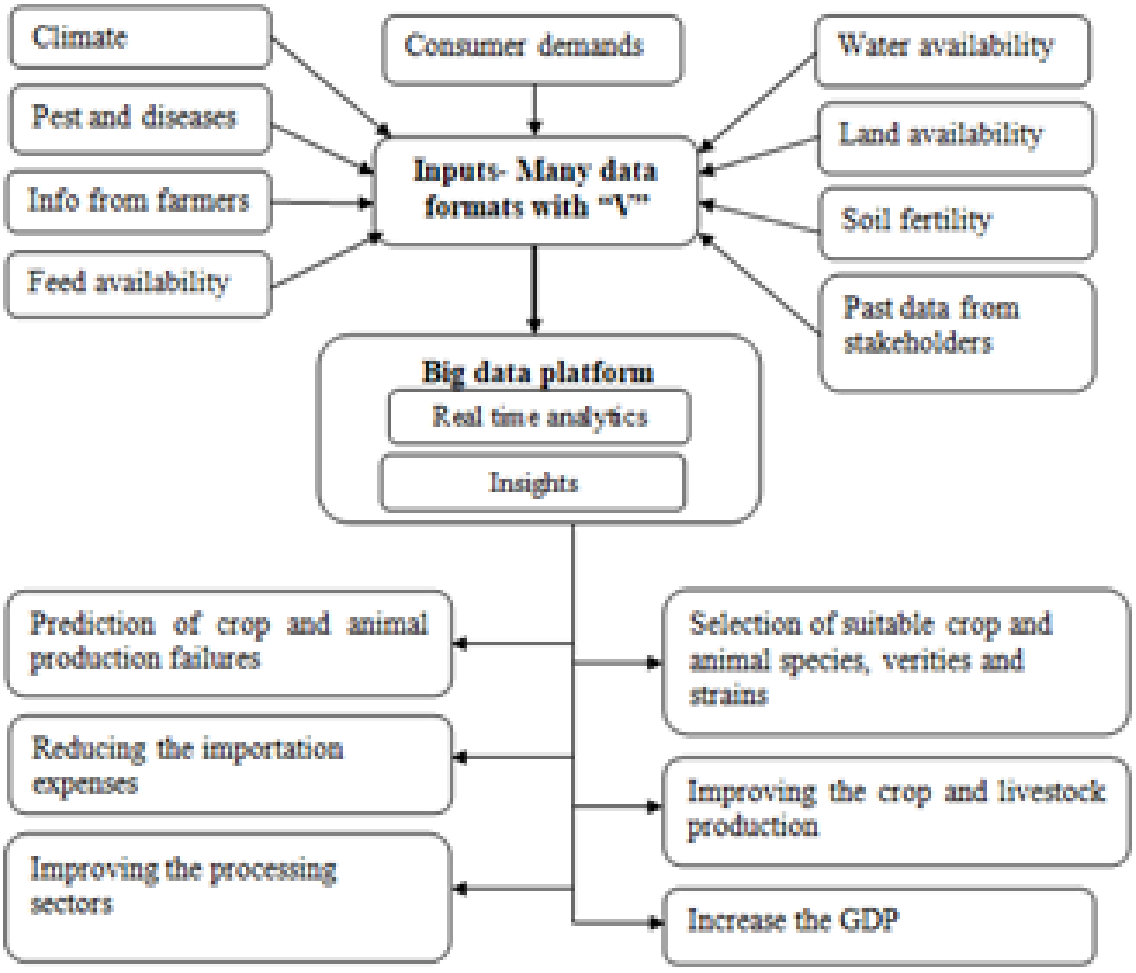

Figure 1 Proposed Agriculture- Big Data adoption model

Then big data need to be stored, managed and processed. It is very important to that in the case of agriculture, farmers and other stakeholders need to extract useful information to assist in decision making (Nada Elgendy and Ahmed Elragal, 2014). From the farmer/ stakeholder perspective, the significance of big data analytics depends on its capability to provide information and knowledge of value.

In general, past and present information available such as past climate records, water availability (past records) etc., as shown in the figure 1 which cannot be used to predict outcomes such as selection of suitable crops etc. Figure 1 illustrates the proposed conceptual model for big data adoption in the agricultural sector. The framework needs to be developed with the input parameters of climate past data, such as rainfall pattern, temperature variation, humidity, etc., pest and diseases, verbal information from farmers, feed availability, water and land availability, soil fertility, past data obtained from stakeholders of agriculture and consumer demands. With the inputs of the above, suitable platform needs to be developed to provide the following insights, such as selection of suitable crops and animal species, improving crops and livestock production, prediction of animal and crop production failures, reducing importation expenses, improving processing sectors and finally to increase the GDP of the country. With the introduction of big data analytics, valuable hidden information can be extracted and applied to enhance in advanced farming technics for increasing productivity.

Summary

Finally, if the correct approach to apply new technology, it will bring with it several potential benefits and innovations, let alone big data, which will lead to a bright future not only in agriculture, if approached with correct processes. However, it is very difficult to deal with big data. Hence, proper storage, management, integration, federation, cleansing, processing, analyzing, etc. are very important to deliver the right results from extracted information as big data exponentially increases the difficulties because of its characteristics. Therefore, further research can focus on enhancing a framework for big data management for each discipline which can overcome the challenges due to characteristics of big data.

The authors believe that big data analytics will contribute much more in all the disciplines including agriculture and can visualize unforeseen insights and advantages to farmers and stakeholders such as researchers, government, etc. Further, it is required to see the possibilities of implementing frameworks based on proposed agriculture-big data adoption model.

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