

ROLE OF COMPUTER TECHNOLOGY IN AGRICULTURE SECTOR: A REVIEW

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ABSTRACT

Agriculture is the most important sector of Indian Economy. Indian is an agriculture based country, where more than 50% of population is depends on agriculture. But farmers in rural areas have to deal with failed crops and animal illness frequently and due to limited communication facilities, solutions to their problems remain out of reach. In any sector information is the key for its development. If the relevant and right information in right time is provided it can help agriculture a lot. Computer science has the ability to model and analyze problems as well as design solutions and verify that they are correct, also comparing different techniques to identify the best one. The computer science is used for solving one of the important issues in energy field. This paper reviews role of computer technology in different field of agriculture.

KEYWORDS: *Agriculture, Computer Technology, Economy, Farmers, Information Technology*

Article History

Received: 10 Aug 2020 | Revised: 13 Aug 2020 | Accepted: 17 Aug 2020

INTRODUCTION

India's food production and productivity is declining while its food consumption is increasing. The position has further been worsened due to use of food grains to meet the demands of bio fuels. Agriculture constitutes a major livelihoods sector and most of the rural poor depend on rain-fed Agriculture and fragile forests for their livelihoods. Farmers in rural areas have to deal with failed crops and animal illness frequently and due to limited communication facilities, solutions to their problems remain out of reach. Agriculture is the most important sector of Indian Economy. Indian is an agriculture based country, where more than 55 % of population is depend on agriculture (1). This structures the main source of income. The commitment of agribusiness in the national income in India is all the more, subsequently, it is said that agriculture in India is a backbone for Indian Economy.

Information Technology in Agriculture

Today, computer science (CS) plays an important role in all fields of knowledge. Also, computer science has strong association with different disciplines; many problems in science, engineering, energy, health care, business, and other areas can be solved effectively using computer science. Computer science has the ability to model and analyze problems as well as design solutions and verify that they are correct, also comparing different techniques to identify the best one. The computer science is used for solving one of the important issues in energy field. It is the technology that is helping to exchange the information in fast and easier way. Due to this technology the distance between or the difference between the nations is reduced and now world is becoming a global village. This technology provides an opportunity to the developing nations and under developed nations so that can build up their strategies and compete with the developed nations. In any

sector information is the key for its development (2). Agriculture is not exception to it. If the relevant and right information in right time is provided it can help agriculture a lot. It helps to take timely action, prepare strategies for next season or year, speculate the market changes, and avoid unfavorable circumstances. So the development of agriculture may depend on how fast and relevant information is provided to the end users. There are other traditional methods to provide the information to the end users. Mostly they are inoculated, untimed and also communication is one way only. It will take long time provide the information and get feedback from the end users.

Role of Computer Technology in Different Sectors

- **Renewable Energy Technology**

In solar systems, accurate knowledge of solar radiation is considered as the first step in solar energy availability assessment (3), (4), (5). Also it is the primary input for different solar energy applications. Since the solar radiation measurement are not available due to the high cost as well as equipment's calibration and maintenance different solar radiation models are developed to estimate solar radiation(6), (7). These models are proposed to predict solar radiation using different techniques such as using meteorological data and geographical data, as well as geostationary satellite images, artificial neural network (ANN), time series methods and stochastic weather methods. Therefore, the best solar radiation models should be recognized to know solar energy potential before setting up any solar energy system (8), (9). Other renewable energy resources like wind energy, bio-energy, and hydro-energy; can also be optimized using computer technology.

- **Geo-Informatics Technologies**

At present, Geographic Information System (GIS), Remote Sensing (RS) and Global Positioning System (GPS) are used in convergence for animal disease management. Both GPS and GIS collect and analyze the data with geographical reference respectively. These geo-reference points are based on the longitude and latitude coordinates of the location under study.

- **Animal Disease Management**

The use of CT (computer technology) in animal husbandry and hospital management dates back to the period of arrival of computers. Since then various CT tools are used at different levels. Conventional communication modalities like print media, radio broadcastings, television, CD-ROMs, Handheld computers have been very widely used. Recent concepts like Internet, Geographical Information System (GIS), Global Positioning System (GPS), Database Management, Computer Aided Design (CAD), computer Networking, Artificial Intelligence adds strength and efficiency to the CT in animal disease management. Most of the CT tools currently used are in Herd Health management (10).

- **Pharmaceutical Sector**

With the introduction of Computer-assisted drug development (CADD) in pharmaceutical industry for drug development based on the integration of mathematical modelling and simulation, the cost of synthesizing and validating a new molecule becomes cheaper as the CADD reduces almost 50 % of the cost (11). This methodology provides knowledge based decisional tool on alternative development strategies based on the evaluation of potential risks on drug safety, and the definition of experimental design of new trials with expected power and probability of success.

- **Soil Quality Assessment**

Assessment of soil quality can be done in farm level and also for regional level. In regional level it can be done based on soil, climate and land uses (12). Some useful technologies aid to understand nature of soil and its problems due to management practices. CTs have developed several folds in the recent past. The vision on identifying the status of natural resources also widened. Soil quality assessment is being done with some useful technologies, like remote sensing.

Remote sensing is a process that collects data about an object from a remote location. Geographers use a number of mechanical devices to achieve this process. These devices contain advanced sensors that can capture information via the reflection or emission of radiation from objects. Devices used for remote sensing are constructed to sense certain wavelength bands. The objects that are sensed have particular spectral signatures and one has to match the object to the sensor. The area reported with productivity decline is demarcated. Remote sensing products are collected and interpreted for low productivity with visual observations.

- **Empowering Women**

Women face enormous challenges to use CT for their own economic empowerment. Using and benefiting from CT requires education, training, affordable access to the technology, information relevant to the user and a great amount of support [to create an enabling environment]. Access to affordable services and availability of infrastructure is without doubt a major requirement if CTs are to be used for women's economic empowerment.

- **Rural Development**

The agricultural sector is confronted with the major challenge of increasing production to feed a growing and increasingly prosperous population in a situation of decreasing availability of natural resources. Factors of particular concern are water shortages, declining soil fertility, effects of climate change and rapid decrease of fertile agricultural lands due to urbanization. However, the growing demand, including for higher quality products, also offers opportunities for improving the livelihoods of rural communities. Realizing these opportunities requires compliance with more stringent quality standards and regulations for the production and handling of agricultural produce. New approaches and technical innovations are required to cope with these challenges and to enhance the livelihoods of the rural population. CT promises a fundamental change in all aspects of our lives, including knowledge dissemination, social interaction, economic and business practices, political engagement, media, education, health, leisure and entertainment (13). CTs can play a significant role in combating rural and urban poverty and fostering sustainable development through creating information rich societies and supporting livelihoods. If CTs are appropriately deployed and realize the differential needs of urban and rural people, they can become powerful tools of economic, social and political empowerment (13).

- **Market Information**

The lack of accurate and timely market information in the agri-input sector is an issue at continental, regional, national and local levels, and remains a key constraint to the development of agricultural business linkages and trade around the world. Significant progress continues to be made by public and private institutions to implement market information services using advanced information and communication technology (ICT) tools. However, the complexities of fertilizer, seed and crop protection product value chains remain major constraints for integration into broader information systems (14). With rapidly increasing access to cell phones and computer centres, even the more remote areas of the continent are benefiting from the information offered through this advanced technology.

- **Decision Support Systems**

Decision Support Systems (DSS) are a specific class of computerized information system that supports business and organizational decision-making activities. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. DSS are data-driven, as the entire process feeds off of the collection and availability of data to analyze using various tools, which use input data/information and produce output/ decision after certain processing based on some set rules/criteria. DSS facilitate users in understanding the impact of various factors/constraints on the system. With the advent of computers, DSS are being developed and used in almost every field (15). By employing DSS a farmer/planner/policy maker can prioritize the important activities having more impact under existing constraints. DSS in agriculture are also used as convincing tools to explore, suggest and propagate technologies/strategies capable of enhancing agricultural production, income and livelihood security of farmers

- **Assessing Climate Change**

In the intersection between climate change and agriculture there are several tools available, because of the high number of crops and because of the complexity of replicating the same conditions across different regions. Every tool allows analyzing different processes of the agricultural sector, from local crop modelling under climate change conditions to the management of economic impacts of climate change on the agriculture sector (soil value variations, demand and supply, production, etc.), and so on. As many tools exist, it's interesting to focus on their common aspects rather than their specific peculiarities. Some of the tools allow simulating the growth of specific crops, verifying their variations under different climate change scenarios. Usually these tools are site-specific, but they can be applied at national and/or regional level through a link to an appropriate Geographic Information System (GIS)(16). Information is vital to tackle climate change effects: for this reason, a shift is needed in the agriculture sector to disseminate appropriate knowledge at the right time to the ones who are at the frontline in the battle: the farmers, in both developed and developing countries. At the same time, information per se is not enough, but appropriate communications systems are needed to ensure that information come to farmers in an effective, accurate and clear way. This means that the information provided to farmers must have the following properties: timing: farmers need to access to information on time, especially if it implies a change in production strategy; reliability: information must necessarily be correct and comprehensive, including any degree of probability and/or margins of error, in order to result as transparent as possible to the recipient; clearness: indications, to be properly applied, must essentially be created and processed taking into account the recipient' peculiarities, thus adapting the content of the message to his own culture.

- **Weather Forecasting**

Weather plays an important role in agricultural production. It has a profound influence on the growth, development and yields of a crop, incidence of pests and diseases, water needs and fertilizer requirements in terms of differences in nutrient mobilization due to water stresses and timeliness and effectiveness of prophylactic and cultural operations on crops. The poor, especially the rural poor, are particularly vulnerable to the negative effects of extreme weather and natural disasters. Yet accurate forecasting and timely warning can mitigate the effects of natural disasters such as floods, and improved weather forecasting can improve crop yields and lessen the effects of severe weather or drought. CT has a crucial role to play in all links of the chain, from detection to modelling and forecasting to advance warning and localization. Yet the vast majority of the poor in developing countries still have very poor access to such information and very little advance warning of adverse events.

Accurate forecasting and the increasingly sophisticated computer models that under gird it, depends on a vast array of data at a global scale, and national meteorological organizations play a key role both as suppliers of data for global forecasting and as consumers of information and forecasting that they localize and share. The costs of upgrading meteorological detection, analysis and reporting systems is substantial, but the benefits of improved forecasting and advance warning are substantial and have a strong pro-poor impact. For this reason, there is a strong case to be made for international donors to partner with governments and local partners to invest in improving and upgrading these systems and assuring that the poor, particularly the rural poor, obtain more timely and accurate weather and natural disaster information (17)

- **Food Processing Department**

Computerized systems are used for the generation processing records, but for control functions such as: formulation control, process deviation calculations, process temperature, process pressure, process timing and container closure (18), (19),(20). The control of functions that may be critical to ensuring a safe food product, must also be reviewed by the investigator to determine that they meet the intent of the desired regulations

Food processing includes the methods and techniques used to transform raw ingredients into food for human consumption. Food processing takes clean, harvested or slaughtered and butchered components and uses them to produce marketable food products(21),(22).The main phases of the food processing business include post-harvest handling& value addition, food logistics, packaging & preservation, quality management, and food marketing, food safety &food storage. There are several different ways in which food can be produced which are one off production, batch production, mass production or just-in-time production (23),(24). The use of computerized systems within the food processing industry regulated by the Food and Drug Administration (FDA) is enlarging day by day and the use of computerized system technology is expected to continue to grow in the food industry as the cost of components decrease, as components are continually improved to withstand the rigors of the food processing environment, and as food companies continue to update production facilities, equipment and manufacturing processes in an attempt to produce high quality, high value products(25), (26), (27).

CONCLUSIONS

Computer Technologies (CTs) are crucial in improving access to health and education services and creating new sources of income and employment for the poor section of society. Being able to access and use CTs has become a major factor in driving competitiveness, economic growth and social development. Information is vital to tackle climate change effects: for this reason, a shift is needed in the agriculture sector to disseminate appropriate knowledge at the right time to the ones who are at the frontline in the battle: the farmers, in both developed and developing countries. At the same time, information per se is not enough, but appropriate communications systems are needed to ensure that information come to farmers in an effective, accurate and clear way. This means that the information provided to farmers must have the following properties: timing: farmers need to access to information on time, especially if it implies a change in production strategy; reliability: information must necessarily be correct and comprehensive, including any degree of probability and/or margins of error, in order to result as transparent as possible to the recipient; clearness: indications, to be properly applied, must essentially be created and processed taking into account the recipient' peculiarities, thus adapting the content of the message to his own culture.

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