

CLOUD COMPUTING IN AGRICULTURE – AN BOON

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ABSTRACT

In India, around 75% of the population earns its livelihood from agriculture. It fulfills the basic need of human beings and animals. It is an important source of raw material for many agro-based industries. India's geographical condition is unique for agriculture because it provides many favorable conditions. There are plain areas, fertile soil, long growing seasons, wide variation in climatic condition, etc. Apart from unique geographical conditions, India has been consistently making innovative efforts using science and technology to increase production. In that one the major booming sector is cloud computing, i.e., Cloud-agro revolution. Due to my passion in agriculture and tied to implement my research area in cloud. Today's agriculture is embedded with advance services such as GPS and sensors [1] which is used to communicate with each other and also used to analyses and exchange Agri Information's among them. IT provides services in the form of cloud to agriculture. Agri-cloud and IT offers expertise service to farmers regarding cultivation of crops, pricing, fertilizers, and diseases details and methods of cure to be used etc. In this field, there are huge discoveries, suggestions regarding modern techniques for cultivation, usage of fertilizers, can obtain cultivation history of the region, etc. In this paper, our study was based on is to design and implement a simple cloud-based application on Agriculture System which is based on agri-cloud that enhance agriculture production and also enhance the availability of data related to research projects in field.

Keywords: Cloud computing, Agriculture, Entrepreneurship, Fodder, Feed, Crops, Agro.

INTRODUCTION

The agriculture and allied sector continue to be pivotal to the sustainable growth and development of the Indian economy. Not only does it meet the food and nutritional requirements of 1.32 billion Indians but it also contributes significantly to production, employment, and demand generation through various backward and forward linkages. Moreover, the role of the agricultural sector in alleviating poverty and in ensuring the sustainable development of the economy is well established.

The sector is, however, currently facing a dilemma. While it has made large strides in achieving the agricultural development goals of food security, availability, and accessibility, it is still being challenged by a formidable agrarian crisis. This situation has recently led to fresh thinking on the developmental approach in the agriculture sector. The need for focusing on the welfare and prosperity of farmers has gained prominence.

Growth of the agricultural sector 1.7 since the beginning of economic reforms in 1991, growth in the agricultural gross domestic product (GDP) has shown high volatility. It has fluctuated from 4.8% per annum in the eighth 5 years plan (1992-96) to a low of 2.4% during the tenth Plan (2002-06) before rising to 4.1% in the eleventh plan (2007-12), as shown in Fig. 1.

This chapter provides information about the recent growth and performance of the agricultural sector and analyses the major emerging challenges. The major policy interventions by the government and their impact on various sub-sectors have also been briefly surveyed. Toward the concluding part, suggestions on the possible pathways for the future are discussed.

KEY FEATURES OF CLOUD COMPUTING [4]

Types

- Public clouds offer infrastructure off-site over the internet. They provide the greatest efficiency but are more vulnerable than private clouds.
- Private clouds provide infrastructure on a private network. They have the highest security, but the hosting company needs to purchase all software and support. It is expensive but secure.

- Hybrid clouds offer multiple public and private options from different providers. Each aspect of your business is differentiated over a hybrid cloud, so they are kept the most efficient.

Characteristics [4]

1. Self-service provisioning means the computing resources are used for almost any kind of work.
2. Flexibility refers to changes in usage to increase or decrease as users see their needs change.
3. Pay-per-use allows users to pay for only the services and resources they use.
4. Maintenance of the servers is easy. Servers are off-site, and the providers take care of software updates. There is no need for users to install software onto individual systems and keep up to date with the software as it develops.
5. Location-free allows users to work from anywhere. As long as you have an internet connection, you can access the cloud. Many providers often have apps available to multiple devices, so you are not restricted. More and more businesses are now granting employees the ability to work away from the office. This feature allows a work-life balance and maintains productivity rates.
6. Backup. Cloud-based backup saves time, avoids larger investments and the need to recruit third-party experts. Choosing cloud backups to decrease the size of their data centers. The lowering of the numbers of servers, the software expense, and the staff personnel can significantly reduce IT costs without negatively affecting an organization's IT capabilities.
7. Cloud-based workload and file sharing streamline teamwork collaboration, which allows data to be shared, accessed, and edited from anywhere. Updates are visible in real-time and are seen by all teammates.

Security features

- Here are five benefits of a top cloud computing security solution:
- Protection against distributed denial of service (DDoS): DDoS attacks are on the rise, and a top cloud computing security solution focuses on measures to stop huge amounts of traffic aimed at a company's cloud servers. This entails monitoring, absorbing, and dispersing DDoS attacks to minimize risk.

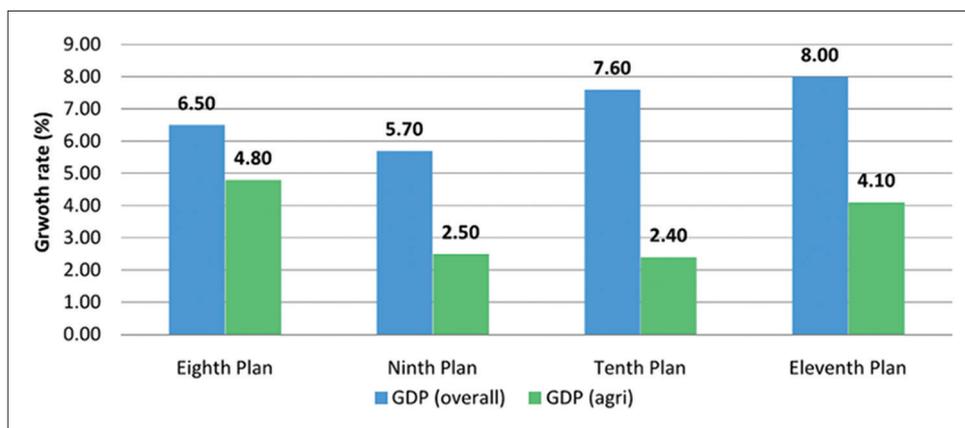


Fig. 1: Growth rate of agriculture

- Data security: In the ever-increasing era of data breaches, a top cloud computing security solution has security protocols in place to protect sensitive information and transactions. This prevents a third party from eavesdropping or tampering with data being transmitted.
- Regulatory compliance: Top cloud computing security solutions help companies in regulated industries by managing and maintaining enhanced infrastructures for compliance and to protect personal and financial data.
- Flexibility: You have the flexibility to avoid server crashes during high traffic periods by scaling up your cloud solution. Then, when the high traffic is over, you can scale back down to reduce costs.

AGRICULTURE LITERATURE REVIEW

Growth of the agricultural sector

Since the beginning of economic reforms in 1991, growth in agricultural GDP has shown high volatility. It has fluctuated from 4.8% per annum in the eighth 5 years plan (1992–96) to a low of 2.4% during the tenth plan (2002–06) before rising to 4.1% in the eleventh plan (2007–12), as shown in Fig. 1.

Food and Agriculture Organization (FAO) 5.71 India is a founder-member of the FAO and has been taking part in all its activities. India has been availing services from the FAO from time to time in the form of training, consultancy services, equipment, and material in the field of agriculture and allied sectors under its Technical Cooperation Programme.

The World Food Programme (WFP) was set up in 1963 jointly by the United Nations and the FAO. India is a founder-member of the WFP, which is mandated to provide emergency food supply in places facing acute food insecurity due to natural calamities as well as manmade causes. At present, the Country Strategy Programme (CSP) 2015–2018 is under operation, which focuses on reducing hunger and malnutrition among women and children in vulnerable areas, the development of appropriate products to deal with malnutrition at early ages among children and the creation of livelihood opportunities for the poor. The first CPAC meeting was held on August 24, 2015, with all stakeholders of WFP CSP for 2015–18. The WFP has also made notable contributions through product innovations such as India mix and mapping of hunger in India through its food atlases.

India's agriculture trade

India is among the 15 leading exporters of agricultural products in the world. The country has emerged as a significant exporter of certain agri-items such as cotton, rice, meat, oil meals, pepper, and sugar. India has developed export competitiveness in certain specialized agriculture products such as basmati rice, guar gum, and castor. As per the WTO Trade Statistics, India's share in agricultural exports and imports in the world in 2014 were 2.46% and 1.45%, respectively (Fig. 2). Agricultural exports and imports as a percentage of agriculture GDP have also been increasing, as shown in Fig. 5.6.

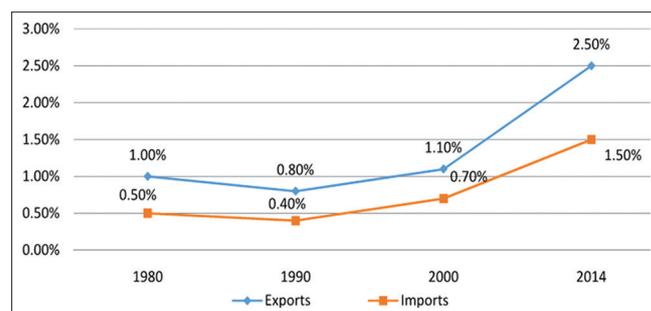


Fig. 2: Imports and exports up to 2014

India's top 10 agriculture commodities imported during the last few years are reported in Table.

Livestock and crop production activities in India generate about 300 crore tonnes of solid biowaste. The safe disposal of agrowaste within short periods is a major concern at the national and international levels. Traditional methods of recycling animal and farm waste take 6 months and yield low-quality organic manure. The exotic earthworm species, *Eisenia foetida* and *Eudrilus eugeniae*, used for vermicomposting generally, cannot survive in high temperatures and humidity and have low fecundity and poor vermicast quality. There is an indigenous earthworm species, *Perionyx ceylensis*, that

1. Thrives on cow dung and crop residue;
2. Adapts to a wide range of temperatures (0°–44°C);
3. Multiplies beneficial soil and fermentation microorganisms; and
4. Is highly prolific.

Mechanization and energy management

Improved machines, implements, and equipment were developed for improving the efficiency of farm operations and resource conservation, in addition to renewable energy technologies and gender-friendly, drudgery-reducing tools developed for women farm workers. These include sugarcane bud chip planting equipment to replace the manual method of sugarcane planting.

Empowering women in agriculture

Conceptual frameworks for developing new gender-related indices for measuring different dimensions of women empowerment in agriculture, farming systems, and gender-friendly technologies were prepared. A multi-story cropping model for a coconut orchard was developed for efficient resource use and to enhance women's participation. The income-generating potential of the second story (banana, papaya, and guava) and ground-story intercrops (cowpea, turmeric, elephant foot yam, and pineapple in the interspaces of the main crop), cultivated by women, was Rs. 414,000 as against Rs. 48,000 in a sole crop. The All India Coordinated Research Projects on home science focused on

food and nutrition security in selected farming systems, drudgery assessment, and mitigation, mitigating occupational health hazards, and on capacity development of youth engaged in agriculture and empowerment of women.

Fodder and feed development

The DADF is implementing the sub-mission on feed and fodder development so as to ensure the availability of fodder. The scheme supports the use of post-harvest technologies to cultivate and preserve fodder. To improve the seed replacement scenario, the department has taken up production of foundation seeds from breeder seeds at its eight regional fodder stations for the last 2 years. For the production of certified seeds from foundation seeds, the department has introduced the "fodder seed procurement and distribution component." After the foundation seeds are produced at all the Department's regional stations, these are offered for further multiplication to state governments, preferably through milk federations, dairy cooperatives, progressive farmers, etc., under a buy-back arrangement for the production of certified seeds.

Assistance is provided to states

The components of the scheme under the sub-mission on feed and fodder development are as follows.

1. Forage production from non-forest wasteland/rangeland/grassland/non-arable land.
2. Forage production from forest land.
3. Cultivation of coarse grains and dual-purpose crops.
4. Fodder seed production/procurement and distribution conservation of fodder through post-harvest technologies
 - Distribution of hand driven chaff cutters
 - Distribution of power-driven chaff cutters
 - Establishment of high-capacity fodder block making units
 - Distribution of low-capacity, tractor-mountable fodder block making units/hay baling machine/reaper/forage harvester
 - Establishment of silage making units
 - Establishment of area-specific mineral mixture/feed processing units
 - Establishment/modernization of feed testing laboratories.

New initiatives

On the occasion of the 87th ICAR Foundation Day, the Hon'ble Prime Minister, Shri Narendra Modi, launched the following programs at Patna.

- i. Farmer, innovation, resources, science and technology (FIRST): This is an ICAR initiative to move beyond production and productivity and to privilege the complex, diverse and risk-prone realities of most farmers by enhancing contact between farmers and scientists through multi-stakeholder participation. Farmer FIRST aims at enriching the farmer-scientist interface for technology development and application. The program aims to investigate the technical, socioeconomic and environmental impact of the project to develop a database on the performance of the technologies of the National Agricultural Research systems (NARS); farmers' perception of the technologies; agriculture as a profession in rural settings; migration; etc.
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- iii. Student Rural Entrepreneurship and Awareness Development Yojana: This is a novel program to integrate skill building and

business modules into agricultural education to provide students with the necessary skills to emerge as agri-entrepreneurs. A 1-year composite program in agriculture education was designed with three components – experiential learning, rural agricultural work experience, and in-plant training or industrial attachment.

- iv. Attracting and retaining youth in agriculture: This is an innovative program to retain rural youth in agriculture; respond to the needs of the country; and build capacity among rural youth through special programs and projects, including a "learn while you earn" program. The program shall develop a comprehensive policy for the development of youth in rural areas; involve youth in policymaking processes from design to implementation; and monitor, evaluate and recognize the requirements of new age farmers and endeavor to fulfill the same. Overall, the program aims to check the rural migration of youth, on the one hand, and unviable holdings, on the other hand, that will have a wider impact on food security within the context of the ever-growing population Mera gaon, Mera gaurav: The program brings together agricultural experts from agricultural universities and ICAR institutes to enable effective and deeper diffusion of information on scientific farming in villages. A group of experts will be associated with one particular village to create awareness and help in adopting new technologies, including those that address farm investment, loans, and availability of inputs and marketing.

Entrepreneurship development and employment generation (EDEG)

Animal farming constitutes the livelihood of the rural poor, who belong to the lowest socio-economic strata and have no means to undertake scientific animal farming with improved foundation stock, proper housing, feeding, and management. Therefore, suitable schemes to popularize scientific animal breeding-cum-rearing of meat-producing animals with adequate financial provisions are necessary to modernize the Indian meat industry and to improve the productivity of small-sized rural farms. The EDEG component of the National Livestock Mission (NLM) encourages commercial rearing of poultry, small ruminants, and pigs by the adoption of scientific methods and the creation of infrastructure. During 2014–15, a total number of 14,488 units of poultry, small ruminants and pigs have been assisted for the above activities under the NLM. During 2015–16, 5547 units have been assisted during the first quarter.

Agriculture statistics in India

The focus of agricultural policy, worldwide, has shifted from merely increasing production to doing so sustainably, while not losing sight of the goals of equity and poverty alleviation. This has increased the demands on agricultural statistics in terms of scope, reliability, and timeliness. There are numerous aspects to agricultural data. These include the structure of agriculture, i.e., agricultural holding by size, operational tenure, land use and input use; and annual agricultural activities which include crop and livestock yield and production, and seasonal information related to cost of cultivation, trade, and prices of agricultural products. Disaggregated agricultural estimates are also required for agricultural planning at the district and lower levels of the administrative hierarchy. The Government of India has evolved statistically sound systems for obtaining reliable data on all the above parameters.

Area, production, and yield of agricultural crops

All-India estimates of major agricultural crops are prepared on the basis of data received from State Agricultural Statistics Authorities in various states and union territories. State governments prepare their estimates on the basis of area enumeration in a sample of 20% villages and yield assessment through crop cutting experiments (CCEs) conducted in a sub-sample of the villages selected for area enumeration. The fieldwork for area enumeration and CCEs in states and union territories is normally carried out by the staff of the Department of Revenue/Agriculture. A fresh sample of 20% of villages is taken every year so that each of the 600,000 villages in the country is covered over a period of 5 years estimates cover Kharif as well as Rabi crops.

CONCLUSION

Finally, it is clear that India's agricultural sector has made huge strides in developing its potential. This agro-cloud revolution massively increased the production of vital food grains and introduced technological innovations into agriculture. Cloud computing is available for use anytime and anywhere so long as the device is connected to the internet based on the software as a service (SaaS), platform as a service (PaaS), or infrastructure as a service (IaaS) service model [2]. It plays an important role in agriculture for intensive farming by the implementation of the latest technologies. It makes the monitoring of agricultural very simple and easy [1]. Cloud computing facilitates the storage, management, access and giving out of the agriculture information rapidly in low cost. With applications of Agro-cloud, the farmers will be benefitted in the context of higher production, marketing, selling, and decision-making processes.

FURTHER ENHANCEMENT

We are going to develop a Mobile app to send automatic SMS for registered farmers about all updates of government schemes related to

agriculture can be presented to the farming community through cloud computing. The primary reason to adopting cloud computing is to help the farmers in taking decision related to production and maintenance.

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