Chapter 5
Analysing the Applications of Cloud Computing in Smart Agriculture

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ABSTRACT

Agriculture has been the backbone of human civilization. For ages, humans have been using traditional farming techniques to produce high-quality crops, but with the era of digitalization and the challenges of these methods, there has been a shift from traditional farming techniques to smarter farming techniques, which utilise the latest technologies to reduce labour and maximise the yield in a given scenario. Smart agriculture produces a large amount of data from sensors and IoT devices; this is where cloud computing comes into play. Cloud computing-based technology provides storage and analysis facilities to deal with huge amounts of data and produces real-time insights that can help the farmer make better decisions. Cloud computing also helps in reducing the cost and resources incurred in smart agriculture techniques, thus making the model more efficient and useful for farmers. This chapter will analyse various applications in which innovative cloud computing technologies can be used in smart agriculture and the drawbacks that should be considered while adopting the cloud model.

1. INTRODUCTION

It is anticipated that the global population will reach 9 billion by the year 2050, which represents an increase of about a quarter in comparison to the current population (World Population Projected to Reach 9.8 Billion in 2050, and 11.2 Billion in 2100 according to United Nations Department of Economic and Social Affairs. Such a high rise in population will certainly require higher demand for food and various

agricultural products. Considering the rise in the global population, it is very crucial to be more vigilant regarding the quality of food and the nutrition content derived from it. Food production should be nearly tripled by 2050 in order to satisfy future food demands. To meet the global food demand in 2050, grain crop production must be increased to 3 billion tonnes from the existing from 2.1 billion tonnes and meat production to 470 million tonnes from the existing 200 million tonnes (Tripathi et al., 2019).

In the present scenario, a significant portion of farmers and growers' time is devoted to monitoring and comprehending the condition of crops, which leaves them with limited time for actual farming activities (Sisinni et al., 2018). Therefore, there is a need for precise and advanced technologies to propel the agricultural sector forward. Moreover, in order to achieve sustainable agriculture, it is crucial to minimize the impact of climatic and environmental factors. Additionally, 42% of the population in the world depends on the agricultural sector for its bread and butter, and is considered as crucial for economies of developing nations (Aznar-Sánchez et al., 2019). Hence, there is a need for revolutionizing the sector with the implementation of Industry 4.0 technologies in agriculture will help alleviate the increasing challenges faced by agricultural processes worldwide.

Technological development has paved a new way for the use of electronic systems in the agricultural environment. Technologies like IoT, Augmented Reality, big data analysis, and artificial intelligence have been integrated with traditional farming techniques with the goal to increase sustainability, productivity, and efficiency (Saban et al., 2022). Cloud computing is an essential component of smart agriculture, as it provides storage services to handle the large amount of data generated by agricultural devices and sensors and the required computing power to analyse the data. Cloud computing enables farmers to view real-time information related to field, soil, moisture, crops, weather, insects, etc. i.e., the components that play a crucial role in agriculture. Smart farming is a technique that uses modern technologies and the traditional approach to increase the quantity and quality of products while decreasing human labour and costs required for production.

Before exploring the applications of cloud computing in the agricultural sector, it is essential to understand the fundamentals of cloud computing and smart agriculture, as well as how they are interconnected. By leveraging cloud computing and Industry 4.0 technologies, the agricultural sector can move toward a more sustainable and efficient future, meeting the growing demand for food while reducing the impact on the environment. This chapter will explore the various ways in which cloud computing can be applied to the agricultural sector and the benefits that it can bring to farmers, growers, and the global population as a whole.

1.1 Cloud Computing

Cloud Computing is the availability of IT Resources on demand. In this fast-paced world, we need immediate access to these resources from any part of the world. (Qian et al., 2009) Whether someone is using e-commerce platform or someone is trying to access his/her banking information, it is all part of cloud computing (Soul et al., 2017).

As shown in Figure 1, there are four different types of clouds namely, Public Cloud, Private Cloud, Hybrid Cloud, and Community Cloud (Bhargav & Manhar, 2020):

- Public Cloud: Public Clouds are clouds that are third party managed that provide cloud services over the internet to the public. These services cost according to the usage of resources.

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