Chapter 48
Using Artificial Neural Networks (ANNs) to Improve Agricultural Knowledge Management System (KMS)

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ABSTRACT

Agriculture is an important sector of the Indian economy. In the present paper an attempt has been made to theoretically explore the development of an agricultural knowledge management system (KMS) in respect of various micro irrigation techniques for agriculture, as well as relevant crop-/region-specific agricultural practices in different regions of the country, as the same has been observed to be very much necessary for the overall benefits of wider cross section of farmers, agricultural scientists, economists, and other stakeholders in the domain. It is further observed that artificial neural networks (ANNs), which are a part of soft computing techniques, can be used as a KMS tool for effective management of various sub sectors of agriculture. In this context, it has been shown that use of ANNs as a KMS tool can improve the effectiveness of applications of the above mentioned agricultural KMS by accurately forecasting the year-wise estimated yield of food grains of India with the help of past data of various relevant parameters.

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INTRODUCTION

As per the study paper of Jennex (2005), Knowledge Management (KM) may be defined as the practice of selectively using knowledge from previous experiences of making decisions to current and future decision making process with the main objective of improving the organization's effectiveness. In this context, it has viewed a Knowledge Management System (KMS), as that system which is created to facilitate or improve the capture, storage, retrieval, transfer, and reuse of knowledge. The perception of KM and KMS is that they holistically combine organizational and technical solutions to achieve the goals of knowledge retention and reuse to ultimately improve the effectiveness of organizational and individual decision making.

Thus an Agricultural Knowledge Management System (KMS) is a KMS which can be developed in certain specific area(s) or domain(s) or sub-area(s) of agriculture sector for facilitating capture, storage, retrieval, transfer, and reuse of knowledge in the specific domain(s).

Agriculture is a vital sector of Indian economy, which contributes about 17% of its total GDP (Gross Domestic Product) and generates employment for around 60% of the population (Arjun, 2013). As per the Annual Report 2016-17 of Department of Agriculture & Cooperation (DAC), Ministry of Agriculture, Government of India, the food grains in India consist of Rice, Wheat, Coarse Cereals (such as, Jowar, Bajra, etc.), and Pulses. The other major agricultural products/ crops are Oilseeds, Sugarcane, Cotton, Maize, Jute and Mesta. Every year, DAC makes estimates of production of each of the individual items of food grains as well as other major crops in million tonnes and total area sown in lakhs or million hectares (Ha) [1 million = 10 lakhs]. From these two estimates year wise Yield of Food Grains in Kg per Hectare (Kg/ Ha) can be obtained by dividing former by the latter. The year wise yield of food grains is very important parameter in the overall agriculture sector in India and all out efforts are generally made by the Central and all State Governments as well as concerned stakeholders to increase the same.

From time to time various researchers in their studies (discussed subsequently in this paper) have observed that the quantum of effective irrigation, especially minor or micro irrigation at farm level is a vital input for improving/ increasing the overall productivity in agriculture sector including yield of food grains of India in a particular year besides other factors. In this context, micro irrigation may be defined as the frequent application of small quantities of water directly above and below the soil surface; usually as discrete drops, continuous drops or tiny streams through emitters placed along a water delivery line (Lamm et.al, 2007).

In view of above, it is observed that development of a related Agricultural Knowledge Management System (KMS) in respect of various micro irrigation techniques for agriculture, as well as relevant crop/ region specific agricultural practices in different regions of India is very much necessary and can be explored, for the overall benefits of wider cross section of farmers, agricultural scientists, economists and other stakeholders in the domain.

There are various tools for properly managing and making decisions in a KMS such as, Soft Computing (SC), Artificial Intelligence (AI) based techniques, Machine Learning (ML) or combinations of all these. Out of the above, Soft Computing based techniques can be used for effective and proper management of different sectors of national economic planning including agriculture. These techniques are built on several sub fields namely, Artificial Neural Networks (*hence forth designated as ANNs*), Fuzzy Logic (FL), Genetic Algorithm (GA), etc., and/ or their combinations. In fact, some of the major practical problems, which can be effectively handled by using soft computing techniques, involve aspects of uncertainty, imprecision, vagueness, sub-optimality, to name a few, where classical mathematical