# E-Green Revolution Through Knowledge Management In Agriculture Sector

Tejas Ghadiyali, Dr. Kalpesh Lad

**Abstract:** The Agriculture Sector is the backbone of the economic development of the country India. Several electronic applications in the field of agriculture help the farmer community to get in touch globally as well as locally for the entire knowledge-based information regarding the agriculture system. Knowledge Management has been imparting a lot in the sector of agriculture, which surely leads towards the e-Green Revolution. In this paper the authors have tried to show such applications and their impact on the agriculture community.

**Keywords:** e-Green Revolution, Knowledge Management in Agriculture, Intelligent application in agriculture.

## 1. INTRODUCTION

The increased use of computer, information technology and electronic device is collectively known as the 'e-Green Revolution'. In the overall development of the country India, Agriculture has played a vital role, as the majority i.e. about 70% [1] people live in villages and most i.e. 60% [2] of them are engaged in agriculture sector. This actually leads importantly towards the overall economic development of the whole country. Knowledge Management is the activity to gain the knowledge from the expertise or experience, either individual or as a process or practice [3]. Agriculture is the production, processing, and marketing of food, fiber, and renewable natural resources. The past decade has shown an explosive growth in search on knowledge and knowledge management in the information systems, especially in agriculture sector [4]. In this sector the individual may be a farmer and the process becomes the agriculture system process from pre-harvesting to post-harvesting in context of knowledge management.

Knowledge sharing is an important knowledge management process and it can surely benefit the farmer community [4]. Agriculture sector has several knowledge management systems which can be in the form of IT applications, decision support system, GIS based system, WSN based system and e-commerce application. In this paper the authors throw light on every category by showing its importance and benefit of such application to the agriculture community and finally conclude the paper with useful suggestions.

## 2. REVIEW OF LITERATURE

Knowledge Management has played a vital role in the up-gradation of the agriculture sector. Efforts made by the agriculture informatics scientist in this direction are worth experience for the farmer community. IASRI in collaboration with Directorate of Wheat Research and IARI, New Delhi developed an expert system on wheat crop management (EXOWHEM) (Islam at al. 2007). This system is basically an remote place information bank which provides all the information in the form of knowledge about the Wheat Crop Management. An 'Expert System for Cotton Crop Management' (Hal, 1990) COMAX (1986), determines the best strategy for applying fertilizer. Sensors in the cotton fields automatically report weather conditions to the system, and Comax re-evaluates its recommendations on daily basis and generate the relative knowledge. University of Agricultural Sciences (UAS), Raichur in collaboration with IIT Kanpur, ICRISAT, Hyderabad and IIM Kolkata developed two novel portals expert to farmer (E2F) and Farmer to Expert (F2E) for information communication to the farming community and knowledge sharing among agriculture experts and farmers. (L.B. Hugar at.al., 2012). In E2F, an agriculture expert can record and send agriculture information to a set of registered farmers through web based interface (web to mobile) or a mobile phone (mobile to mobile). An expert can also send text messages (SMS) to the farmers. In F2E, farmer will have access to speak to an expert (through mobile).

IIIT, hyderabad has developed eSagu, an expert personalized agricultural advisory system. (P.Krishna Reddy et.al. (2004-2012)). The eSagu system aims at providing farm-specific agricultural expert advices to the farmers in a timely manner at regular intervals depending on crop, throughout crop growing period. Laser sensor based herbicide applicator link with the expert system and generate the knowledge about the missing area in the entire field during the spraying operation (K.N.Agarwal et.al. 2012). In this application Laser sensor acts as "eye" to the equipment, which sprays liquid only on the weed patches. GeoSense, a decision support system developed by IIT Bombay, IIT Hyderabad and The University of Tokyo (J Adinarayan et.al. 2012). This system modules with flux tower with three different types of sensor for temperature, relative humidity and $CO_2$. Such input generate the real time knowledge for the weather profile which useful for the farmer community to calculate the water requirement and irrigation schedule. A.Paventhan et.al. (2012) give an SNMP-based approach to real-time soil property monitoring using a 6LoWPAN-(Low-power Wireless Personal Area Network) enabled Wireless Sensor Network. They suggest that 6LoWPAN test-bed can be expanded to become an experimental facility to test

various ideas like heterogeneity, interoperability, scalability, standardization etc. in real time knowledge generator.

## 3. SIGNIFICANCE OF KNOWLEDGE MANAGEMENT IN AGRICULTURE SECTOR

Being a core component of the economic development, Agriculture sector has significant importance for the country India. This significanc can be maintained by applying different knowledge based or knowledge management applications in this sector. Such applications not only help the farmer community to take right decisions but also guide them for the steps to be taken by them in the overall process. Such knowledge richability surely helps them in different activities of agriculture right from Crop production to crop protection and marketing, Soil and water management, Watershed development, Organic farming, Crop-weather watch, Integrated Pest Management, Inter-cropping system, Bio-fertilizer system, Early warning system and so on.

There are several web-services [5, 6] available which actually help the farmer community to gain the information and thereby help in knowledge generation. Such knowledge generation helps them in their productivity and quality and thereby profitability in the competitive agriculture market.

## 4. KNOWLEDGE MANAGEMENT IN AGRICULTURE

Traditional farming practice has evolved over the years.

ICT in the form of knowledge management system can be used to a great extent in many ways using IT applications, Decision support system, GIS based system, WSN based system and e-commerce as follows:

A. IT Applications: In the agricultural sector, the chances of increasing the gross cultivated area are limited so increase in agricultural production is required which demands crop water requirements on the one hand and major improvements in performance of existing irrigation and drainage systems on the other hand. It is very hard to maintain huge irrigation system manually. So the ICT application in irrigation and drainage monitoring systems gives us the entire information about the irrigation system [7] and can be maintained by a few members. Such system really benefits an increase in food production, water conservation and to protect the environment. Laser Sensor Based Herbicide

applicator (fig.1a) and flux tower (fig. 1b) sensor based applications are the innovative IT applications in the agriculture sector.

B. Decision Support System: A Decision Support System (DSS) helps the agriculture community to make decisions by presenting information relevant to their critical questions in a simplified manner which is easy to understand. E.g. a DSS application in the agriculture sector is 'Soil and Water Conservation Management' [8]. The prime objective of this

**Fig-1 a.** Laser Sensor Based Herbicide applicator


**Fig-1 b.** Flux Tower

system is to provide watershed conservation measures based on slope, soil type and Land Capability Classes (LCC). Here some parameter inputs are required to generate the result, which help the watershed manager in making decisions. In the agriculture sector, for a different purpose, we have a different decision support system [9,10,11,12,13,14] which directly or indirectly helps in solving the problem and supports in decision making.

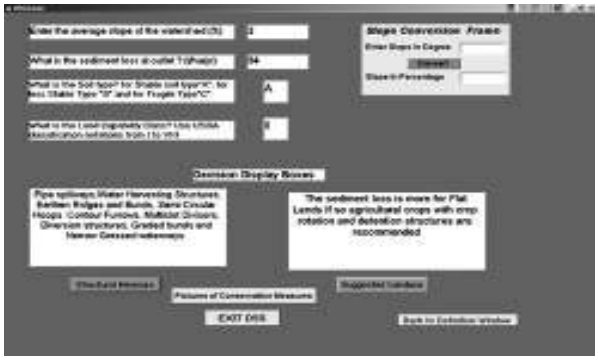


Fig-2 DSS for Soil and Water Conservation

C. GIS Based System: A geographic information system (GIS) is a technological tool for comprehending geography and making intelligent decisions. So, GIS organizes geographic data so that an agriculture community reading a map can

select data necessary for a specific task. A good GIS program is able to process geographic data from a variety of sources and integrate it into a map project. GIS is playing an increasing role in agriculture production throughout the world by helping farmers increase production, reduce costs, and manage their land more efficiently. In agriculture sector, we have the GIS applications such as crop yield estimates, soil amendment analyses, and erosion identification and remediation. ARC/INFO is one of the first GIS softwares used all over the world. Later on other GIS softwares have been made available, such as PAMAP, MAPINFO, GRASS, ISROGIS, IDIRISI and GRAM for different functions.

D. WSN Based Application: The wireless sensor network (WSN) is one of the most significant technologies in the 21st century. The agriculture sector has Wireless Sensor network (WSN) applications for different purposes. 'Environment monitoring server system' [21] is one of the WSN based applications in the agriculture sector. The main aim of this system is to collect environmental and soil information through sensors; image information through CCTV; and local information through GPS modules.

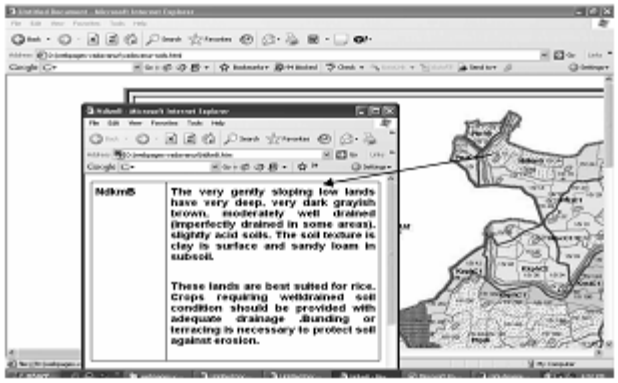


**Fig-3** GIS for Action Plan Map for Agriculture

This collected information is stored into database for knowledge generation. For sufficient power infrastructure, a solar cell-based power supply is implemented. So such system basically monitors the external environment and thereby improves agriculture product quality and also contributes to the increasing of crop yields.

**Fig-4a.** WSN for Environment monitoring server system

**Fig-4b.** Soil Sensor Application

Other WSNs are also available in the agriculture sector for the purpose of Site-Specific irrigation [16, 17], Green house monitoring [18] and Agriculture Recommended system [19, 20].

E. E. e-Commerce Application: Agri-business, Agriculture-Trade, Agriculture Marketing, Horticulture are some of the examples of the e-commerce application in the agriculture sector. Such applications continuously guide the agriculture community regarding the commercial activity like trade, business and marketing. Moreover the Government of India has also launched several portal services such as AGRISNET, AGMARKNET, HORTNET, APEDA, AgRIS, VISTARNET etc. Such services basically are helpful to the farmer community in searching the information and thereby generation of knowledge in the respective domain of agriculture sector.

## 5. KNOWLEDGE MANAGEMENT SYSTEM IMPLEMENTATION ISSUES

Though we have the above mentioned Knowledge Management Systems available in the agriculture sector, still this sector faces several difficulties in the implementation of such knowledge management systems in India, due to many reasons such as poor literacy ratio of the farmer community, poor ICT knowledge, poor ICT availability in many areas of the village, Regional language compatibility problem, Un-affordability for GIS system for many farmer communities. So this is also a burning issue that can be minimized using the proper steps taken by the government agencies in the form of training to farmer communities and ICT reachability to the root village area.

To overcome such limitation government, NGO, private training agencies should focus more on farmer's literacy and there by ICT literacy. Instead of traditional method, literacy should be given by hands on experiments. The knowledge representation should be in regional language and simple. Regional language IVR system may be helpful for knowledge acquisition to the farmer community.

## 6. CONCLUSION

In this paper, the authors have introduced a new terminology – 'e-Green Revolution'. Here, the focus has been on the current scenario of Knowledge Management in the domain of Agriculture process, product and business. The authors have also showed the benefits that can be availed by using such knowledge management systems in the agriculture sector. In spite of some implementation limitations of such system, it can help the farmer community at large and consequently make them avail the benefit of the knowledge generated by the knowledge management system and thereby increase the overall profitability.

## 7. REFERENCES

1. Golait, Current Issues in Agriculture Credit in India: An Assessment, RBI, Occasional Papers, Vol.28, Iss.No.1, pp.1-2, 2007.

2. Government of India Planning Commission, Report of the Working Group on Agriculture Research and Education for the Eleventh Five Year Plan 2007-2012, pp – 16-17.

3. Tapan K. Pandya, 'Knowledge Management, a global Perspective' Excel Books 2008, New Delhi. ISBN:978-81-744-621-1, 135-144.

4. Peter Wagner, Karin Rosskopf , "Knowledge Management in agriculture From Data Generation to Knowledge Sharing", EFITA, 2005 Portugal (Presented Paper).

5. Manes, ICT applications in agriculture from Precision Agriculture to Aml, Presented in MIDRA Consortium, Ambient Intelligence Workshop, Florence as on 15-16/07/2004.

6. Satpal, Level of Agricultural Technology in India (1757-1857), Asian Agri-History, National Institute of Science, Technology and Development Studies, Vol. 1, pp 5-25, 2007.

7. Bart Schultz et.al. "Irrigation And Drainage Systems Research And Development In The 21ST Century", Netherlands.

8. A. Sarangi et.al. "A Decision Support System For Soil And Water Conservation Measures On Agricultural Watersheds", Wiley Inter Science (www.interscience.wiley.com). DOI: 10.1002/ldr.589 'Land Degradation & Development' Vol.15 pp 49–63 (2004).

9. Anurag Agrahari et.al. A Theoretical Framework for Development of Decision Support system for Agriculture' RESEARCH INVENTY: International Journal of Engineering and Science ISSN: 2278-4721, Vol. 1, Issue 6 (October 2012), pp:50-55.

10. Jintrawet et al, A Research Report on 'Decision Support System Research and Development Network for Agricultural and Natural Resource Management in Thailand: A TRF-DSS Experience' Southeast Asian Studies, Vol. 1, No. 1, April 2012, pp. 141–162.

11. Papathanasiou et.al., 'A Decision Support System For Farm Regional Planning', Yugoslav Journal of Operations Research Vol. 15 (2005), Number 1, 109-124.

12. Prof. Mrs. J.R.Prasad, Prof. R.S.Prasad et.al. 'A Decision Support System for Agriculture Using Natural Language Processing (ADSS)' Proceedings of the International Multi Conference of Engineers and Computer Scientists(IIMECS) 2008, 19-21 March, 2008, Hong Kong.

13. Wang Zhi-Qiang, Chen Zhi-Chao, "A Web-based Agricultural Decision Support System on Crop Growth Monitoring and Food Security Strategies" Proceedings of the Third International Symposium on Computer Science and Computational Technology(ISCSCT '10) ISBN 978-952-5726-10-7, Jiaozuo, P. R. China, 14-15, August 2010, pp. 487-491.

14. Racca Paolo et.al. "Decision Support Systems in Agriculture: Administration of Meteorological Data, Use of Geographic Information Systems (GIS) and Validation

Methods in Crop Protection Warning Service" Chapter-16, ISBN 978-953-307-326-2, Published: September 9, 2011 under CC BY-NC-SA 3.0 license.

15. Anil Rai, "Remote Sensing and GIS application in agriculture", Indian Agriculture Statistics Research Institute., pp-1-10.

16. Y.Kim. at.al, "Software design for wireless sensor-based site-specific irrigation", Computer and Electronic in Agriculture, Volume 66, Issue 2, May 2009, Pages 159–165.

17. Evans, R.G.Yunseop Kim et.al. "Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network", Instrumentation and Measurement, IEEE Transactions on (Volume:57 , Issue: 7 ).

18. Zhou Yiming et.al. "A Design of Greenhouse Monitoring & Control System Based on ZigBee Wireless Sensor Network", Wireless Communications, Networking and Mobile Computing, 2007. WiCom 2007. pp- 2563-2567.

19. Laliwala, Z., "Semantic and Rule Based Event-driven Services-Oriented Agricultural Recommendation System",Distributed Computing Systems Workshops, 2006. ICDCS Workshops 2006. 26th IEEE International Conference 2006 pp-24

20. F.J.Pierce et.al., "Regional and on-farm wireless sensor networks for agricultural systems in Eastern Washington, Elsevier, Volume 61, Issue 1, April 2008, pp-32-43.

21. Jeonghwan Hwang,,"Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Networks" , Sensors 2010, 10, 11189-11211; doi:10.3390/s101211189 pp 111089 to 11211.

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