

# Impact of Soft Computing in Indian Agricultural Scenario

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**Abstract**— Since the creation of organisms on earth, it is inevitable to depend on food. Agriculture is therefore, consider being one of the extremely essential sector upon which human existence depends on. However, evolution of mankind has constantly proven growth of science and technology. Therefore integration of science and technology in agriculture is considered a judicious action. This paper therefore brings in awareness on various possibilities of application of advanced technological concepts such as soft computing techniques like neural networks, fuzzy logic in Indian agricultural scenario. This knowledge provides scope for in- depth research in above said area and enable towards betterment of human life.

**Keywords**— Indian Agriculture, Soft Computing, Neural Networks, Fuzzy Logic

## I. INTRODUCTION

The growth of human civilization over the ages was mainly impacted by the advancement in agriculture sector. The rise and fall of great civilizations like Indus Valley civilization, Harappan civilization were based on the progression and regression in agriculture. Even though human race has progressed from farming to industrialization and to an era of technology, agriculture is the one sector that will never lose its significance due to its impact. The produce and outcome of agriculture is very much necessary for the sustainment of human race.

Since global population is increasing, there is an increase in need for the human necessities like food, water, clothing and shelter. Thereby more and more land for agriculture is taken out use to serve other purposes every year. Thus, there is a significant degradation of land due to erosion and conversion. Pollution in water sources is another threat for agriculture. Other available resources are also affected badly, due to which agriculture sector is badly affected. Various factors, if summarized include the drastic increase in population all over the globe, the change in climatic conditions, loss of agricultural land, the scarcity in water resources, monoculture in farming, etc. The concerning cofactors

include middleman between the farmers and the customers ,fertilizers, lack of water, soil fertility, labors, climate factor and rapid decrease of fertile agricultural land due to urbanization

The need of time is qualitative and quantitative growth in agriculture with minimum available resource. Research in the field of agriculture has resulted in yielding high productive crops as well as managing land. The extensive research and development in all the fields of farming and breeding resulted in increased productivity that leads to green revolution. The adverse effect of it is deterioration of soil health as well as low nutrient uptake in crops and pastures. The extensive use of pesticides and weedcides result in adverse health effects in farmers as well as the consumers. Also, weeds and pests gain resistance to it. The one solution that can be offered to it is the introduction of computing techniques in the analysis of various aspects that affect the farming.

Information and communication technologies (ICTs) play an important role in agriculture scenario to increase the production, efficiency. Agricultural engineering is the one engineering discipline that deals with using various engineering techniques in a cost effective way to increase the productivity with minimum impact on the environment. The one thing that is yet to be exploited in Indian agricultural scenario is the use of computing and engineering techniques to solve the problems faced by farmers in the real time scenario. The problems faced by farmers are complex as well as the resources required for the solution is pretty huge. Even if a near optimal solution is obtained, it will have a very large impact. This can be very much achieved by the use of technology and other soft computing techniques.

The research is mainly based on Indian scenario where the conditions and problems of farmers in several villages at different villages of India. A questionnaire is prepared which is focusing on common problems faced

by farmers. Thus obtained data is used in the further data analysis and research process.

The proposal is to introduce an e-Agriculture framework where all the conditions related to a product is share to the farmers in any possible way, and the data to be shared will be obtained from systems that process and analyse already existing conditions. Soft computing techniques can be widely used in analysing the pre-existing conditions to predict a future scenario that includes post-harvest, fertilization, weather conditions, cost of vegetables, schemes, soil fertility.

This paper gives an overview of the problems faced by farmers based on a survey carried out and possible solutions that can be derived using soft computing techniques. The whole paper is organised as follows, literature survey followed by case study. The observation from case study is mentioned in subsequent section. The possible solution that can be derived using soft computing techniques is specified next. Recommended solution upon their implementation ascertains elimination of middle man system between the farmer and customers and yields benefit to the farmers efforts.

## II. LITERATURE SURVEY

Authors of [1] suggest how one can make use of the current advancements in communication technology. They use the Android smart phone to create an application which can serve the farmers with details such as weather update, price updates about various products from all the markets present in a particular region, news about the agricultural commodities and so on. But the disadvantage of this method is that the application will be useful only if the farmer know to use the Smartphone.

Authors of [2] indicate how user can leverage the benefits of mobile technology to help the farmers. Usually in any company there will be a separate section to deal with the queries of the customer. This paper tells us that by setting up a call centre to deal with various issues faced by the farmers can improve the GDP by a good level. A farmer can interact with a person who has knowledge or who can guide them using various databases and results available with him to provide a satisfactory solution to the problems faced by the farmers.

Authors of [3] specify about the role of mobile phones and information exchange in a place like India where more than 50% of the population is dependent on agriculture and most of them are illiterates. As the number of mobile phones being used by the farmers increases we can devise many ways to educate the farmers about the various agricultural issues and their

solutions. This scale of increase in the usage of mobile phones will lead to the upliftment of women.

In the paper [4], authors make use of the concept of big data analytics to find a pattern in agricultural produce so that one can innovate the results obtained out of the analysis and use it to increase the annual yield out of the farms. We look into the data collected over years, user's feedback and expert advice to identify effective and beneficial farming patterns.

Authors of [6] highlights on the problems and prospects of e-agriculture in rural Indian context. It includes facts on Information asymmetry between farmers, regions and countries. The paper describes E-agriculture with the application of existing Information and Communication Technologies (ICT) [5].

Authors of [7] proposed a project, namely-Kakashi project. This project is on adapting adhoc sensor network technology to avoid vermin damage to crops by animal to improve the production. The main goal of this project is to monitor the entire agriculture farm land and send the signals to farm owners when unwanted situation occurs [6].

Authors of [8] describe a mobile based application, namely Krishi Ville, for farmers. This application takes care of the updates of various agricultural commodities, agricultural news updates, weather forecast updates etc [8].

Authors of [9] put forward policy proposals to promote the application of new agriculture science and technology. As the construction of new village gradually advanced, the agriculture science and technology has an important effect on improving conditions of production and income which made to show strong interest and demand for new science and technology. They conclude that efficiency of agricultural production has quickly improved by applying new agricultural science and technology continuously with different links of agricultural production [9].

Authors of [10] introduced hyper spectral remote sensing technique to monitor the plant diseases, Insect Pests and Invasive Plants Species. This information is useful for estimation of crop yield and also for classification of agricultural crops. Some of the techniques used for processing the image are Dimension Reduction/Band selection, Classification/Clustering, Establishment of Spectral library and Radiometric Calibration/Correction [10].

Authors of [11] discussed the Agriculture Advisory System. This system aimed at bridging the information gaps that exists between farmers and extension workers and agricultural scientists in a country. This paper also presents an innovative technology development effort, analyses the technological challenges faced and also the

feedback obtained from early field implementation using different approaches. This is implemented to serve farmers in few districts of Tamil Nadu [11].

Beside the research work on agriculture, several websites by both central and state governments are in service. These websites are providing information on different phases of agriculture in their own way. A top-down strategy is mainly used for flow of information. Data on seeds, pesticides, machinery and fertilizers are made available and is not properly utilized by the end users such as agricultural officers and farmers. Most of the websites are merely provides the static data and lack in the dynamic interface among stakeholders. There are almost 23 divisions on agriculture with 88 websites by government of India [1]. Very few of the states have launched web site on agriculture with limited services.

Authors in [10] write on basic concepts in soft computing and the various applications it has. The authors were able to specify the n number of applications it has from actuarial science to image processing to process control to turning, milling, drilling in grinding. The authors further specify which component of soft computing is more applicable in each field, which includes artificial neural network and fuzzy logic system in agricultural sector.

The authors in [9] specify how soft computing techniques can be applied in agriculture sector. The authors specify how various factors that directly and indirectly affect the farming can be studied and analysed in precision farming. The authors have coined various applications of soft computing techniques in soil and water context, also its future in precision farming is discussed.

III. AGRICULTURAL PROBLEMS FACED IN INDIAN SCENARIO

The problems faced by farmers in Indian scenario can be classified into two, general and region specific. Crop based problems are one set that affects the farmers that are growing them, but the general problems that are faced by the farmers is one and the same. Any self-employed person will have one man intension and that is profitability which is not achieved in case of farming due to the lacuna in the Indian scenario. In order to learn more about the problems faced by farmers a questionnaire was prepared that focuses on common problems faced by farmers. It includes questions that cover all the scenarios. The sample survey is done in several villages, as an example, Hobli level at Ramanagara district, Karnataka state, which covers almost 150 small scale and large scale farmers. Table 1 is the brief format of the questionnaire.

TABLE I: QUESTIONNAIRE USED IN THE SURVEY

Issue 1	Crops Cultivated
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Issue 2	Assistance in the form of finance and man power
Issue 3	Availability of required service and goods
Issue 4	Supports available and used from agricultural office
Issue 5	Availability of transportation
Issue 6	Government Schemes awareness and usability section
Issue 7	Technology level support from regional agriculture offices
Issue 8	Adaptation of Information Technology section
Issue 9	Opinion on proposed approach
Issue 10	Farmers suggestion section

Each issue considered in the questionnaire section had number of sub sections, and the response was collected from large scale, medium scale and small scale farmers. The analysis of the response was performed and the result obtained leads to the conclusion that the problems faced by the farmers remain the same, no matter in what scale the farmer is cultivating.

The typical problem with farmers even from large scale to small scale is, right from seeding to marketing phases. The major problem is with lack of awareness with recent advancement and its suitable adaptation. Because most of the people doing farming are illiterate, it is very much necessary to make them aware of the available resources and aids. Marketing is another problem with limited markets. Hands on information regarding availability of commodities are not available which unnecessarily wastes his time and money. Through most of the farmers are not explored to recent happenings, they are interested in adapting themselves to new system which would change their life style.

IV. THE SCOPE OF SOFT COMPUTING IN AGRICULTURE SECTOR

Neural networks are one main soft computing technique that can be used in agriculture systems. Data related to various factors related to agriculture is collected and is feed to neural network. Based on the training data feed, the required information is tapped. It includes the prediction of climatic conditions, availability of rain fall; since rain fall is one important factor in which whole of Indian agriculture depends on probability of occurrence of adverse climatic conditions, drought, soil fertility, occurrence of diseases as well as weed problems. The recent advancement in technology enables one to predict the diseases that a crop can have from just analysing a leaf. That is the extent to which technology has grown. But the services are not directly available to the farmers. Existence of middleman is the one main problem. If adverse climatic conditions can be predicted and known to the governing authorities, the

measures to overcome it can be taken care, and various schemes for it can be designed and implemented.

Climate change stresses agriculture via rising temperatures and changing precipitation patterns, as well as increased soil vulnerability, climate variability, pests and crop disease, and increased atmospheric carbon dioxide. Affordable greenhouse solutions work on a small, sustainable scale to mitigate some of the effects of climate change and provide strategies for smallholder farmers to adapt to the changing environment. Greenhouses cannot reverse climate change, but they are well suited to increase the adaptive capacity of the agricultural sector in developing nations. Thus schemes like that can be designed and provided to the farmers if required.

Effective watering can be made possible in drought affected areas by implementing moisture sensitive sensors and making the farmers aware of the optimum water required for each crop, which can again achieved by using fuzzy logic systems.

The whole system proposed will be a cyclic interrelated system with components that can be designed from the data obtained from artificial neural network and fuzzy logic system. The transportation of the produce from production site to the seller and consumer was one concerning factor. It can again be solved by pre arranging the agricultural vehicles based on the outcome prediction of each crop. Real time communication can be established with vehicles using IEEE 802.11b/g and farmers mobile device.

The bank can also develop various schemes to aid farmers based on the outcome of the prediction, thereby taking care of the risk associated with the causality prediction like crop failure, drought, extreme climatic conditions etc. Farmers if educated well on the recent technologies and if given with anytime anywhere mobile devices will benefit a lot from the technology and thereby the productivity as well as profitability of the hard work can be improved to a larger extend.

Thus, from the case study and application of technology for the issues raised by the farmers, it is evident that there is wide scope of research to be carried out in order to enhance lifestyle of farmers, their productivity growth and hence economy of Indian agricultural scenarios.

#### V. ACKNOWLEDGEMENT

The authors would like to acknowledge all the farmers and village agricultural officials for giving their opinion and thoughts during the conduction of this study.

#### VI. CONCLUSION

Agriculture is the most vital field which demands complete attention. Indian agricultural scenario is yet to undergo transformations in the modes of agricultural productivity. This paper therefore aims to provide an insight to improve productivity and add value to the farmer's effort by applying technology in them. A case study conducted with group of farmers has brought out the need of application of neural networks and fuzzy logic as predictive tactic to achieve the above mentioned objective. The work limits to presenting the applicability of the above said technology to improve Indian agricultural conditions. However, further research is opened up to come out with predictive model using agricultural empirical data and formulate all possible risk management strategies for the same.

#### REFERENCES

- [1] Singhal, M.; Verma, K.; Shukla, A. Krishi Ville — “Android based solution for Indian agriculture” Advanced Networks and Telecommunication Systems (ANTS), 2011 IEEE 5th International Conference on Year: 2011
- [2] Jhunjhunwala, Ashok; Umadikar, Jayalakshmi; Prashant, Suma “A New Personalized Agriculture Advisory System” Wireless Conference (EW), Proceedings of the 2013 19th European Year: 2013
- [3] Chandra, D.G.; Malaya, D.B. “Role of e-Agriculture in Rural Development in Indian Context” Emerging Trends in Networks and Computer Communications (ETNCC), 2011 International Conference on Year: 2011
- [4] Ahrary, A.; Ludena, R.D.A. “Big data application to the vegetable production and distribution system” Signal Processing & its Applications (CSPA), 2014 IEEE 10th International Colloquium on Year: 2014
- [5] Visit [www.agricoop.nin.in/Reports](http://www.agricoop.nin.in/Reports) and publications on 12-01-2016
- [6] Deka Ganesh Chandra, Dutta Borah Malaya , “Role of E-Agriculture in Rural Development in Indian Context”, Emerging Trends in Networks and Computer Communication,2011, Udaipur ,22nd -24th April 2011, pp. 320-323, 2011.
- [7] Norio Yamaguchi ,Yohei Sakai,Tatsuro, Shiraiishi,Shuhei, Onishi and Takashi Kowata, “E-kakshi Project, An Agri Sensor Network Using Adhoc Network Technology”, SICE Annual Conference ,2011, Tokyo ,13th -18th September 2011,pp. 2808-2810, 2011.
- [8] Manav Singhal, Kshitij Verma, Anupam Shukla, “Krishi Ville-Android based Solution for Indian Agriculture”, Advanced Networks and Communication Systems(ANTS)2011,Bangalore ,26th -27th November 2011, pp. 134-139.
- [9] Yanbo Huang,\* , Yubin Lanb, Steven J. Thomsona, Alex Fangc, Wesley C. Hoffmannb, Ronald E. Laceyd, “Development of soft computing and applications in agricultural and biological engineering”, Computers and Electronics in Agriculture 71 (2010) 107–127
- [10] Santosh Kumar Das1, Abhishek Kumar2, Bappaditya Das3 and A.P.Burnwal, “On Soft Computing Techniques In Various Areas”, Acer 2013, Pp. 59–68, 2013. © Cs & It-Cscsp 2013 Doi : 10.5121/Csit.2013.3206
- [11] Ashok Jhunjhunwala, Jayalakshmi Umadikar, Suma Prashanth, “A New Personalized Agriculture Advisory System”, Wireless Conference(EW) 2011,Guildford, UK , pp. 1-6, 2011.