



# International Journal of Emerging Technologies in Computational and Applied Sciences (IJETCAS)

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## Study of Information Communication Technology in Agriculture Research in India

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**Abstract:** Nowadays, computers are being used to mechanization, automation and to develop decision support system, expert system, GIS, Remote Sensing for taking strategic decision on the agricultural production and protection research. Recently remote sensing and geographic information system has place a major and crucial role in agriculture research especially in the field of yield prediction, suitability of soil for particular crop, integrated pest management, water management and site specific resource allocation of agriculture inputs, etc. India has accomplished an impressive progress in agriculture during the last six decades. At present, there are numerous challenges to be addressed on priority for making India a developed nation through progress in agriculture. In the current millennium, there are challenges of scarcity of land & resources and very high population to be faced simultaneously. Therefore, there are challenges to the Indian agricultural research to provide the food to the increasing population. The event of Information Communication Technology (ICT) as a highly powerful enabling tool for delivery of services in the public and the private sector has by now been universally recognized. ICT has the potential to change the information and knowledge in agricultural research as well as to disseminate it to the farmers. Science and technology are available globally, it must be realized that information and knowledge are also available globally. This opens the avenues for international cooperation in research and development in agriculture.

**Keywords:** Information Communication Technology, ICT, Agriculture, Research, India

### I. Introduction

Indian population is 1.244 billion and World's population is 7.234 billion as on 11-11-2013 at 00.05 hours ([www.indiastat.com](http://www.indiastat.com)). Total population of India were 1,21,05,69,573 (100%), Rural population were 83,34,63,448 (68.8%), urban population were 37,71,06,125 (31.2%) in 2011 Census India. Population of India were 2<sup>nd</sup> largest in the world. Total cultivators in India in 2011 were 11,86,92,640 (24.6% to total population), Rural 11,49,68,498, Urban 37,24,142. Total agricultural labourers were 14,43,29,833, rural 13,69,94,451 (30% of total population), urban 73,35,382. The agricultural operated area was 159.18 million ha. in 2010-11. Average landholding per person was 0.80 ha (Agricultural Census 2010-11). India's share on total agriculture imports is 3.71% to total world imports (FAO Statistics, 2011). There are 99 research centers working under ICAR in India to do research in agricultural science. Foodgrain Productions have increased to 255.36 million tonnes in 2012-13 from 50.83 million tonnes in 1950-51. In the current millennium, there are challenges of scarcity of land, water & resources and very high population to be faced simultaneously. There are many challenges to the Indian agricultural scientific community to provide the food security to the increasing population. Agriculture continues to remain a major sector of the Indian economy. It provides 60 per cent of employment and continues to be the primary source of living for 70 per cent of the population. Technological progress in agriculture is, therefore, crucial for the overall economic development of the country. The total geographical area of India is estimated at 328.8 million hectares. The gross cropped area is about 180 m.ha, of which 35 m.ha are under double cropping. Rice is the most important crop followed by wheat, pulses, oilseeds, sorghum, and maize. Cotton and sugarcane are the principal commercial crops.

### II. The Present Agricultural Research Systems of India

India has one of the largest agricultural research systems in the world with the largest number of scientific personnel of any developing country except China. The research system includes approximately 30,000 scientists and more than 100,000 supporting staff actively engaged in research related to agriculture. Although the total number of scientists engaged in agricultural research in India looks very impressive, it compares less favorably with many developed countries. To cater the needs of Agricultural Research and Education, Indian National Agricultural Research System (NARS) through its vast network of 30,000 scientists working at central institutes. The scientific achievement in the field of agriculture by attaining green, white yellow and blue revolutions have made. Now a day's revolution in information technology, for working scientists and research managers has assumed paramount importance. The present agricultural research system comprises essentially two main streams, the ICAR at the national level and the Agricultural Universities at the State level. There are at present 45 Agricultural Universities including the Central University in the North Eastern Region. Besides,

several other agencies such as General Universities, Scientific Organizations, and various Ministries/ Departments at the Centre, as also Private or Voluntary Organizations participate directly or indirectly in research activities related to agriculture.

### III. National Agricultural Research System

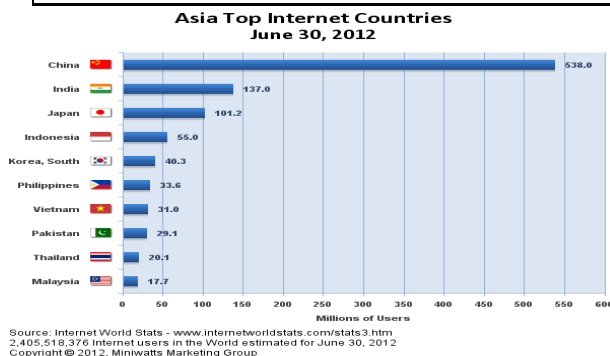
1. The ICAR system
2. The Agricultural Universities System
3. Other Agencies
4. Linkages Among the Sub-Systems
5. International Co-Operation

### IV. Application of Computer in Agriculture Research

Computer application in agriculture research involves various aspects ranging from simple computation of data, data storage, simulation models, expert systems, decision support systems, research management system, trend forecasting, virtual farms, information flow, sharing the data and knowledge etc. Application of computer technology and information technology (IT) in agriculture research requires changes in our conventional working methods and development of new systems so that synergy of this exercise yields positive results. In the next generation, the same computers have been used to mechanization, automation and to develop decision support system for taking strategic decision on the agricultural production and protection research. Recently remote sensing and geographic information system has place a major and crucial role in agriculture research especially in the field of yield prediction, suitability of soil for particular crop, and site specific resource allocation of agriculture inputs, etc. Indian computer software industry has been ‘a source of dynamism and technological innovation, it has provided demonstration effects for other industries in terms of export orientation, strategic alliances and foreign investment. It has been building India’s image abroad in terms of entrepreneurial and technological capabilities. India is rapidly becoming a world leader in this field also, known for its expertise in computer software development in recent past. The amount of computers worldwide varies from day to day but it is estimated that there are more than 850 million. In India 57 million PCs are in use and 3.56 % sharing of world total. The number of people with access to mobile phones in developing countries surprises many in the developed world. According to the IAMAI (Internet and Mobile Association of India) there were 137 million people logging on to the internet each week in India at the start of 2012. That is nearly twice the total population of the UK - but it still represents only a small proportion (8.2%) of the 1.244 billion Indian population. The majority of internet users are male (83%) urban dwellers and only 24 million people living in rural areas have access to the internet. The Indian government has stated that increased internet access would bring huge educational and research benefits to the country and been involved in projects to provide cheap computers to poorer sections.

WORLD INTERNET USAGE AND POPULATION STATISTICS June 30, 2012						
World Regions	Population (2012 Est.)	Internet Users Dec. 31, 2000	Internet Users Latest Data	Penetration (% Population)	Growth 2000-2012	Users % of Table
Africa	1,073,380,925	4,514,400	167,335,676	15.6 %	3,606.7 %	7.0 %
Asia	3,922,066,987	114,304,000	1,076,681,059	27.5 %	841.9 %	44.8 %
Europe	820,918,446	105,096,093	518,512,109	63.2 %	393.4 %	21.5 %
Middle East	223,608,203	3,284,800	90,000,455	40.2 %	2,639.9 %	3.7 %
North America	348,280,154	108,096,800	273,785,413	78.6 %	153.3 %	11.4 %
Latin America / Caribbean	593,688,638	18,068,919	254,915,745	42.9 %	1,310.8 %	10.6 %
Oceania / Australia	35,903,569	7,620,480	24,287,919	67.6 %	218.7 %	1.0 %
<b>WORLD TOTAL</b>	<b>7,017,846,922</b>	<b>360,985,492</b>	<b>2,405,518,376</b>	<b>34.3 %</b>	<b>566.4 %</b>	<b>100.0 %</b>

Source: [www.internetworldstats.com](http://www.internetworldstats.com)



**Figure 1: IT-based Agro-advisory system**

Source: <http://www.iiit.ac.in/files/iiit/eSaguShyam.jpg>

## V. Present Status of ICT in Indian Agriculture

ARIS 'Agricultural Research Information System' programme, was funded by World Bank under National Agricultural Research Project (NARP) and then National Agricultural Technology Project (NATP), resulted in creating awareness, access to basic computer facilities, Internet connectivity, email, development of databases, application software and HRD in computer application. Now it is time to go for more intricate real-time, system-wide applications to conduct and manage agricultural research through a computerized system, which has become necessary in order to address the present day challenges of achieving increased growth rate coupled with efficient and prompt delivery systems. Thus ICAR through its project ARIS is developed infrastructure at majority of sites of National Agricultural Research System (NARS) institutions for development of database and access of information effectively. Now, ARIS have improved research; planning, dissemination of research findings, information sharing mechanism, feedback mechanism and provides help in bringing an element of transparency in flow of information, which are great gain for the system.

Information Communication Technology (ICT) has facilitated the much needed community empowerment and development by meeting their information needs. ICT is also an important enabler in research activities to accomplish tasks faster, more efficiently and effectively. It holds as much potential for development of agriculture sector as for any other sector in India. ICAR has initiated various ICT programmes for agriculture sector in the country. Major ICT initiatives are ERNET, NICNET, NATP, ARIS, ATIC, NME-ICT, NKN, AgRIS NET, Agri-Daksh of IASRI, NISAGENET of ICAR, MSSRF, Chennai, econnectivity of 200 Krishi Vigyan Kendras spread across the country, Video-Conferencing and IP Telephony for agricultural scientists, Agricultural Research Portal, Centralized and Secure Data Center, National Agricultural Bioinformatics Grid, Digital Repositories of Research Information, e-Learning courseware for UG/ PG programs in Agriculture, Epublishing and Open Access of research journals, MIS for e-Governance, Inflibnet. The Consortium for e-Resources in Agriculture (CeRA) established at Indian Agricultural provides access to a collection of about 2,000 international journals in more than 120 libraries in National Agricultural Research System (NARS). Till October 2010, the number of visitors to CeRA website is more than 2 million and the total download of full text articles is more than 1.5 million. A high-end statistical package SAS would enable the researchers in NARS to undertake probing, in-depth, appropriate, intractable analysis of data generated in advanced research areas, and it would also facilitate data sharing over web and creation of analytics over the web useful for All India Coordinated Research Projects and other Network Projects of NARS system that allows farmers to send queries to agricultural experts in their local languages through sms to mobile and receive personalized advice or relevant information in the local language by Tata Consultancy Services Ltd. (2009). Under the NAIP of ICAR, Agropedia a multi-language agriculture knowledge repository of universal meta models and Indian localized content has been developed for a variety of users by IIT, Kanpur and ICRISAT. Under an ambitious project on "Establishment of National Agricultural Bioinformatics Grid (NABG)" supercomputing facilities for undertaking research in the field of Agricultural Bioinformatics are being developed. This national facility will provide computational framework to support biotechnological research in the country. Development of databases, data warehouse, software and tools, algorithms, genome browsers and high-end computational facilities through systematic and integrated approach in the field of agricultural bioinformatics is the first priority of the project. Agribusiness sector requires adequate, reliable, timely information and analysis on various aspects of business, major national and international market, demand and supply pattern, scientific forecasting, crop and weather information and its impact on agribusiness sector.

ICT initiatives in agriculture in India primarily include those by governments, nongovernment agencies as well as by private sector organizations and some international initiatives. Whereas some initiatives address the issue of accessibility to agricultural knowledge, others provide integrated services to the rural people. Some of earliest national level initiatives include Ministry of Agriculture and Co-operation, Govt. of India, Many State Agriculture Department, MSAMB, APEDA, AGMARKNET - initiative to provide market price information across the agricultural markets in the country by NIC (2000), Kisan Call Center – to enable to access public information and services via mobile devices, Ministry of Agriculture, GOI (2004), e-Sagu – an ICT based cost effective agricultural information dissemination system for expert agriculture knowledge to the farming community by IIT, Hyderabad (2004) and Kisan Soochna Kendra by IIT, Roorkee (2005). A wireless rural networking technology - nLogue was developed by Tenet Group of IIT, Chennai to connect every village in a district using terrestrial wireless and provide village kiosks. Some ICT based agribusiness initiatives include ITCs e-chaupal - information technology based platform used by farmers in India to sell their agricultural produce, look up weather information, and obtain expert crop advice (2000), Agriwatch.com – a portal for farmers, traders, processors of agricultural outputs, suppliers of agricultural inputs etc. by Indian Agribusiness Systems Pvt. Ltd. (2001), Drishtee.com – rural supplychain and distribution network, iKisan.com - an agri portal for addressing the Information, Knowledge and Business requirements of various players in the agri arena, viz. Farmers, Trade channel partners and Agri Input / Output companies by Nagaarjuna group of private companies. ICT driven methodologies have been developed for forecasting crop yield in advance of harvest using data on plant characters, weather and agricultural inputs. Using these approaches, it is feasible to forecast yield about

one to two months before harvest of crops at district agro-climatic zone and state levels. Methodologies have been developed for forewarning crop pests and diseases of major crops. ICTs have been leveraged to confer the power or expert knowledge cutting across all the barriers to even the small farmers in the remotest parts of country in real time benefitting rural population of some districts. The knowledge could be even customized to strengthen or help the individual farmer in decision making regarding selection of crop, variety or applying need based agricultural practices or in choosing the right markets to sell the produce. There are various agricultural ICT initiatives, which follow different approaches to fulfill national objectives and these address different goals.

## **VI. Sustainable Development**

Need for sustainable development of agriculture has posed new challenges not only in development of farm technology but also to quick dissemination and extension of agricultural technology to the farmer's fields. The information and knowledge has become one of the most critical inputs to agriculture in addition to soil, seed, water, fertilizer, pesticides, farm implements, etc. Access to information and knowledge about weather forecast, agro-advisories, agricultural prices, inputs, right farm practices, reliable research recommendations, etc. have become critical for improving agricultural productivity and farm profitability while protecting fragile natural resources. Current system of sharing information and knowledge amongst research managers, research workers and extension machineries is not able to deliver the desired results. Therefore, it has become absolutely necessary to manage the information resources related to agricultural activities in an effective and efficient manner using modern Information Communication Technology. Thus, the traditional agricultural research education- extension system needs to be evolved into a more versatile, responsive and proactive Agricultural Knowledge Management System capable of meeting the demands of present day planners to double the growth rate of agricultural sector to reach targeted 4 per cent annually.

The contribution of public research-education-extension system in attaining selfreliance in food production is very well recognized. But in this changing time, traditional public research education-extension system is not able to address multi faceted problems faced by the country. The existing public research-education-extension system is also constrained by limited resources, vast spreads, divergent needs and diverse responsibilities of handling emerging issues like global marketing, agri-business, quality conscious consumers and WTO issues. The need of the hour is to evolve a comprehensive agriculture research education- extension system shared by all the stakeholders. These stakeholders could be national planners, research managers, scientists, teachers, students, farmers, co-operatives, agricultural consultants, farmers organizations, unemployed agricultural graduates, nongovernmental organizations, Krishi Vigyan Kendras (KVKs), state extension agencies, agribusiness companies, input dealers, newspapers, agricultural magazines, private television channels, private sector banks, market information systems, weather forecasting agencies, etc.

The Green Revolution gave a sudden boost to the production and productivity of major cereals in the assured irrigated areas. Quick dissemination of Technological information from the Agricultural Research System to the Farmers in the field and reporting of farmers' feedback to the research system is one of the critical inputs in Transfer of Agricultural Technology. The information and communication support during last 50 years has mainly been conventional. The extension personnel of the Department of Agriculture disseminated the technological messages to the farmers manually. This approach has not been able to reach majority of the farmers who are spread across the whole country. The diversity of agro-ecological situations adds to this challenge further. Farmers' needs are much more diversified and the knowledge required to address them is beyond the capacity of the grass root level extension functionaries. Today it is possible to find a solution to this situation by using the potential of Internet based technologies to meet the location specific information needs of the farmers. Information and communication networks are expanding very fast. Internet connectivity has touched almost all the districts in the country and is moving down to the block and village levels. Pilot projects to connect rural community to cyber-space are underway at various locations. The convergence of computers and communication technologies has open up vast arena of Internet and Intranet. Concept of Village Information Kiosks is fast spreading to blocks/mandals and villages empowering Indian farmers to digitized access of vital information available through the Internet. There are dozens of cyber-experiments going on in rural India, which have unequivocally demonstrated the power of Internet and Information Technology. The overwhelming response and eagerness of farmers to use such systems is now paving the way for replicating cyber extension initiatives in large numbers. The challenge is to create relevant digital content by agricultural research and education system of the country by vertical integration and horizontal sharing. India is a large country with inherent geographic, ecological and cultural diversity, making information dissemination and communication a challenging task. Agriculture being no exception. The total 143 Mha of net area cultivated in India, is divided into about 115 M holdings, of which 56.7 per cent are less than 1 ha in size, termed as Marginal Farms and about 20 per cent holdings in 1-2 ha range, called Small Farms. So, farmers with Small and Marginal holdings, constitute as much as 3/4th of the farming community in India. They are generally poor, have low level of literacy and have capital and management constraint. Disseminating information to this sector of agrarian population is essential for growth but remains a big challenge.

Information is vital to fulfill these dictates of time. Quick access to information at global level through ICT thus provides the way to tackle future challenges of Indian Agriculture. The scientific achievements in the field of agriculture by attaining green, white, yellow and blue revolutions have made India a leading agricultural nation on both regional and international levels. Also, India is well known for its expertise in computer software development and is rapidly becoming a world leader in information and communication technologies. Therefore, India has all the necessary ingredients and required manpower to succeed in application of computers and information technology in the field of agriculture research. A computer based National Agricultural Research Knowledge Management System is providing successful and is taken up at much larger scale in the interest of the growth of agrarian population and the country as a whole.

### **VII. National agriculture research data-center with super computing facilities and secured access through intranet**

For real-time computer applications in agricultural research, state-of-the-art Information and Communication Technology (ICT) facilities, maintained on 24×7 basis without fail is a must. It has been observed during last decade of experimenting with computer application in agriculture that maintaining such facilities by individual institutions under NARS is very difficult.

Maintaining email servers, web-servers, Local Area Networks (LAN) has become big problem for most of the institutions under NARS in view of ever increasing and technologically challenging security threats viz. computer viruses, spam, phishing attacks, cyber crimes and so on. The highly skilled manpower required to maintain ICT systems cannot be recruited and retained in NARS due to several fold salary differences between public research organization and private ICT organizations. Therefore, the best option is to create integrated professionally managed ICT facilities, securely accessible to all institutions under NARS. A National Agriculture Research Data-Center with supercomputing facility which can provide safe access to members of NARS



**Figure 2: Expert system on Agriculture Source: [www.icar.org.in](http://www.icar.org.in)**

through secured Intranet would be the best option - strategically, logistically, technologically and economically. NARS with core competency in agriculture research, education and extension need not diversify too much in highly competitive area of ICT. However, a core group of experts having background in ICT and agriculture research is necessary to function as system analyst who can understand and define NARS's computer application requirements, interface with highly skilled ICT experts from the industry, ensure correct implementation of computerized systems, monitor and certify the computerized systems for long term use in agriculture research. We are moving towards an era of intelligent organization which means that organization's explicit and tacit knowledge is an invaluable asset and should be captured digitally, so that it can be shared and enriched without repetition for specific service objectives. This digital knowledge in the form of databases, expert systems, decision support systems, management information systems, and various other applications needs to be stored safely and securely for centuries to come. Therefore, secured storage systems are indispensable for any organization. The National Data-center can provide such facility for agriculture research sector. The National Data-center can house digital storage, messaging server, web server, Intranet application server, Database/Data warehousing servers and servers for numerous applications viz. financial management system, research management system, personnel management system, knowledge dissemination system, knowledge sharing systems, remote collaboration systems, weather forecasting and agro-advisory systems, highend super computing facilities such as for genomic research etc.

### **VIII. Digital content – databases, data warehouses, commodity/crop portals, inter crop portals, expert systems, simulation models, web services**

Digitization of the traditionally existing content has gained importance for creating organizational knowledgebase and easy access of relevant information by the stakeholders. Contents in the form of WebPages, Databases, Data warehouses, Expert Systems, Application Software, Intranet and Work flow Applications, Training Modules, Extension Modules, Webbased Services etc. are necessity of the day in order to exploit full potential of the IT in agriculture. The people who own the content may be encouraged to create these contents and share based on policy.

### **IX. Agriculture Expert System**

An expert system is a specific kind of information system in which computer software serves the same function expected of an expert. The computer, programmed to mimic the thought processes of experts, provides the decision-maker with suggestions as to the best choice of action for a particular problem situation. The hope is that we can design computers (information systems) that extend our ability to think, learn, and act as an expert. Expert systems allow users to influence the knowledge of experts without requiring their presence. Expert systems are useful in any field especially in agriculture where experts are rare, expensive, or inaccessible. The knowledge base is the core component of any expert system since it contains the knowledge acquired from an expert in the field and from published literature. The tasks involved in developing any knowledge base include knowledge acquisition, knowledge representation, knowledge programming, and knowledge refinement. Agricultural expert system is one artificial intelligence technique in agricultural information area, and is very critical in the transformation of traditional agriculture to modern integrated agriculture. Its core techniques include data technique, knowledge representation technique, multi-media technique, internet techniques as well as its integration. Agri-Daksha is the Agriculture Expert System developed by IASRI, New Delhi.

### **X. Remote Sensing, Geographic Information System and Geographical Positioning System**

Remote Sensing (RS) refers to the process of gathering information about an object, at a distance, without touching the object itself. The most common remote sensing method that comes to most people's minds is the photographic image of an object taken with a camera. Remote Sensing techniques have a unique capability of recording data in visible as well as invisible (i.e. ultraviolet, reflected infrared, thermal infrared and microwave etc.) part of electromagnetic spectrum. Therefore certain phenomenon, which cannot be seen by human eye, can be observed through remote sensing techniques i.e. the trees, which are affected by disease, or insect attack can be detected by remote sensing techniques much before human eyes see them. Geographical Information System (GIS) is a computer-based information system that can acquire spatial data from a variety of sources, change the data into useful formats, store the data, and retrieve and manipulate the data for analysis. Today, GIS is a multi-billion dollar industry and has become part of a basic information infrastructure for private enterprises, government agencies, and academic institutions. The majority of the operational GIS are used for thematic mapping, handling spatial queries, and decision-making support.

The application of remote sensing data taken momentum in the field of agriculture and crop studies in India especially crop production forecasting covering both crop inventory and crop yield forecast models, drought assessment, soil mapping and soil degradation, command area monitoring, flood damage assessment, land suitability mapping, insect pest infestation forecasting and widespread availability of satellite signals that allow private use of Geographical Positioning System (GPS) made it possible for farmers to spatially locate data from precision farming applications. GIS technology is being increasingly employed by agriculture researchers to create resource database and to arrive at appropriate solutions/strategies for sustainable development of agricultural resources.

The application of remote sensing and GIS techniques in the management of agricultural resources are increasing rapidly due to improvement in space borne remote sensing satellites in terms of spatial, spectral, temporal and radiometric resolutions. The trend in developing GIS analytical functions is to better integrate GIS with other software in statistical analysis, operations research, and artificial intelligence (AI) tools. Looking into the future, geographical information systems will likely become more user friendly. With the development of web-based GIS, there is an evolution from single user systems to more open, multiple-user systems.

### **XI. Precision Agriculture**

Precision Agriculture is conceptualized by a system approach to re-organize the total system of agriculture towards a low-input, high-efficiency, sustainable agriculture. This new approach mainly benefits from the emergence and convergence of several technologies, including the Global Positioning System (GPS), geographic information system (GIS), miniaturized computer components, automatic control, in-field and remote sensing, mobile computing, advanced information processing, and telecommunications. Since, last 3 years government of Maharashtra have successfully launched the Integrate pest management system for soybean crops and it uses ICT, GPS, GIS for data communication and overall management of pest throughout the state. Dr.PDKV, Akola, have started the application of ICT to send the experts SMS to the farmers of Vidarbha region of Maharashtra state for precision agriculture. Agricultural research is now capable of gathering more comprehensive data on production variability in both space and time. The desire to respond to such variability on a fine-scale has become the goal of precision and sustainable agriculture.

### **XII. Decision Support Systems**

Computer systems that provide users with support to analyze complex information and help to make decisions are called decision support systems (DSSs). Decision support systems are information systems with a specific function to help people with the problem solving – to some extent and decision making process. DSS consists of

a collection of people, procedures, software, and databases with a purpose. The computer is the primary technology in such systems. Decision support systems may work actively or in a passive mode. Passive systems are mostly used by decision makers, experts, or agricultural supervisors for reference purposes, while active systems give advice in certain situations, such as alerting technical personnel when a parameter being monitored exceeds its designated threshold value.

### XIII. Conclusion

Use of computer and application of ICT has become a common phenomena in every walk of life. Corporate houses, Banks, Private business establishments, Government to Citizen applications all have been benefited by use of this new technology. Agricultural Research and Development sector are also benefited by the ICT revolution. NARS has also benefited by deployment of ICT in agricultural research. There is urgent need to move to next higher level of computer applications by deploying nationwide integrated information systems to address to the diverse needs of NARS. We need to develop our own standards for digitization and sharing of data in agriculture research sector. National level mega information systems and web services accessible from any part of the country and world are need of the hour. Synergy of integration, consolidation and sharing the agricultural research information would help in achieving future goals. The ultimate National Agricultural Research Knowledge Management System should enable a research planner/ manager to extract comprehensive information to enable him to set priority, plan strategies, monitor and achieve national goals. A research scientist should be able to access all the sources of information to enable him to execute research mandates in most efficient and effective manner. A farmer sitting at a remote village throughout the country should be able to get best solutions to his farming problems by interacting with the system in most user friendly manner and in their own/comprehensible language.

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