**Information and Communication Technology for Transfer of Technologies**

Dr. Shankara M.H, Assistant Professor & Head, Division of Social Science, College of Agriculture, Hassan, Karnataka, India and

Dr. Chaitra T.M, Assistant Professor, RIAMS, Hassan, Karnataka

[shankrimh@gmail.com](mailto:shankrimh@gmail.com)

**1)    Cyber Extension**

Cyber Extension thus can be defined as the "Extension over Cyber Space". As the word Extension is subject-neutral, so is Cyber Extension. But in the applied context of Agriculture, Cyber Extension means, "using the power of online networks, computer communications and digital interactive multimedia to facilitate dissemination of agricultural technology". Cyber Extension includes effective use of Information and Communication technology, national and international information Networks, Internet, Expert Systems, Multimedia Learning Systems and Computer based training systems to improve information access to the Farmers, Extension Workers, Research Scientists and Extension Managers.

Extension always having certain unique features of communications in cyber space i.e in cyber extension. They are

i. Access to the stored information in cyber space free.

ii. The information is available instaneously round the year and twenty four hours a day.

iii. Communication can also be interactive through e-mail, discussion groups, and new groups.

iv. We can Access the available information from any point on the globe.The communication through cyber extension is dynamic and ever growing.

**Important Tools of Cyber Extension:**

The important tools of cyber extension include:

a.     E-mail

b.     Telnet

c.      FTP

d.     Gopher, Archie, Veronica

e.      Usenet Newsgroups

f.       World Wide Web

**World Wide Web (WWW):**

The World Wide Web (www) is the Internet’s multimedia service that contains a vast storehouse of hypertext documents written using the Hypertext Markup Language (HTML). Hypertext is a method for presenting text, images, sound, and videos that are linked together in a non-sequential web of associations. The hypertext format allows the user to browse through topics in any order. There are tools and protocols to explore the Internet. These tools help to locate and transport resources between computers.

**File Transfer Protocol (FTP):**

File Transfer Protocol (FTP) support is one method of supporting remote networks. It is a protocol, which allows simple file transfer of documents. There are FTP servers, which provides vast amount of information stored as files. The data in these files cannot be accessed directl, rather the entire file must be transferred from the FTP server to the local computer.

The most common protocol used for sending files between computers is the FTP. FTP allows for transferring both text and binary files. Both Microsoft operating systems and unix system include the traditional character based FTP client.

**Electronic Mail:**

E-mail or the electronic mail is the most widely used application on the Internet for sending and receiving electronic messages. It is currently one of the most popular activities on the Internet. For most of the Internet users, it has practically replaced other traditional methods such as telephones, faxes etc. Technically E-mail is a system of delivery of messages on the computers connected via communication networks. E-mail is electronic version of the paper mail or letters used to deliver personal and official messages. E-mail is used to communicate all types of messages- text, graphics, audio, and also visual clips as long as these can be digitized.

In government offices and research organizations most of the communication with the international organizations- the World Bank, Food and Agriculture Organization, United Nations Development Programmes, is in form of e-mail. The largest users of e-mail, however, are the students of graduate and post-graduate programmes in the universities.

**Discussion Groups and News Groups:**

Discussion groups are the virtual networks of Scientists and other stake holders having email interactions / message postings on a common subject. Discussion groups undertake in-depth discussion on email mode. The emerging subject, issue is flagged by one of the group members and then an email alert is sent to all the members. An agreed time frame of one week to 10 days is decided for getting inputs from all the group members and the responses are shared among all. Thus, highly focused discussions take place on the internet, without having any physical meeting. Discussion groups are emerging as one of the very effective scientific discussion forums on the internet.

The solution exchange supported by United Nations Organizations (UN) (website address : [www.solutionexchange-un.net.in](http://www.solutionexchange-un.net.in/)), has proved to be an excellent enabler of focused group discussions on highly topical issues like “Sustainable Agricultural Extension Systems”, “Spreading the ICT Revolution in Rural India- Experiences and Examples”, “Establishing Rural Business Hubs” during last two years. Over 4000 experts and field managers have participated and contributed / benefited from the discussions. The consolidated responses on all these topics were later published for wider circulation.

**Telnet:**

Telnet is an application that allows you to log on to a remote computer. It is like a terminal emulation programme. Telnet sessions present text based data as a terminal would. However now GUI (Graphic User Interface) clients are now available which offer better service.

**Gopher, Archie, Veronica:**

Gopher was the first attempt of making it easy to access resources on the Internet. As recently as in 1994, Gopher was considered the most useful Internet tool. Gopher uses text based nested menus to access FTP sites, directories, files and documents. Gopher was designed by computer scientists at the University of Minnesota. Gopher sites did a good job of organizing FTP sites, but it did not take long before the number of Gopher sites was unmanageable. Archie, Veronica, Jughead, and other sites were all developed to assist with finding the right Gopher site. Gopher and its derivatives have been largely made obsolete by the search engines available on the web today. Web clients can handle Gopher transactions, and in fact a user is offered link to a Gopher site without realizing it.

**Usenet Newsgroups:**

More than 20,000 Usenet Newsgroup categories are currently organized which cover almost any imaginable area of interest. Newsgroups provide a bulletin board type area where users can read other opinions and are sent entries of their own to be posted. Modern web browsers like Netscape and Explorer include software for reading and posting to Usenet. Email mailing lists are an alternative for Usenet groups as these lists are normally more focused.

***Advantages***

* **Saves money, time and effort:** scientists will prepare electronic version of messages themselves. These versions don’t have to be printed and posted. This will save money and time. Cyber messages will be updated online and that saves time too. Cyber extension can provided more in-depth analysis and can also provide detailed on-farm research results to the curious users / farmers.
* **Cuts steps from extension process:** Cyber Extension will remove a number of steps altogether from the traditional extension process. In the context of Agriculture, the zonal workshops and training to subject matter specialists (SMS) can be eliminated altogether. The scientists can directly post the information on the Internet, which will be directly available to extension functionaries at district, sub division, block and village level. All the concerned will get the information immediately and queries / clarifications will also be addressed equally fast, without involving a chain of extension machinery. In the context of Rural Development the details of Central and State sponsored schemes can be directly communicated to the ultimate user/ beneficiary. The lists of Below Poverty Line (BPL) can be made available to all the agencies like Regional Rural Banks, DRDAs and list of beneficiaries under one programme can be made available to other implementing agencies, to avoid duplication of efforts in same direction.
* **Information rich and interactive:** It appeals to the curious extension workers and analytical farmers. It will allow them to search and locate the information they need quickly. The extension workers can talk to the concerned scientists for more information on the subject, wherever the scientists may be. The rural technologies can be made available on CD-ROMs for quicker dissemination.
* **Offering instant international reach:** Online networks have created an instant global village. Cyber extension will eliminate the time and distance barrier that get in the way of knowing the latest information on any particular problem from any part of the world. One can reach any university, National, state level training and research institutions and other research station and discuss his / her problems with the best scientists / experts in the field.
* **Continuously available**: One of the key attributes of an online information service is that it is available all the time, 24 hours a day, 365 days a year. Your cyber extension functionary doesn’t sleep; he doesn’t go on leave. If you have connectivity, you can get information, from wherever it is available.

***Limitations***

* Cyber extension is becoming an tool for development communication, however most rural communities are not yet able to take advantage of this new tool due to illiteracy, lack of skills, economic power.
* There will be both irrelevant and relevant messages.
* Cyber extension is more expensive.
* It cut steps from extension process like training and zonal workshops.
* Not all messages will be suitable to all farmers.

**2) Interactive video**

It is a rapidly emerging communication mode, which represents the fusion of a computer, Video and laser technologies. In interactive video, the user can control which part of a program to view, or interact with certain parts of the program. It allows a viewer to participate in a simulated conversation on the screen. This is one of the most widely used mediums for the last one and half decade in the advanced countries.

**3) Tele conferencing**

In the 1960, the American Telephone and Telegraph Company first introduced the teleconferencing system "picture phone" in USA. It is a new form of video-based communication via telephone lines or satellite broadcast. It is a substitute for face to face meeting. It can bring people together who are geographically isolated, to express their viewpoints and share their experiences.

**4) Audio conferencing**

It is the verbal communication through telephone. It is a satisfactory communication tool in many situations. In multi site, multi participant meetings it facilitates dialogue, question and answers and immediate response from the participants.

**5) Video Conferencing**

It is the process of conducting a conference between two or more people at different locations by using computer networks to transmit audio and video data. Videoconference can be a point to point or point to multipoint operation.

**6) Computer conferencing**

Computer based meeting involving exchange of voice and pictures between two individuals or groups. It is based on electronic mail only, in addition to person-to-person messaging group communication is also facilitated.

**7) Multimedia**

Multimedia refers to a synthesis of text, data, graphics, animation, optical storage image processing and sound.Computer multimedia will offer learners more complete and individual control over their learning. This system facilitates interactivity and better understanding between the individual learners and the subject matter.

**8) Databases:**

May contain informations such as traits of animals' breeds, plant and animal diseases, and possible control methods, data and formulae to be used to calculate a feeding ration, weather forecasts, library catalogues and documentations' systems.

**9) Tele Text**

It is a system somewhat like view data in which printed information is telecast through television rather than transmitted through a telephone line. It has no interactive capacity and it has a very much smaller database

**10) Optical Communication technology**

Use of light waves for communication purposes gave rise to the modern technology of optical communication. In this new method, optical fibres that are very thin, long stands of ultra purity glass are being used to link the transmitter and the receiver. Information in the form of a series of light pulses produced by small semiconductor lasers is passed through such fibres. At the receiving end these light pulses are converted back into original information using appropriate detectors and decoders. Human voice, TV pictures and computer data can be transmitted and received with great ease and convenience using optical fiber communication techniques.

**11) Very Small Aperture Terminal Technology (VSAT) Service**

This service provides satellite-based network for business communication using the cost effective VSAT technology. All it does is to link head office of company or a corporate house to its various locations like factories, service units and other offices particularly those located in remote areas, using satellite network. Such networks are called Closed User Group (CUG) network. Besides high-speed data transmission from one location to another, people can even talk on the network.

**12) Electronic Data Interchange (EDI)**

It enables two organizations usually a customer and supplier to exchange routine documents such as purchase orders and invoices using standard electronic forms and their own computers linked through a service provider. It is faster, cheaper and reliable means of exchanging export documents. It works on internationally accepted protocols and facilitates quicker exchange of documents.

**13) Expert system**

It is one of the important application oriented branches of Artificial intelligence. In the past decade, a great deal of expert systems had been developed and applied to many fields such as office automation, science and medicine including agriculture. At the beginning of development of agriculture expert systems it was applied to diagnosis the diseases and pests of various crops. In recent years, research and development of the fields of agriculture domain have been paid much attention by many countries.

**14) Artificial intelligence**

It is a scientific field concerned with creating computer systems, which can achieve human level of thinking and problem solving. It is a multi disciplinaryfield devoted to the reproduction of methods or results of human reasoning and brain activity. The major goal of artificial intelligence is to make machines that have intelligence, thinking and reasoning power, problem solving capabilities, manipulation of incomplete and erroneous data, etc.

**15) Fax**

It is a device used for transmission of a written document, photograph, map or any other graphic material electronically. It is one of the variants of E-mail. For transmission, the original documents placed in the facsimile or fax machine which scans the document and converts the written or graphic information into electronic signals and establishes a link up with a similar receiving fax machine at the receiving end.

**Application of ICT tools and in Animal Husbandry Extension**

|  |  |
| --- | --- |
| **ICT tools** | **Uses in Animal husbandry extension** |
| 1. Interactive video | Information delivery, education, problem solving. |
| 2. Audio conferencing | Training, Institutional out reach and administrating extension services. |
| 3. Multimedia | Training, Information delivery |
| 4. Internet | Information can be made available to the farmers round the clock. |
| 5. Expert system | Decision making, designing, selection, diagnosis and prediction. |
| 6. Agri portal | Instant information on markets, news and weather. |
| 7. E mail, Mobile phone | Providing information at the right time |
| 8. website | Latest farming oriented news and information. |

**ICT INITIATIVES IN ANIMAL HUSBANDRY AND DAIRYING**

Some of the successful ICT initiatives taken up under different projects in India are the Warna Wired Village Project providing Internet access to cooperative societies spread in 70 villages of Maharashtra. The aim is to provide information to the villagers by establishing networked booths in the villages. The Information Village Project of M.S Swaminathan Research Foundation (MSSRF) established a hub of information network, in Villianur village ( Pondicherry ) to cater to the information needs of the rural people. It is aimed at bringing the benefits of modern ICTs to rural families in Pondichery.

The DAH&D has already established a Local Area Network (LAN) with 230 nodes at Krishi Bhawan, New Delhi with Internet access through NICNET gateway. An ICT Learning (e-Learning) Centre has also been established to provide on line internet access. The Dairy Information and Services Kiosk (DISK) is one of the successful initiatives taken up by Gujarat Cooperative Milk Marketing Federation Ltd (GCMFL) with the help of Indian Institute of Management, Ahmedabad. „DISK‟ model includes a complete history of milk cattle owned by the member farmers. The details such as breed and history of diseases, inoculation, and artificial insemination are maintained in the system. It is being used at milk collection centers and in cooperatives to measure butter fat content of milk, test the quality of the milk and to make prompt payment to the farmers. It has resulted in the removal of incentives to those who adulterate milk, reduced the time for payments from 10 days to less than 5 minutes and instilled confidence in farmers on cooperative set up. The National Dairy Development Board has established “AKASHGANGA” which provides total integrated solution for automatic milk collection.

The Central Institute for Research on Goats (CIRG) has developed e-mail Conference System for Goat Outreach on its goat-nic.in server using free software called 'majordoma' which is available on www.greatcircle.com on a free Linux operating system. Three e-mail conferencing systems, viz., mail to: goat-net@cirg.nic.in., livestocknet@cirg.nic.in and fishnet@cirg.nic.in have been launched by the institute to help information inflow among technologists, farmers, development officers and planners.

Under Animal Health Project funded by Department for International Development (DFID), Rajiv Gandhi College of Veterinary and Animal Sciences (RAGACOVAS) Pondicherry in collaboration with University of Reading, UK, has designed an interactive touch screen information Kiosk. It has information on important cattle diseases in addition to management of cattle and methods of acquiring information. Livestock farmers can access the needed information on cattle management with the touch of the screen which had text and pictures with sound back-up. A similar attempt was made in developing a touch screen information kiosk on dairy cattle management by TANUVAS, Chennai. RAGACOVAS also developed an Information kiosk on management of goats for the benefit of the goat keepers under Rural Innovation Fund project in collaboration with MSSRF.

**Toll free number** 1800-180-1551created by Ministry of Agriculture, Govt of India, can be used by farmers anywhere in the country to access the information on agriculture and allied subjects.

**USE OF ICT IN EXTENSION:**

**1. Social change:** Communication today is the key element in the development and implementation of policies and programmes aimed at the well being and welfare of people everywhere. The role of communication is particularly important in relation to such social changes occurring in the modern world as socio-economic, environmental and developments in active components of society like family, women and young people.

**2. Economic prosperity:** ICT for economic prosperity indicates using it in an effective way to stream line administration, improve productivity in industry which in the long run will influence the performance of the economy.

**3. Rural Development and food security:** Information and knowledge play a key role in ensuring food security and are essential for facilitating rural development and bringing out social and economic change. The least expensive input for rural development is knowledge. Rural communities require information on supply of inputs, new technologies, early warning systems (droughts, Pests and diseases), Credit, Market prices and their competitors. New ICTs have the potential for getting vast amounts of information to rural population in a more timely, comprehensive and cost effective manner and could be used together with traditional media and the greater tasks like rural development and food security will be achieved in the long run.

**4. IT and poverty alleviation:** IT provides citizens with information about market prices and social services, such as health, knowledge, education, jobs and investment opportunities and reduction in poverty level. For (eg): the farmer who benefits from technology to get daily market prices and can subsequently buy seeds at 20% less and sell produce for 20% more by eliminating the middleman.

**5. Empowering rural communities:** ICTs can empower rural communities and give them a voice that permits them to contribute to the development process. With new ICTs, rural communities can acquire the capacity to improve their living conditions and become motivated through training and dialogue with others at a level where they make decisions for their own development Giving a voice means giving them seat at the table to express their views and opinions and become part of the decision making process. The approach should be participatory and could lead to improved policy formulation and execution.

**6. Targeting marginalized groups:** Most rural people lack the power to access information. ICTs could benefit all stake holders including the civil society, in particular youth and women. Other disadvantaged groups that could be targeted include the disabled and subsistence peasants.

**7. Creating employment:** Through the establishment of rural information centres, ICTs can create employment opportunities in rual areas by engaging as telecentre managers, subject matter specialists, information managers, translators and information technology technicians. Such centres help to bridge the gap between urban and rural communities and reduce the rural - urban migration problem. The centres can also provide training and those trained may became small scale entrepreneurs.

**8. ICTs for improving linkages:** Weak linkages between researchers, front line workers and farmers have been a major constraint that has resulted in research findings not being applied by poor rural farmers. ICTs can improve and strengthen these linkages can ensure knowledge and information , which are essential for an effective TOT.

**9. e-Governance:** Application of IT to governance in rendering administrative services - from ration cards, motor licences, land records, health, education and municipal services.

* e-Governance can improve and facilitate direct connections between citizens and government and encourages their participation in governance. It can help in alleviation of poverty.
* It can open up avenues for direct participation of woman in various governmental schemes and decision making processes.
* It can enhance democratic processes and citizen empowerment.
* It can reduce hardship and multiply productivity of employees.

**10. ICT as an aid:** The information services have to cater to the needs of common man in the areas like natural resources, energy, health and sanitation and employment. The services have to be directed towards promoting information to the extension worker who is a middle man in the transfer chain and to meeting the needs of the actual user.

**11. ICT a group work:** Group work is widely practiced by Government, business and other social organizations. However its effectiveness and the outcome are reduced due to many reasons.

**12. ICT for planning:** The National Natural Resource Management System (NNRMS) has been drawn up by the nodal agency of the Government’s Department of space in cooperation with several other agencies and organizations. The NNRMS scheme is now being linked with the natural Resource Data Management System (NRDMS) to help districts in formulating district plans.

**13. ICT for national development:** ICT should be designed to serve the community to improve its productive capacity and its overall quality of life, which would mean progress. The need for identification of different categories of users, their information seeking behavior patterns, capability of assimilation of information and application to different tasks are important.

**14. Artificial intelligence for risk assessment:** It is the ability of computers to make human like judgements.

**15. Expert system for various fields:** Expert system can be defined as a man-machine system designed to collect technical knowledge related to specified areas and accumulate it in a knowledge base after changing it into a structured form and ultimately, to solve problems in the specified areas using various inference systems in addition to the technical knowledge.

**16. Computers for productive rural banking:** Almost 70 percent of bank branches are in the rural areas. Hence computers can be productively used to reduce the volume of work.

**17. Distance education in computers:** The role of central computing facilities has shifted during the last three years toward the provision of services to support teacher - student communications. The computer Mediated Communications (CMC) services include electronic mail, conferencing, assignment submission and feed back, and continual updating of course materials.

**18. Geographical Information System (GIS):** are being used for mapping, analysing, planning and interpreting massive amounts of natural resources, topographic and demographic data - making this one of the most potent tools for planners.

**19. Agri portal:** An agri portal is a special website that adjusts dynamically to present targeted information according to a person’s specific requirements. It is especially designed for agricultural and rural folks, to provide instant information on markets, news and weather.

**20. ICT use in animal husbandry research:** In addition to data management and analysisuse in agricultural research has been in supporting multidisciplinary and multi-location research in Latin America and several Asian countries.

**21. Gyanvani Radio network:** It is the mile stone activity of the TNAU under TOT efforts along with IGNOU, New Delhi to produce technical programmes for all kinds of learners.

**22. TOT through web page:** WWW.tnauiv.org. The website featuring the activities of the TNAU including details on agro climatology, weather forecasting, market intelligence etc. It has been developed by TNAU for the benefits of the farming community.

**23. On line auction:** The site will provide information on the quality, availability of products on daily basis and details about growers, traders and exporters.

**PROSPECTS OF ICT:**

* New range of additional media that can be part of the communication for development ‘mix’ of traditional and/or appropriate media
* Where accessible, these new media have features that enable bottom-up articulation and sharing of information on needs and local knowledge
* Can increase efficiency in use of development resources because information is more widely accessible
* Can result in less duplication of activities because information is more widely accessible
* Tend to reduce communication costs (often dramatically) in comparison with other available communication choices
* Provide global access to information and human resources
* Rapid speed of communication – locally, nationally and globally.

**Problems of ICT:**

* Capital cost of technologies, and cost of ongoing access and support, can be high
* Inherent need for capacity-building
* Can lead to technological dependence
* Lack of accessible telecommunications infrastructure in many rural and remote areas
* severely limits available choices of new ICTs
* Many ICT projects are characterized by poor and non-participatory planning
* Funding agencies often derail potentially useful projects by a continued desire for
* ‘magic bullet’ solutions, or projects that showcase technologies and agency icons
* Funding agency orientation to ‘proprietary’ technological solutions, when available
* tools and applications can yield better and cheaper results
* Funding agencies often want to showcase tangible capital projects over less tangible,.
* but more meaningful, communication processes
* ICT projects often lack attempts to integrate with existing media, local communications methods and traditions
* ICT projects often lack involvement of all stakeholders in planning – especially
* women and youth.

**References:**

* Ministry of Agriculture, Govt. of India, 2009, www.agricoop.nic.in
* www.agmarket.nic.in/
* http://www.thehindubusinessline.com/todays-paper/tp-agri-biz-and-commodity/tnau-launches-online-initiative-to-provide-price-information-to growers/article1054147.ece
* http://www.e-agriculture.org/news/dynamic-market-information-sametitnau
* WWW. Agmarknet. 2 PDF
* Elias, M. (n. d.). GIS and Remote Sensing for Natural Resource Mapping and Management. Retrieved on 5th October 2012 from <http://www.saudigis.org/FCKFiles/File/SaudiGISArchive/2ndGIS/Papers/2_E_MohamedElias_UAE_F.pdf>
* Harahsheh, H. (2001). Development of Environmental GIS Database and its Application to Desertification Study in Middle East. Chiba: Chiba University
* Swe, M. (2005). Application of GIS and Remote Sensing in Myanmar. Retrieved on 5th  October 2012 from <http://www.aprsaf.org/data/aprsaf12_data/day2/eo/5_APRSAF-12MS.pdf>
* <https://www.csc.gov.in/>
* <https://en.wikipedia.org/wiki/Common_Service_Centers>
* [www.teach-ict.com/as\_a2\_ict\_new/ocr/A2...ict/...weather/.../pg7.htm](http://www.teach-ict.com/as_a2_ict_new/ocr/A2...ict/...weather/.../pg7.htm)
* <https://www.itu.int/dms_pub/itu-t/oth/.../T060F0060080016PDFE.pdf>
* Nicol, Chris, ICT Policy: A Beginner’s handbook, Association for Progressive Communications - [www.apc.org](http://www.apc.org)
* extension://efaidnbmnnnibpcajpcglclefindmkaj/https://coabnau.in/uploads/1611051638\_ICTinAgriculture.pdf
* <https://www.cropin.com/ict-in-agriculture>
* Adhiguru, P. and Devi, S.V. ICT in Indian Agriculture: Learnings and way ahead. Int. J. of Ext. Edu.; 2012; 8:1-4
* Ansari, M.A. and Pandey, N. 2011.Assessing the potential and use of mobile phones by the farmers in Uttarakhand (India): A special project report. G.B. Pant University of Agriculture and Technology, Pantnagar, India. Ansari, M.A. and Pandey, N. (2013) Assessing the potential and use of mobile phones in agriculture. Karnataka Journal of Agricultural Sciences, 26(3): 388-392.
* Bahl, M. S&T for Rural India and Inclusive Growth: ICT in Agricultural Marketing 2008 ([http://www.nistads.res.in](http://www.nistads.res.in/)).
* Chandrashekara, P., “Private Extension: Indian Way, Private Extension: Indian Experiences”, 2001. National Institute of Agriculture Extension Management, Hyderabad, p. 25.
* Chhachhar, A.R., Querestic, B., Khushk, G.M. and Ahmed, S. 2014 Impact of ICTs in Agriculture Development. J. of Bas. App. Sci. Res. 2014; 4(1):281-288.
* Jabir, A. Use of quality information for decision -making among livestock Farmers: Role of ICT . Liv. Res. for R. Dev. 2011; 23 (3).
* Manzar, O. Adversity to Success the World’s Best e-Content and Creativity Experience. The Country Paper INDIA, Global ICT Summit. 2004; Digital Empowerment Foundation, Hong Kong.
* Meera, Shaik N., Anita Jhamtani and Rao D.U.M., Information and Communication Technology in Agricultural Development: A Comparative Analysis of Three Projects from India, Agricultural Research and Extension Network, 2004.Network Paper No. 135.
* National Policy for Farmers, 2007. Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India. P. 15.
* N. Jamaluddin, Adoption of E-Commerce Practices among the Indian Farmers, A Survey of Trichy District in the State of Tamilnadu, India, Procedia Economics and Finance 7. 2013; pp 140 – 149.  
  [CrossRef](https://doi.org/10.1016/S2212-5671(13)00228-1)
* Paul, J., Katz, R. & Gallagher, S. Lessons from the Field: An Overview of the Current Usage of Information and Communication Technologies for Development. 2004; P5-11. Digital Dividend/World Resources Institute, Bhttp://www.digitaldividend.org/pdf/lessons.pdf
* Rebekka S., Saravanan R.: Access and Usage of ICTs for Agriculture and Rural Development by the tribal farmers in Meghalaya State of North-East India. J. of Agri. Infor. 2015; 6 (3):24-41.
* RML (Reuters Market Light). 2010. ―Transforming the Indian Farming Community through Access to Intelligent information. Brochure.
* Shalendra, K.C. Gummagolmath and Sharma P. ICT Initiatives in Indian Agriculture- An Overview, Ind. J. of Agri. Eco. 2011; 66 (3).
* USAID, ICT to Enhance Farm Extension Service in Africa, Briefing Paper, November, 2010.
* <https://www.computerscijournal.org/vol10no3/role-of-ict-in-agriculture-policy-implications/>
* https://www.fao.org/e-agriculture/blog/icts-and-agricultural-extension-services