INFORMATION AND COMMUNICATION TECHNOLOGY FOR TRANSFER OF TECHNOLOGIES

Authors

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

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

Ms. Amrutha Basavaraju
Post Graduate Scholar
Department of Agricultural Extension
UAS, GKVK
Bangalore, Karnataka, India.

Dr. Bhuvana N
Independent Research Consultant
Agricultural Extension and Rural
Development
Bangalore, Karnataka, India.
shankrimh@gmail.com

I. INTRODUCTION

Information and Communication Technology (ICT) has emerged as a powerful tool in the realm of technology transfer, revolutionizing the way knowledge and innovations are disseminated and adopted. ICT encompasses a wide range of digital technologies, including the internet, mobile devices, computers, multimedia, and telecommunication systems that enable seamless communication, data sharing, and collaboration across geographical boundaries.

The transfer of technologies plays a crucial role in driving progress and development across various sectors, such as agriculture, healthcare, education, and industry. Traditionally, technology transfer relied on conventional methods like workshops, training sessions, and printed materials to convey knowledge and expertise. However, with the advent of ICT, the landscape of technology dissemination has undergone a transformative shift.

ICT facilitates real-time access to information, breaking down barriers of time and distance, and enabling swift and efficient communication between experts, researchers, extension workers, and end-users. It offers innovative platforms for interactive learning, multimedia content delivery, and data exchange, empowering individuals and communities with the tools and knowledge required to embrace advancements and improve their lives.

In this era of rapid technological advancement, harnessing the potential of ICT for technology transfer holds immense promise. This introduction explores the various facets of ICT applications in technology transfer, delving into its benefits, challenges, and potential for empowering individuals and communities with transformative knowledge and innovations. Through the ICT technologies, we embark on a journey to explore how this dynamic medium can catalyze sustainable development and pave the way for a better, interconnected world.

1. **Cyber Extension:** Cyber Extension, in the context of agriculture, harnesses the power of online networks, computer communications, and digital interactive multimedia to facilitate the dissemination of agricultural technology. It involves the effective use of Information and Communication Technology (ICT), national and international information networks, the Internet, expert systems, multimedia learning systems, and computer-based training systems. By utilizing these technological advancements, Cyber Extension aims to improve information access for farmers, extension workers, research scientists, and extension managers.

   - **Unique Features of Cyber Extension Communication:** Cyber Extension exhibits several distinctive features that set it apart from traditional communication methods. These features ensure swift and efficient access to information for users across the globe:

     ➤ **Instant Access to Information:** The stored information in cyber space is readily accessible, and users can retrieve it instantaneously throughout the year, 24/7.
     ➤ **Interactive Communication:** Cyber Extension fosters interactive communication through mediums like e-mail, discussion groups, and newsgroups. This enables fruitful exchanges of ideas, knowledge, and expertise among stakeholders.
     ➤ **Global Accessibility:** One of the key advantages of Cyber Extension is its borderless nature. Users can access available information from any point on the globe, promoting seamless global collaboration and knowledge-sharing.
     ➤ **Dynamic and Expanding Communication:** Cyber Extension continuously evolves as technology progresses. It adapts to emerging trends, new tools, and ever-changing needs, making it a dynamic and ever-growing platform for agricultural extension.

   - **Important Tools of Cyber Extension:** To achieve its goals, Cyber Extension relies on a variety of essential tools that facilitate effective communication and information dissemination:

     ➤ **E-mail:** Electronic mail allows direct and personalized communication between individuals, enabling quick exchanges of messages and documents.
     ➤ **Telnet:** Telnet allows remote access to computers and resources on a network, enabling users to interact with distant systems as if they were locally connected.
     ➤ **FTP (File Transfer Protocol):** FTP enables the seamless transfer of files between computers over a network, ensuring efficient sharing of resources.
     ➤ **Gopher, Archie, Veronica:** These early internet search tools facilitated the retrieval of information and files from distributed servers.
     ➤ **Usenet Newsgroups:** Usenet provides a platform for discussion and exchange of information on specific topics through threaded discussions.
     ➤ **World Wide Web:** The World Wide Web, commonly known as the web, revolutionized information access and sharing on the internet, enabling users to navigate and interact with interconnected multimedia content.

   - **The World Wide Web (WWW):** The World Wide Web (WWW) is a multimedia service on the Internet that houses an extensive collection of hypertext documents written in Hypertext Markup Language (HTML). Hypertext allows for the

presentation of text, images, sound, and videos interconnected through non-sequential associations, creating a web of linked information. This format enables users to browse through topics in any order, making navigation flexible and intuitive. Various tools and protocols support exploration and resource transport between computers on the Internet.

- **File Transfer Protocol (FTP):** File Transfer Protocol (FTP) is a method used to support remote networks and facilitate simple file transfers of documents. FTP servers store vast amounts of information in files, but accessing data in these files requires the transfer of the entire file from the FTP server to the local computer. FTP is widely used for sending both text and binary files between computers, and both Microsoft and Unix operating systems include traditional character-based FTP clients.

- **Electronic Mail (E-mail):** Electronic mail, or e-mail, is the most widely used application on the Internet for sending and receiving electronic messages. It has become one of the primary communication methods for Internet users, replacing traditional means like telephones and faxes for many. E-mail operates as a system for delivering messages between computers connected via communication networks. It is the digital equivalent of paper mail, allowing the exchange of various types of messages, including text, graphics, audio, and video clips, as long as they can be digitized.

II. DISCUSSION GROUPS AND NEWS GROUPS

Discussion groups are virtual networks where scientists and other stakeholders engage in email interactions or message postings on specific subjects. These groups conduct in-depth discussions via email, where a topic or issue is introduced, and all members participate by providing their inputs over an agreed-upon timeframe. This mode of communication facilitates highly focused and fruitful discussions without requiring physical meetings. Discussion groups have proven to be effective scientific forums on the internet.

- **Telnet:** Telnet is an application that enables users to log on to a remote computer, functioning as a terminal emulation program. It presents text-based data similarly to a terminal, although GUI (Graphic User Interface) clients are now available, offering improved service.

- **Gopher, Archie, Veronica:** Gopher was an early attempt to simplify accessing Internet resources and was considered highly useful back in 1994. It employed text-based nested menus to navigate FTP sites, directories, files, and documents. Computer scientists at the University of Minnesota designed Gopher, which excelled in organizing FTP sites. However, as the number of Gopher sites grew rapidly, it became challenging to manage them all. To address this issue, derivative services like Archie, Veronica, and Jug head were developed to assist users in finding the right Gopher site. Eventually, Gopher and its counterparts became obsolete, as modern search engines on the web gained popularity. Web browsers can still handle Gopher transactions, and users may come across Gopher links without realizing it.

- **Usenet Newsgroups:** Usenet encompasses over 20,000 categories of newsgroups, covering a wide range of interests and topics. These newsgroups serve as bulletin board-style platforms where users can read and post their own entries and opinions. Modern web browsers like Netscape and Explorer provide software for accessing and participating in Usenet discussions. Alternatively, email mailing lists offer a more focused alternative to Usenet groups.

- **Advantages:**

  - ➢ **Cost and Time Efficiency:** Cyber Extension saves time and money as scientists can prepare electronic messages themselves, eliminating the need for printing and postage. Information can be updated online swiftly, making it more efficient. It also allows for in-depth analysis and provides detailed on-farm research results to interested users and farmers.
  - ➢ **Streamlining Extension Process:** Cyber Extension streamlines the traditional extension process by removing certain steps. Instead of zonal workshops and training for subject matter specialists (SMS), scientists can directly post information on the Internet, making it accessible to extension functionaries at various levels without involving a chain of intermediaries. This direct communication facilitates quicker dissemination of information and addresses queries and clarifications promptly.
  - ➢ **Information-Rich and Interactive:** Cyber Extension caters to curious extension workers and analytical farmers by offering quick access to the information they need. Extension workers can interact with scientists on specific subjects, regardless of their location. Rural technologies can be made available on CD-ROMs for faster dissemination.
  - ➢ **Instant Global Reach:** Online networks create an instant global village, enabling Cyber Extension to overcome time and distance barriers. Users can access the latest information on any specific problem from anywhere in the world and connect with experts and scientists worldwide to discuss their issues.
  - ➢ **Continuous Availability:** Cyber Extension is available 24/7, offering continuous access to information throughout the year, eliminating limitations posed by working hours or holidays.

- **Limitations:**

  - ➢ **Limited Reach in Rural Communities:** Despite its potential as a development communication tool, Cyber Extension faces challenges in rural communities due to factors like illiteracy, lack of skills, and limited economic resources.
  - ➢ **Relevance of Messages:** Cyber Extension may present both relevant and irrelevant messages, making it essential for users to filter and discern the information they require.
  - ➢ **Higher Cost:** Implementing Cyber Extension can be more expensive compared to traditional extension methods.
  - ➢ **Reduction in Extension Activities:** With the direct access to information, Cyber Extension may reduce the necessity for certain extension activities like training workshops.

> ➢ **Information Suitability:** Not all messages may be suitable for all farmers, as the information needs of different individuals may vary.

1. **Interactive Video:** Interactive video represents a dynamic convergence of computer, video, and laser technologies, fostering a novel communication approach. Users can actively influence their viewing experience by controlling which segments of a program they wish to access. Moreover, this technology empowers viewers to interact with specific elements displayed on the screen, simulating engaging conversations. Over the last decade and a half, interactive video has gained widespread popularity in advanced countries as a compelling means of communication and user engagement.

2. **Teleconferencing:** In the 1960s, the American Telephone and Telegraph Company introduced teleconferencing with its "picture phone," revolutionizing video-based communication via telephone lines or satellite broadcasts. As a powerful substitute for face-to-face meetings, teleconferencing enables individuals geographically distant to converge virtually, sharing their perspectives and experiences in real-time. This technology plays a crucial role in bridging gaps between remote locations and fostering seamless collaboration across distances.

3. **Audio Conferencing:** Audio conferencing streamlines verbal communication through telephone networks, providing an efficient platform for multi-site, multi-participant meetings. Through real-time dialogue, question-and-answer sessions, and immediate responses, audio conferencing facilitates seamless and interactive communication among participants, regardless of their geographical locations.

4. **Video Conferencing:** Video conferencing revolutionizes communication by enabling virtual conferences between individuals or groups situated in different geographical areas. Through computer networks, audio and video data are transmitted, fostering interactive discussions, presentations, and collaborations. Video conferencing presents a flexible and effective alternative to in-person meetings, promoting efficient communication across distances.

5. **Computer Conferencing:** Computer conferencing leverages electronic mail and person-to-person messaging to facilitate voice and image exchange between individuals or groups. This technology fosters group communication and collaboration, allowing participants to engage in productive discussions and share information seamlessly.

6. **Multimedia:** Multimedia serves as a versatile and integrated communication platform, combining text, data, graphics, animation, optical storage, image processing, and sound. Learners benefit from immersive and interactive learning experiences, gaining greater control over their educational journey. Through multimedia, individuals can access diverse resources and engage with content in more engaging and comprehensive ways.

7. **Databases**: Databases store valuable information, ranging from animal breed traits and plant and animal disease data to feeding ration formulas, weather forecasts, library catalogs, and documentation systems. These repositories of structured data enable efficient retrieval and management of essential information.

8. **Teletext:** Teletext represents a television-based system that broadcasts printed information to viewers. Unlike transmitted via telephone lines, teletext lacks interactive features but delivers concise and relevant data to audiences through the television medium.

9. **Optical Communication Technology:** Optical communication technology harnesses light waves to transmit information via ultra-pure glass fibers. This method ensures efficient transmission and reception of various data, including human voice, TV pictures, and computer-generated content. Optical communication has significantly advanced the efficiency and convenience of data transfer.

10. **Very Small Aperture Terminal Technology (VSAT) Service:** The VSAT technology provides businesses with satellite-based networks for cost-effective communication. These networks, known as Closed User Group (CUG) networks, connect head offices to various remote locations, enabling high-speed data transmission and voice communication. VSAT technology plays a pivotal role in bridging communication gaps and enhancing connectivity within organizations.

11. **Electronic Data Interchange (EDI):** EDI facilitates seamless electronic document exchange between organizations, streamlining routine processes such as purchase orders and invoices. By utilizing standardized electronic forms and service providers, EDI ensures quicker, reliable, and cost-effective exchange of export documents and promotes efficient business operations.

12. **Expert System:** Expert systems are a vital branch of Artificial Intelligence (AI) that focus on practical applications. These systems emulate human reasoning and problem-solvin1g capabilities, making them valuable tools in various domains, including agriculture. In agriculture, expert systems aid in diagnosing diseases and pests in crops, enhancing agricultural practices and research.

13. **Artificial Intelligence (AI)**: Artificial Intelligence is a multidisciplinary scientific field dedicated to creating computer systems capable of human-level thinking, reasoning, and problem-solving. AI aims to replicate human intelligence and cognitive abilities in machines, driving advancements in various sectors, including research, automation, and decision-making.

14. **Fax**: Fax, short for facsimile, serves as an electronic document transmission device. It enables the transmission of written documents, photographs, maps, or graphics electronically. The fax machine scans the original document, converts the information into electronic signals, and sends it to a receiving fax machine, ensuring efficient and reliable communication.

III. APPLICATION OF ICT TOOLS AND IN ANIMAL HUSBANDRY EXTENSION

ICT tools have revolutionized the way Animal Husbandry Extension services are delivered, providing numerous benefits to farmers and extension workers alike:

- **Interactive Video:** Interactive videos serve as versatile tools for information delivery, education, and problem-solving. Farmers can access instructional videos on various aspects of livestock management, enabling them to enhance their skills and practices. Additionally, interactive video platforms facilitate real-time discussions and consultations with experts, addressing specific challenges faced by farmers.

- **Audio Conferencing:** Audio conferencing plays a vital role in training programs and institutional outreach. Extension workers can conduct remote training sessions, reaching a larger audience and ensuring efficient dissemination of knowledge. It also allows for smooth administrative coordination of extension services across various locations.

- **Multimedia:** Multimedia platforms offer dynamic training opportunities and information delivery to farmers. Through interactive content, farmers can gain in-depth insights into best practices, disease management, and livestock nutrition, enhancing their understanding and decision-making abilities.

- **Internet:** The internet serves as a 24/7 information hub for farmers, providing access to a vast array of resources on livestock management and agriculture. Through websites, online databases, and social media, farmers can stay updated on the latest agricultural news, market trends, and weather forecasts, empowering them to make informed choices.

- **Expert System:** Expert systems are powerful tools for decision-making, designing livestock management strategies, and predicting outcomes. These AI-based systems assist farmers in diagnosing animal health issues, selecting appropriate breeding methods, and optimizing feeding practices.

- **Agri Portal:** Agriculture portals offer instant access to critical information on markets, agricultural news, and weather updates. Farmers can stay informed about commodity prices, market trends, and potential risks, enabling them to make well-informed marketing decisions.

- **E-mail and Mobile Phones:** E-mail and mobile phones play a crucial role in providing timely and relevant information to farmers. Extension workers can send advisory messages, weather alerts, and reminders, fostering better communication and knowledge dissemination.

- **Website:** Agriculture-oriented websites serve as a valuable resource for farmers, offering the latest news, research findings, and practical guidance on animal husbandry practices. These platforms empower farmers to stay updated on emerging technologies and industry developments.

IV. ICT INITIATIVES IN ANIMAL HUSBANDRY AND DAIRYING

In India, several successful ICT initiatives have been implemented under various projects to enhance information access and communication in rural areas. One such project is the Warna Wired Village Project, which provides internet access to cooperative societies across 70 villages in Maharashtra. The aim is to establish networked booths in the villages, enabling villagers to access vital information.

The Information Village Project by M.S. Swaminathan Research Foundation (MSSRF) focuses on establishing an information network hub in Villianur village, Pondicherry. This initiative aims to cater to the information needs of rural communities and bring the benefits of modern ICTs to rural families in the region.

The Department of Animal Husbandry and Dairying (DAH&D) has successfully set up a Local Area Network (LAN) with 230 nodes at Krishi Bhawan, New Delhi, offering internet access through the NICNET gateway. Additionally, an e-Learning Centre has been established to provide online internet access.

The Dairy Information and Services Kiosk (DISK) is another noteworthy initiative led by the Gujarat Cooperative Milk Marketing Federation Ltd (GCMFL) in collaboration with the Indian Institute of Management, Ahmedabad. DISK maintains detailed records of member farmers' milk cattle, including breed information, disease history, inoculation, and artificial insemination details. It is utilized at milk collection centers and cooperatives for measuring butter fat content and testing milk quality, enabling prompt payment to farmers, eliminating incentives for milk adulteration, and instilling confidence in the cooperative setup.

The National Dairy Development Board's "AKASHGANGA" initiative offers a comprehensive integrated solution for automatic milk collection.

The Central Institute for Research on Goats (CIRG) has developed an e-mail Conference System for Goat Outreach on its goat-nic.in server using free software called 'majordoma'. This system facilitates information exchange among technologists, farmers, development officers, and planners.

Under the Animal Health Project funded by the Department for International Development (DFID), the Rajiv Gandhi College of Veterinary and Animal Sciences (RAGACOVAS) in collaboration with the University of Reading, UK, designed an interactive touch screen information Kiosk. It provides essential information on cattle diseases and management methods, allowing livestock farmers to access needed information with ease. Similarly, TANUVAS, Chennai, has also developed a touch screen information kiosk on dairy cattle management.

The Ministry of Agriculture, Government of India, has introduced a toll-free number 1800-180-1551 for farmers across the country to access information on agriculture and allied subjects.

These diverse ICT initiatives showcase the potential of technology in transforming agricultural and animal husbandry practices, providing valuable information, improving efficiency, and empowering rural communities with knowledge and resources.

V. ICT USE IN EXTENSION

ICT has become a powerful tool in extension services, contributing to various aspects of social and economic development:

- **Social and Economic Change:** ICT plays a vital role in facilitating social changes, empowering marginalized groups like women and youth, and promoting economic prosperity by streamlining administration and improving productivity.

- **Rural Development and Food Security:** ICTs offer access to crucial information on inputs, technologies, market prices, and weather conditions, contributing to rural development and ensuring food security through knowledge dissemination.
- **Poverty Alleviation:** Information provided by ICTs, such as market prices and social services, can reduce poverty levels, enabling farmers to make informed decisions and enhance their income.
- **Empowering Rural Communities:** ICTs empower rural communities by giving them a voice in decision-making processes, leading to improved policy formulation and execution.
- **Employment Generation:** Establishing rural information centers and telecenters create employment opportunities in rural areas and bridge the gap between urban and rural communities.
- **Strengthening Linkages:** ICTs improve linkages between researchers, frontline workers, and farmers, ensuring knowledge transfer and effective technology adoption.
- **e-Governance:** ICT applications in governance enhance citizen participation, especially among women, and improve service delivery, leading to poverty alleviation.
- **Supporting Group Work:** ICTs enhance the effectiveness of group work in government, business, and social organizations, improving outcomes.
- **Artificial Intelligence and Expert Systems:** AI and expert systems assist in risk assessment, solving complex problems, and providing tailored information in various fields.
- **Distance Education and GIS:** ICT facilitates distance education, enabling teacher-student communication and continual updating of course materials. GIS aids in mapping and analyzing natural resources and demographics.
- **Agri Portal:** Specialized agricultural websites, agri portals, offer targeted information on markets, news, and weather for rural and farming communities.
- **TOT through Web Platforms:** Web pages and online portals like TNAU's website and Gyanvani Radio network support training of trainers (TOT) efforts and knowledge dissemination.

These ICT initiatives contribute significantly to sustainable development, empowering rural communities, and improving overall agricultural and extension services in India.

1. Prospects of ICT

- ICT offers new media channels to complement traditional communication methods in development efforts.
- These new media enable bottom-up sharing of information and local knowledge when accessible.
- It increases efficiency and reduces duplication of activities by making information widely accessible.
- ICT tends to lower communication costs significantly compared to other options.
- It provides global access to information and resources, facilitating rapid communication locally, nationally, and globally.

2. Problems of ICT

- The capital cost and ongoing expenses of ICT technologies can be high.
- Capacity-building is necessary to effectively utilize ICT.
- Dependence on technology can become a concern.
- Limited telecommunications infrastructure in rural and remote areas hinders ICT adoption.
- Many ICT projects lack proper planning and stakeholder involvement.
- Funding agencies sometimes prioritize flashy projects over practical and meaningful communication processes.
- Integration with existing media and local communication methods is often overlooked.
- Insufficient involvement of all stakeholders, including women and youth, in planning and implementation occurs in some ICT projects.