

THE ROLES OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN THE PROVISION OF RELIABLE RESEARCH INFORMATION

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Abstract

The digital era has brought about a transformation in the ways that knowledge is accessible, shared, and used across many fields, with Information and Communication Technology (ICT) emerging as a key component in the supply of trustworthy research information. The many ways that ICT may improve the consistency, availability, and sharing of research findings are examined in this study as it demonstrates how digital platforms, databases, and communication tools support open science culture, encourage the openness of data sources, and enable researchers to collaborate in real time. The study also looks at how ICT has affected data management procedures, highlighting the value of cloud computing and sophisticated analytical tools in maintaining data security and integrity. Through the use of ICT, researchers may reduce biases, traverse large information landscapes, and bolster the validity of their results. In conclusion, this study also highlights how crucial information and communication technology (ICT) is to creating a more knowledgeable, effective, and cooperative research environment and opening doors for creative solutions to current problems with knowledge generation and distribution. One of the recommendations was that institutions should implement comprehensive digital literacy training for researchers and students to ensure they are proficient in utilizing ICT tools effectively for accessing and evaluating reliable research information.

Keywords: Roles, ICT and Research Information.

Introduction

Information and communication technology (ICT) has become a key player in improving the accessibility and dependability of research information in the modern academic and research environment. As a result, effective tools and platforms are increasingly needed to manage, transmit, and evaluate the vast amounts of data that are created globally on an exponential basis. According to a report by the International Telecommunication Union (ITU, 2021), the proliferation of internet connectivity and digital technologies has transformed how researchers engage with information, enabling unprecedented access to vast repositories of knowledge and facilitating collaboration across geographical boundaries.

Moreover, ICT is a complex component of research and has a big influence on all phases of the process, from cooperation and data gathering to distribution and analysis. For instance, advanced data management systems and cloud computing solutions allow researchers to store, process, and analyze large datasets efficiently, thus enhancing data reliability and integrity (Khan et al., 2019). Additionally, peer review and transparency are facilitated by digital channels for disseminating research findings, such academic social networks and online journals, which are crucial for guaranteeing the reliability of published material.

Furthermore, the development of ICT-driven open access efforts has democratized access to research material by eliminating long-standing obstacles that frequently restrict the availability of academic resources. This paradigm shift not only empowers researchers from developing countries but also fosters a culture of collaboration and knowledge sharing that is vital for addressing complex global challenges (Smith & Jones, 2021). Innovative tools for data visualization and analysis have also been developed as a result of the incorporation of ICT in research procedures, allowing researchers to display their findings in more understandable and captivating ways.

ICT has many advantages, but there are some drawbacks. These include problems with data security, the digital divide, and the reliability of information sources. Understanding the roles of ICT in delivering trustworthy research information is crucial for researchers, institutions, and policymakers alike as the research landscape continues to change. However, the objective of this study is to investigate the many aspects of ICT's influence on research dependability, emphasizing the potential and difficulties that come with living in a digital age.

Concept of ICT

Information and communication technology (ICT), is technology that facilitates information-related activities such as; data collection, processing, storing, and presenting. These activities also increasingly include teamwork and communication. ICT can be defined as any device that can electronically store, retrieve, alter, send, or receive data in a digital format. Robots, email, digital television, and PCs are a few examples of ICT. However, in the mid-1980s, the term "Information and Communication Technology" (ICT) was first used to describe all kinds of electronic systems used for broadcasting telecommunications and mediated communications. Examples of these systems included computer software and hardware, video games, cell phones, the internet, and personal computers. Computer and communication technologies also comprise ICT. According to Ashikuzzaman (2023), computer technology is the tool for storing and processing information in digital form, while communication technology helps us to transfer and disseminate digital information.

In addition, information and communication technology (ICT) refers to a wide range of technical applications as Information, communication, and technology are combined to form the term ICT. Moreover, technology is the use of computers and communication, and information is knowledge. A research by Walia (2021) explained information and communication technology is an integration of computing system, communication technologies and process for generation of information and dissemination. Similarly, Bostrom (2023) also mentioned that ICT is the fusion of infrastructure and components that enable modern computing. Therefore, information and communication technology (ICT) is said to be the collection, processing, storage, and sharing of information using a mix of computer programs and communication tools. Oftentimes, the most

expensive and advanced computer-based technologies are linked to information and communication technologies. ICTs are essentially instruments for handling information as they are diverse range of products, services, and programs used for creating, storing, processing, distributing, and exchanging information. Technology tools and resources utilized for communication are referred to as Information and Communication Technology. Furthermore, the goal of ICT is to improve access to information and make human-to-human, human-to-machine, and machine-to-machine communication easier and more efficient (Rouse, 2024).

Concept of Research Information

“Re” and “search” make up the two syllables that make up the word “Research”. The prefix "Re" means once more, afresh, or repeatedly while the verb “Search” means to investigate attentively and intently, to test and attempt, or to explore. Combined together, they create a word that designates a methodical, diligent, and meticulous examination. Research is said to be a project in a particular field of study that is carried out to prove ideas or facts. According to Law Insider (2020), Research Information means technical data, processes, methods, inventions, compositions-of-matter, biological materials, equipment, instruments, apparatuses, devices, articles of manufacture or component parts(s) thereof developed under or resulting from the performance of Research under the Research Agreement and improvements thereof, except for improvements on new subject matter not funded by Licensee.

However, Research Information is related to technological information, discoveries, apparatus, gadgets, and component components created through study. Information management systems and computer software developed over the course of the study are included in the above description. Except for biological elements, the actual parts and equipment are not to be regarded as transferred. An institution's research efforts are described in research information as they include the details on the scientific staff and organization, projects, outside financing, publications, patents, and other aspects of a research institution. It also consists of the all data, expertise, and materials (such as chemical compounds or substances, biological cells or their components, whether synthesized or generated from biological material) created during research under the research plan, but which do not qualify as inventions.

Components of ICT

A wide range of technologies that make information storage, retrieval, processing, and distribution easier are together referred to as information and communication technology. Knowing the components of ICT is crucial as society depends more and more on digital platforms for data management and communication. Nevertheless, the components consist of the following:

- **Hardware**

The actual components that make up the ICT's technological infrastructure are referred to as hardware. Computers, servers, routers, switches, storage devices, and mobile and tablet devices for communication are all included in this. According to Mwaura et al. (2019), hardware forms the backbone of ICT systems, providing the necessary tools for data processing and communication. Still, the performance and efficiency of ICT applications have been greatly improved by the ongoing development of hardware technology, including higher storage capacity and quicker CPUs.

- **Software**

Programs and apps that operate on hardware and let users accomplish particular tasks are referred to as software. System software, application software, and operating systems fall under this category. As emphasized by Hossain et al. (2021), software plays a critical role in facilitating user interaction with hardware and managing data processes. Although software as a service (SaaS) allows users to access programs remotely through the internet, increasing flexibility and lowering costs, cloud computing has also revolutionized software delivery approaches.

- **Networks**

ICT requires networks because they allow devices to communicate and share data. These networks consist of the internet, wide area networks (WANs), and local area networks (LANs). Data transport over long distances is made easier by networking technologies like fiber optics and wireless communications. However, the global cooperation and information exchange have been promoted by the introduction of high-speed internet and sophisticated networking protocols, which have completely changed the way people and organizations interact.

- **Data**

ICT is fundamentally based on data, which is the primary resource that powers information systems. It includes a variety of formats, such as text, audio, video, and pictures. For data security, accessibility, and integrity to be guaranteed, effective data management techniques are necessary. According to Kaur and Bhardwaj (2021), the rise of big data analytics has transformed how organizations harness data for decision-making, enabling them to extract valuable insights and drive innovation.

- **Human Resources**

The design, implementation, and management of ICT systems require qualified workers, which makes human resources an essential part of the technology. This include those working in IT, data analysts, software developers, and technology consumers. People must get training and ongoing professional development in order to acquire the skills necessary to adjust to the quickly changing ICT environments. As highlighted by Islam et al. (2019), fostering a culture of digital literacy and ongoing education is vital for maximizing the potential of ICT in organizations and ensuring that users can effectively leverage technology for their needs.

- **Processes**

The policies and guidelines that control how an ICT system is used and operated are referred to as processes. These consist of change management methods, security policies, user access restrictions, and data backup and recovery protocols. Processes with clear definitions ensures that the system is utilized successfully and efficiently while lowering the possibility of mistakes, data loss, or security breaches. Additionally, processes facilitate the standardization of work and the internal exchange of best practices, which raises quality and productivity levels all throughout the company.

- **Communication**

The interchange of data and messages between different ICT system components as well as between users and the system is referred to as communication. An ICT system cannot function well without effective communication since it prevents people from working together, sharing knowledge, and making poor judgements. However, there are several ways to communicate, including through file sharing, video conferencing, email, and instant messaging. Transport layer protocols and standards, such TCP/IP and HTTP, provide dependable and secure data transfer between networks.

- **Storage**

In an ICT system, storage refers to the hardware and media used to store and maintain data. There are several kinds of storage such as the tertiary storage, secondary storage and main or primary storage. Primary storage is quick, but it is volatile, so when the power is cut off, the data is gone. Although secondary storage is slower than primary storage, it does not lose data over time while the tertiary storage adds another level of data security and is utilized for off-site backups and archiving.

- **Input and Output**

The terms "input" and "output" describe the tools and procedures needed to load data into an ICT system and display or generate output. Keyboards, mouse, scanners, and touchscreens are examples of input devices; displays, printers, and speakers are examples of output devices. Users can interact with the system and carry out certain operations, such typing text, navigating menus, or printing documents, with the help of input and output devices. To ensure that users can enter and retrieve information with ease, an ICT system's usability and accessibility depend on its effective input and output.

- **Security**

The methods and procedures used to prevent unwanted access, alteration, or destruction of an ICT system and its data are referred to as security. An ICT system's security is essential to maintaining the availability, confidentiality, and integrity of its data. Intrusion detection systems, firewalls, antivirus software, encryption, and access restrictions (such as passwords and biometric identification) are examples of security measures. A thorough strategy that takes into account both technological and human aspects, such user awareness and training, is necessary for effective security. To maintain the system's overall security and find and fix vulnerabilities, regular security audits and upgrades are crucial.

Roles of ICT in the provision of Research Information

The field of research has seen a significant transformation because to information and communication technology (ICT), which makes it easier to provide, manage, and disseminate research information. The creation and dissemination of knowledge has been completely transformed by the use of ICT into research procedures, which has improved information cooperation, accessibility, and dependability. Among the roles are:

- **Improved Access to Resources**

Improving access to a wide range of materials is one of ICT's main functions in research. Scholarly books, papers, and other academic materials are accessible to scholars worldwide through digital libraries, online journals, and databases. With the growth of open access programs, research findings are now more widely accessible, allowing scholars from other fields to interact with state-of-the-art information. By giving researchers immediate access to material, this enhanced accessibility not only encourages inclusion but also quickens the speed of study.

- **Enhanced Collaboration**

ICT makes it easier for academics from different institutions, fields, and geographic locations to collaborate. Real-time collaboration and information sharing are made possible by online platforms and communication technologies including project management software, collaborative document editing, and video conferencing. As noted by Kuhlmann et al. (2019), such technologies foster interdisciplinary research efforts, allowing diverse teams to combine their expertise to tackle complex problems. The quality and scope of research are improved by seamless collaboration, which eventually produces more reliable and creative results.

- **Data Management**

The accuracy and dependability of research information depend heavily on effective data management, and ICT is vital in this regard. Large amounts of data are easier to organize, store, and retrieve with the help of databases, cloud storage options, and advanced data management tools. These technologies allow researchers to conveniently maintain and retrieve their data while also guaranteeing the security and integrity of the data.

- **Support for Data Analysis and Visualization**

ICT gives academics strong data analysis and visualization tools, improving their capacity to comprehend and communicate complicated data. Software tools for data visualization, machine learning, and statistical analysis enable academics to extract valuable insights from their data. As highlighted by Li et al. (2021), the use of advanced analytical tools and visualization techniques enhances the communication of research findings, making them more accessible to a broader audience. Researchers may successfully communicate their findings and involve stakeholders by converting raw data into visually appealing representations.

- **Promotion of Open Science**

The concepts of open science, which place an emphasis on accessibility, cooperation, and transparency in the research process, are supported by the use of ICT in research. Researchers are encouraged to make their work publicly available using digital platforms that facilitate the sharing of research data and findings. This allows for peer evaluation and validation of findings. The movement towards transparency is of utmost importance in tackling social issues, since it facilitates the collaborative sharing of information and assets.

The weak Point of ICT in provision of Research Information

Information and communication technology (ICT) has improved research information availability tremendously, but it is not without drawbacks. The efficient use of ICT in research is

hampered by a number of problems, such as concerns about privacy and data security, the digital divide, information overload, and the reliability of online sources. It is imperative that scholars and organizations comprehend these weaknesses in order to effectively manage the intricacies of the digital terrain. The following are ICT's weaknesses in providing research information:

- **Data Security and Privacy Concerns**

The most serious disadvantage of ICT in research is the data's susceptibility to breaches and illegal access. Data security and privacy issues are becoming more pressing as researchers manage sensitive data more often through online platforms and cloud storage. According to Ali et al. (2020), many researchers are hesitant to share their data due to fears of potential leaks or misuse, which can hinder collaboration and the sharing of valuable information. Furthermore, maintaining sensitive and personal data for researchers is made more difficult by the need to comply with data privacy laws like the General Data Privacy Regulation (GDPR).

- **The Digital Divide**

One major barrier to using ICT for research effectively is still the digital divide. ICT access discrepancies can worsen already-existing inequalities, even if ICT has the ability to democratize information access. Researchers working in impoverished nations frequently have difficulties gaining access to cutting-edge technology and dependable internet connectivity, which restricts their capacity to participate in international research networks and get vital resources. This digital gap may lead to an unequal distribution of opportunities and information, which would impede the general advancement of research in less developed regions.

- **Information Overload**

Researchers may find it challenging to identify reliable and pertinent sources due to the overwhelming amount of information that is readily available online. The exponential increase of digital content may make it difficult for academics to sort through and assess the reliability of the material they come upon. A researcher's capacity to make thoughtful conclusions may be hampered by information overload, which may also cause cognitive fatigue and lead to data interpretation errors. Strong information literacy abilities are essential for researchers, as the task of traversing large information landscapes is challenging.

- **Reliance on Technology**

Researchers may face hazards as a result of their growing reliance on ICT technologies, especially in the event of technological malfunctions. Software bugs, system failures, or data loss can cause serious delays and disruptions to research projects. According to Hossain et al. (2021), over-reliance on technology can diminish critical thinking and problem-solving skills among researchers, as they may become overly dependent on automated systems for data analysis and interpretation.

- **Credibility of Online Information**

The spread of unreliable and perhaps false information might result from the ease with which content can be published online. One big weakness in the ICT environment is the difficulty of verifying the reliability of internet sources. The integrity of researchers' work may be jeopardized by biased information, non-peer reviewed publications, or fraudulent studies. As emphasized by

Ritchie et al. (2020), the lack of rigorous vetting processes for online content can undermine the trustworthiness of research findings, making it crucial for researchers to develop skills to critically assess the reliability of information sources.

Strategic methods of eliminating the weak Point of ICT in provision of Research Information

Enhancing the dependability, comprehensibility, and general calibre of research outputs necessitates addressing the weaknesses of Information and Communication Technology (ICT) in the dissemination of research information. Scholars and institutions can cultivate a more robust and effective research environment by putting these weaknesses into practice. Some of the more effective strategies to address these weaknesses are listed below:

- **Enhancing Data Security Measures**

Researchers and institutions need to implement comprehensive data protection plans in order to address privacy and data security issues. This includes implementing robust cybersecurity protocols, such as encryption, multi-factor authentication, and regular security audits (Ali et al., 2020). Furthermore, researchers must receive training on the best methods for sharing and managing data, with a focus on how crucial it is to abide by data privacy laws. Prioritizing data security allows researchers to protect sensitive data while fostering cooperation and fostering trust.

- **Bridging the Digital Divide**

Governments and organizations can invest in infrastructure development, subsidies internet access, and provide reasonably priced technology solutions to institutions with limited resources in order to eliminate the digital divide. Specific initiatives are required to improve access to technology and internet connectivity, especially in developing regions. In order to guarantee that researchers in underprivileged regions have equal opportunity to engage in the global research environment, collaborations between universities, non-governmental organizations, and the commercial sector may also be fostered. These partnerships can enable knowledge transfer and resource sharing.

- **Improving Information Literacy**

Improving the information literacy of researchers is essential to tackling the issues of legitimacy and information overload. Institutions should offer training programs focused on developing critical skills for evaluating information sources, managing data, and navigating digital research environments (Hossain et al., 2021). Promoting an information-literate culture can help researchers make more informed judgements and uphold the integrity of their work by helping them distinguish between reputable and questionable sources of information.

- **Promoting Technology Training**

In order to reduce the hazards linked to dependence on technology, it is imperative to have continuous training and professional development initiatives. Institutions have to offer resources and programs that concentrate on data analysis tools, research methodology, and new technologies. Institutions can enable researchers to efficiently use ICT while retaining critical thinking and problem-solving skills by providing them with the tools they need to adapt to new technology.

- **Establishing Credible Information Sources**

The establishment and promotion of credible online channels for the dissemination of research findings is crucial in addressing the problem of information credibility. Collaborating with established publishers and academic societies can ensure that research outputs are subjected to rigorous peer review processes (Ritchie et al., 2020). Creating criteria for the publication of research online can also aid in upholding strict integrity and quality standards. Promoting open access platforms that priorities openness and disseminate research findings among scholars may help enhance the reputation of the scientific community.

Conclusion

In conclusion, Information and Communication Technology (ICT) plays a transformative role in the provision of reliable research information, shaping the future of scholarly communication and knowledge dissemination. By enhancing data management, fostering collaboration, and promoting open access, ICT not only improves the reliability and accessibility of research but also empowers researchers to navigate an increasingly complex information landscape. As we continue to embrace technological advancements, addressing the challenges associated with data security, information credibility, and the digital divide will be crucial.

Recommendations

1. Institutions should implement comprehensive digital literacy training for researchers and students to ensure they are proficient in utilizing ICT tools effectively for accessing and evaluating reliable research information.
2. Researchers and institutions should adopt advanced cybersecurity protocols and best practices to safeguard sensitive data, ensuring the integrity and confidentiality of research information throughout its lifecycle.
3. Researchers should be encouraged to leverage cutting-edge data analytics and visualization technologies to enhance the clarity and impact of their findings, making complex data more accessible and comprehensible to diverse audiences.

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