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## Use of Information and Communication Technology (ICT) in Research

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**Abstract:**

ICT is the boon for research community, it is enhancing the quality of the research, helpful the entire research process. Each and every stage of the research ICT tools are plays very curial role with help of various tools, software's, teleconferencing technology. Research Survey, Collection of data, literature review, Collection of data, analyzing of data, Management and interpretation of data, plagiarism and to publish the article from the research are the area where the ICT is play very important role. It's save the time as well accuracy with speed of the investigators.

**Key words:** ICT, Information and communication technology and Research; Research and ICT

**Introduction:**

ICT in higher education used for research and other academic works like creating online lectures, courses, tutorials, lectures, content creation, uploading on cloud or intuitions website or social networking sites, research processing, collection, scrutinize, analyzed and finding new knowledge before and during the covide, and now very essential needs for students, researchers as well for academicians to provide service to the society.

**What is the Information and Communication Technology (ICT)?**

ICT consist hardware-software, Computer networks, media for collect, preserve, process, disseminate, and transmit or access the information e.g text, images, voice. ICT has two terms 'Information' and 'Communication Technology' refers to tele-communication system, any computer network, satellite system for the development of the nations. There are many ICT components are used in the society like computers, internet, smart phones, digital tvs', artificial intelligence, Internet of things and robotics and more. Today worlds developed by use of it's, no nation can develop without knowing its usages and important either in business operation or education. (Bala & Rani, 2018; Pratt, 2022)



Picture1 - Source : [https://cdn.ttgtmedia.com/rms/onlineImages/ICT\\_components.jpg](https://cdn.ttgtmedia.com/rms/onlineImages/ICT_components.jpg)

The term ICT Sometimes used as synonyms to Information technology (IT) in United States for Business operation but mainly its use as border term of the Computer and telecommunication technology as well know use in education and research.

### **What is Research?**

As per (Department of Education and Training, 2020) Research as *“the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes.”*

As per the online (Cambridge Dictionary, 2022) Research is *“a detailed study of a subject, especially in order to discover (new) information or reach a (new) understanding”*

As per the Online (Merriam-Webster Dictionary, 2022) defined research as *“1: studious inquiry or examination : especially : investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws. 2 : the collecting of information about a particular subject. 3 : careful or diligent search”*

define research as “organized inquiry” (Emorcy, 1976)

define “Research simply means a search for facts-answers to questions and solutions to problems. It is purpose of investigation. It seek to find explanation to unexplained phenomenon, to clarify the doubtful propositions and to correct the misconceived facts” (Krishnaswami & Ranganathan, 2007)

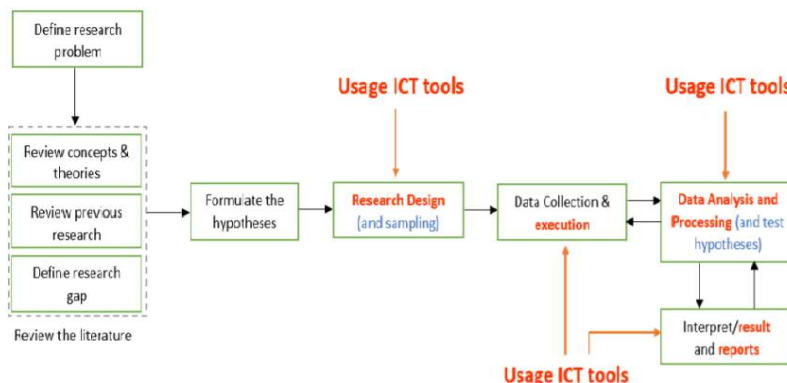
define Research as “a more efficient and effective approach to expand knowledge, however, is the conduct of special, planned, and structured investigation-a approach known as research” (Busha & Haeter, 1980)

To evaluate the few definition of the research give brief understating that research is systematic efforts to search the answer of a question or the problem. The Growth and development in any filed is depend and based on new knowledge again through the research activities. Present era without use of ICT scientist or researcher cannot manage their research in various stages of the research. To maintain, storage, retrieval, analyzing, finding and presentation of the research and its data available greatly depend on the ICT.

ICT helps researcher on following broader areas are :

1. Find relevant information sources in respective subject worldwide and make exchange them with others (no limitation)
2. Do research effectively with broader scope
3. Information collected can critically analyzed
4. Manage the information with use of various software
5. Search Open Access and Commercial Databases, E-Journals, E-Books and other media in general and specific subject
6. Collected or downloaded resources or Search result can be manage, exchanged and stored online and offline
7. Researcher can get result of its work in specific format.

## ICT use in Research Process Flow Chart:

**RESEARCH PROCESS FLOW CHART**

Picture1 - Source : [https://www.raiuiversity.edu/wp-content/uploads/2020/06/ICT%20tools%20in%20Research\\_10-11June2020.pdf](https://www.raiuiversity.edu/wp-content/uploads/2020/06/ICT%20tools%20in%20Research_10-11June2020.pdf) page 6

**Uses if ICT in research process is following steps are following:**

**Step 1: Identify the Problem:** To identify the research problem is difficult task. Find out the subject or topic in which researcher is more interested as professional will help more for further study. To avoid duplication of work while choosing the topic or title must take care and before finalizing or accepting the problem for the dissertation, it must have to discuss with colleagues, friend, experts and teachers. The research topic or problem should be practical, relatively important, feasible, ethically and politically acceptable. (Dudovskiy, 2011).

**Step 2: Evaluate the Literature:** After finalization of research statement, topic or area, researcher must find out previous studies or work on his research area will helps researchers to study the scope, Geographical area, limitations, findings, and conclusion etc. which gives him clear idea about the work already done and his research problem is differ from it or he can find out different aspects to study which is not covered in earlier research. To search the relevant literature investigator has to find out various primary and secondary sources like books, journals, articles, online-offline database, e-books, e-journals etc. Researcher has search and find vast amount of literatures in various medium and to tracking and managing all the information-resources are easily manage by Information and communication technology. Researcher can access the data through various sites like Shodhaganga for full-text PhD thesis, Shodhgangotri for Synopsis, Subject Gateways, subject specific search engines, subject Directories, Open Access Directory, Commercial Databases, E-journals, E-books, E-articles etc. through computer and internet.

**Step 3: Create Hypotheses:** After selection and making narrow the research statement or idea, writing hypotheses need careful understanding of the research topic comprehensively. According to your topic or idea you can make some statements or arguments which can be tested. It is a precise, testable statement of what the researchers predict will be outcome of the study. In research, there is a convention that the hypothesis is written in two forms, the null hypothesis, and the alternative hypothesis (called the experimental hypothesis when the method of investigation is an experiment). (Academy, 2022; "Research Hypothesis," 2022; "Research Process Steps," 2022)

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**Step 4: The Research Design:** Research design is the framework of research methods and techniques chosen by a researcher to conduct a study. It is the plan for achieving objectives and answering research questions. Its goal is to design research to test hypotheses, address the research questions, and provide decision-making insights. The research design aims to minimize the time, money, and effort required to acquire meaningful evidence. This plan fits into four categories: (“Research Process Steps,” 2022)

- a. Exploration and Surveys
- b. Sampling
- c. Data Analysis
- d. Observation

**Step 5: Describe Population or Sampling:** As per the research area or topic, researcher has to prepare planning for sampling or know the population required for the study. Researcher find out the certain groups of people in the community to target a specific age group, males or females, geographical location or an ethnic groups according the study and finalized require sample size, select randomly or cover all the participants to collect data. To contact the sample participants via post (mail), email, telephone, or in person has to be decided.

**Step 6: Data Collection:** Data collection is essential to get the answer of the research issues mentioned in the study. Investigator collects the data from the literature and by the people or participants who give the feedback or answered. Data must be collected from the two categories of researchers eg. Primary data collection and Secondary data collection. Surveys allow collecting data about opinions, behaviors, experiences, and characteristics by asking people directly. There are main survey methods to choose from: questionnaires, interviews and observation Experimental, Schedules, .(McCombes, 2021; “Research Process Steps,” 2022)

With the help of the ICT, data collection activity can be performe through online, web based or internet activity or by survey. ICT through internet technology and web based software can reduce the time and cost of the researcher to collect the response from the participants. The data collected through ICT can also be used directly the original data into statistical software for data analysis. (“Application of ICT in Research, Role and Tools of ICT | Scholarify.In,” 2019)

ICT tools are available on internet through witch researcher can gat/collect and store relevant data which are:

1. questionnaire : Google Forms, Survry Monkey, KwikSurveys, LimeSurvey, PollDaddy, Responster (for Mobile), Alchemer, JD Esurvey, Quick Survey, TellForm, Typeform, Jotform, SoGoSurvey, SurveyPlanet, Zoho Survey, Crowdsignal.
2. Referencing tools ; Endnote, Zotero, Mendely etc.
3. Data designing tools,
4. MS-office tools : Word, Excel and Powerpoint
5. Database tools : MS access, SPSS
6. Data storage tools: Ms Sql, My Sql etc.
7. Search Engines and websites on Internet: Google Scholars, Google, Yahoo, Microsoft academic Search, SSRN, NDTL, NDL etc.
8. E-resources: Archives.org, Academia.edu, ResearchGate, DOAR, NROER, Open Library, Manybooks, Getfree books etc.

Secondary data like Literature survey, Official and unofficial reports, library resources also helps to collect the data.

**Step 7: Data Analysis:** Data analysis is very important to archives aim and objectives of the research. In data analysis required editing and coding-decoding of data. Data analysis methods vary

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between secondary and primary studies, as well as, between qualitative data analysis and quantitative data analysis.

**Quantitative data analysis:** analyze the data which collected from various sources mainly available in number forms, using SPSS software we can performs various analysis and test result like Statistical test T-test & Z-Test, MANOVA ( Multivariate analysis of variance), Chi-Square Test, Data Mining (Apriori algorithm, Market Basket Analysis). For Numerical Analysis report we can get - Number and String variables form SPSS, Square root and other inbuilt string and numerical functions, MAX, MIN, AVERAGE, SUM, COUNT, TOTAL, SUB-TOTAL etc.

There are various Statistical tools available through we can get various analysis and staticals report the ICT tools are : SPSS (Social Science Package for Social Science), R (R Foundation for Statistical Computing, MATLAB (for Mathworks), Ms-Excel, SAS (Statistical Analysis Software), Graph Pad Prism, Minitab etc.(Sonar, 2020)

**Qualitative data analysis:** Researcher may analyze the data collects using various methodds Contents text, image, video, audio etc (excluding numerical data) are analyzed with help of various ICT tools like Nvivo, SPSS Text Analysis, ATLAS.ti, MAQDA, transana etc.

**Step 8: The Report-writing:** After completing the all the stage with data collection, analyzing, and final findings, researcher carefully write the report with proper layout contains cover page, title page, acknowledge, preface, declaration, List of tables, graphs, charts, table of contents, Introduction states that the purpose and methods, scope and limitations of the research, main research report divided into various chapters, summary and findings includes recommendation, bibliography further suggestion should be included.

MS-word is used for writing research documentation as for research proposal to thesis. The documentation is created using MS-word with writing, formatting, updating, delete, and modifications, referencing etc are very useful.

MS-excel is also used for designing tabular/Matrix form documents and numerical calculation of the tabular data and draw the graphs of the related data or tabular data as for supporting research documents. (Sonar, 2020)

**Step 9: Plagiarism Dictation:** Final summation of the research report in the University or Institution or publication of the article in the journals, requires undergoing to plagiarism check with various online tools. It's give similarity report which show researcher has properly motioned citation or credits to its original works used in the report. The some online ICT tools like Urkund (now Ouriginal), Turnitin, Duplichecker, SEO tools, Grammerly etc. are very useful for checking.

**Step 10: Publication of research paper:** Researcher need to publish his report in journals required to know the various data set, norms, citation style like MLA, APA, IEEE etc to published in the peticulaer publishers, each and every publisher has its on norms and style, researcher has to submit manuscript accordingly which more acceptable format if now follow the norms the manuscript rejected. ICT tools will help to know the various data set and norms of various publishers. Researcher can find out which journals are appropriate can easily compare relevant journals to find the best place for publication through online services available which are ; SHERPA - RoMEO online resource to check publisher copyright and self archiving policies, Springer Journal Suggester, Elsevier®JournalFinder, Journal finder Wiley, AUTHOR SERVICES Supporting Taylor & Francis authors etc.

**Conclusion:**

Information and communication technology (ICT) is paying a very important role in education and research. Help of ICT information is available on finger tips via internet; telecommunication technology is essential and need of the 21st century to progress and development of the people and nations at every corner of the life. ICT is plays very prominent role

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in whole research process, Pre-research, post-research, report writing, citation, data management, data modification, plagiarism check, literature search, literature review, publication and so on. ICT is time saver, accuracy maintainer, making things simple with speed to complete the research process, enhances the quality and of research work. It helps to increase knowledge contribution and helps to enhancing the scope of accessibility of research data which is boon for the research community.

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