Al-Kitab Journal for Pure Sciences (2023); 7(1):11-26.

https://doi.org/10.32441/kjps.07.01.p2

Al-Kitab Journal for Pure Sciences
ISSN: 2617-1260 (print), 2617-8141(online)
www.kjps.isnra.org

# The Seven Sources of Information Technology and Its Role in The Development of Scientific Research

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**Citation**: Borghosh RM. The Seven Sources of Information Technology and Its Role in the Development of Scientific Research. Al-Kitab J. Pure Sci. 2023;7(1):11-26. DOI: https://doi.org/10.32441/kjps.07.01.p2.



**Keyword:** I.T. Sources - ICT - Scientific Research

**Article History**

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|---|---|
| Received | 10 Apr. 2023 |
| Accepted | 05 Jun. 2023 |
| Available online | 20 Jun. 2023 |

## Abstract:

With the rapid technological development in various walks of life, Information Technology (IT) resources play an exceptional and critical role in the advancement of the field of scientific research, as data sources and electronic content E-Data & E-Content transfer scientific and research resources in a digital (electronic) format to achieve communication and understanding. Among the researchers, the sources of the containers of storing electronic content in its various capacities and forms are indispensable for any researcher to save the research material in the short or long term, while the sources of software from operating systems, software and various applications play an essential role to help the researcher to collect the research material and see the continuous updates in the field of his research and facilitate his work whether before or during the writing of the study or even after writing the research and publishing and tracking its impact, and these facilities provided to the researcher are more evident in the resources of electronics Microelectronics, which are represented by the size of the memory RAM & ROM and also CPU, and the researcher can only do the above through the sources of computers Computer H.W. of various sizes and types, network sources and communication technology (CT) systems, and all of the above sources of information technology are transmitted between

users of End Users Information systems specialists, which represent the seventh source of information technology, namely the sources of specialized human resources for the system.

**Keywords:** IT Sources - ICT - Scientific Research.

# المصادر السبعة لتكنولوجيا المعلومات ودورها في تطوير البحث العلمي

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**الخلاصة:** مع التطور التكنولوجي السريع في مختلف مناحي الحياة، تلعب موارد تكنولوجيا المعلومات دوراً استثنائياً ورئيسياً في النهوض بمجال البحث العلمي، حيث تقوم مصادر البيانات والمحتوى الإلكتروني بنقل البيانات الإلكترونية والمحتوى الإلكتروني إلى الموارد العلمية والبحثية بصيغة رقمية لتحقيق التواصل والتفاهم بين الباحثين، كذلك مصادر أوعية تخزين المحتوى الإلكتروني بسعاته وأشكاله المختلفة لا غنى عنها لأي باحث لحفظ المادة البحثية على المدى القصير أو البعيد، بينما تلعب مصادر البرمجيات من أنظمة تشغيل وبرمجيات وتطبيقات مختلفة دوراً أساسياً لمساعدة الباحث على جمع المادة البحثية والاطلاع على التحديثات المستمرة في مجال بحثه وتسهيل عمله سواء قبل أو أثناء كتابة البحث أو حتى بعد كتابة البحث ونشره وتتبع أثره وتأثيره، وهذه التسهيلات المقدمة للباحث تكون أكثر وضوحاً في موارد الإلكترونيات الدقيقة والتي تتمثل بحجم ذاكرة الوصول العشوائي وذاكرة القراءة، وأيضا وحدة المعالجة المركزية، ولا يمكن للباحث القيام بما سبق إلا من خلال مصادر أجهزة الكمبيوتر بمختلف أحجامها وأنواعها، ومصادر الشبكات وأنظمة تكنولوجيا الاتصالات وجميع مصادر تكنولوجيا المعلومات المذكورة أعلاه تنتقل بين المستخدمين النهائيين المتخصصين في نظم المعلومات، وهي مصادر الموارد البشرية المتخصصة للنظام.

**الكلمات المفتاحية:** مصادر تكنولوجيا المعلومات، تكنولوجيا الاتصالات والمعلومات، البحث العلمي.

## 1. Introduction:

Information technology sources are the central pillar of the development and upgrading of scientific research at the moment, given the rapid developments in the world during the past few years in these sources, which serve all fields, including the field of scientific research, in the past the researcher suffered a lot to collect information in the field of his research and is forced to move between remote areas and sometimes between countries to find out the latest developments of scientific research, but now within minutes in front of his electronic device can access the finest Universities and access to the latest research, and even the participation of other researchers, which works to improve the level and efficiency of scientific research.

Data &E-Content have provided huge digital libraries accessible to researchers, and a study conducted on graduate students by Hadagali et al. [1] has confirmed that the information contained in electronic resources is better than the content printed in MKTP versions and that most researchers have access to electronic resources to search library information. The study by Thabet Hassan and Omar Tawfik [2] also indicated that information technologies play an important role and influence in enhancing the efficiency and productivity of scientific research despite the obstacles that crown its employment.

Information and Communications Technology ICT participates actively in many aspects of the research process because of its facilities and benefits, which improve the quality of academic research output. Nakhai et al. [3] listed some of these benefits, including reaching universality and achieving more references and quotations, saving time by searching, collecting, and analyzing information quickly using various techniques, such as the technology of information tools, and achieving more references and quotations. Using a computer speeds up the different stages of research, ensures the accuracy of even minute details, and prevents the information from remaining hidden. It also protects researchers from common human errors and improves the accuracy of research work and discipline through Structure, classification, and other methods. Enhancing motivation, one of the attractions and features of the computer and the Internet, are some of the tools, planning programs, archive features, and time management in arranging activities and observations and carrying out different stages of productive study. It is efficient in raising researcher motivation and lowering research fatigue, teamwork, and the availability of communication facilities and the chance to use networks in this technology, as well as the configuration of the right conditions for large-scale and collective organizational and research activities, durability, and scientific sobriety, and provided by this technology to store results, ease of maintenance, decreased volume of information and increased rob. Using multimedia in research based on textual material and information technology improves the effectiveness and appeal of the study. With the possibilities of information and communication technology and the Internet, researchers can publish their work more simply and quickly than ever before, and anyone may access and utilize it for free. This feature can increase the motivation and efforts of students and newcomers to scientific research and make their studies permanent. They can publish each piece of their study internationally and in endless editions freedom from space and time to conduct research and gather information; a variety of resources can be carried easily in the form of a CD or

other storage device for electronic content, reducing the researcher's interest in the specific time and location and making it possible for them to conduct research in areas where ICT is available. We can say that without this technology, it would be nearly impossible to prepare comparative studies, various technical lists, statistical graphs, virtual experiments, basic searches, and modernization, where the use of information technology makes the research current and in line with the most recent information and scientific findings and allows the researcher to access the most recent theories and findings at any time.

In the following paragraphs, we discuss the involvement of the seven ICT sources (**Figure 1**) in the growth of scientific research by elaborating on each source individually.

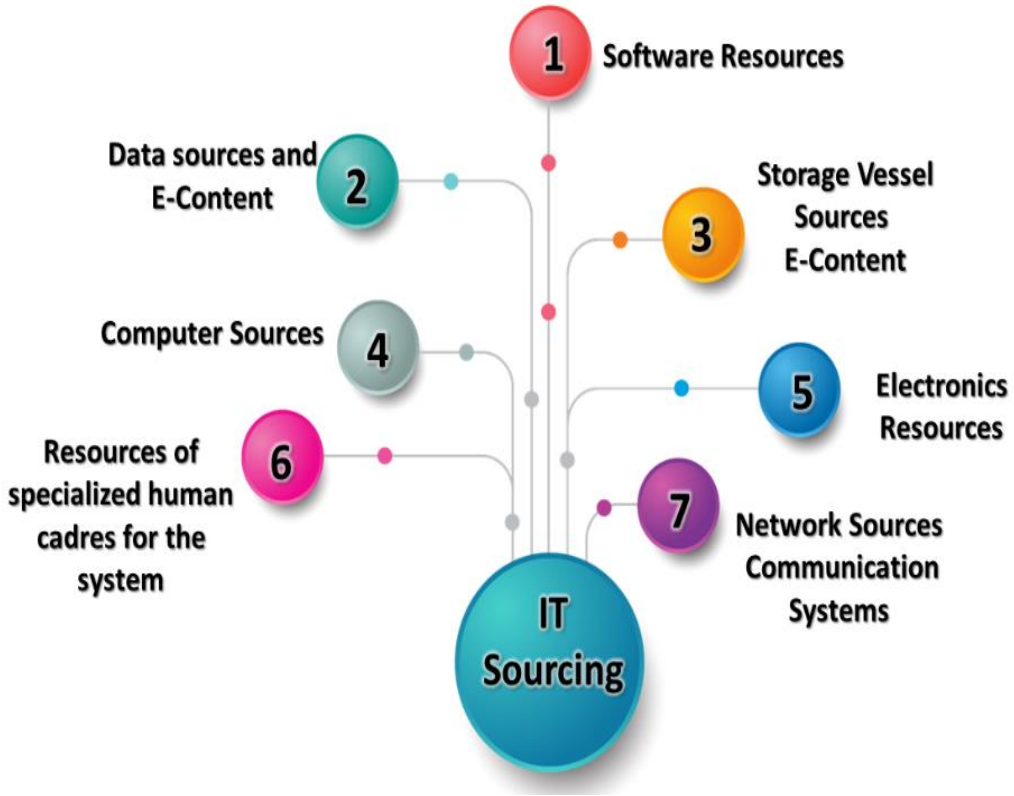


**Figure -1 The Seven IT Sources (prepared by the researcher)**

## 1.1 The Role of Data Sources and Electronic Content In The Development Of Scientific Research

E-data is facts that are displayed in many forms, which may be words, numbers, images, symbols, graphics, sounds, signals, visual clips, or animations, which are transmitted in the form of electronic digital symbols to achieve their purpose and to communicate these forms with the same quality, the same shape, and the same quantity.

According to the Annie study [4] findings, there is a strong correlation and a positive impact between faculty members' productivity and the use of electronic resources, especially at the level of international publishing. As a result, it is essential to upgrade digital content for scientific research in general and digital Arabic content. As previously mentioned, [5] there are several ways to do this.

1- Translation: Obliging specialists in scientific research to obtain a degree in translation is an essential qualification to join the field of scientific research.

2- The quality of research products available in digital content: the need to adopt the citation of elaborate and reliable digital content, cooperation between researchers in the same institution and international external institutions, diversity and overlap of the field, and the involvement of young researchers with expert researchers.

3- Access mechanisms: Securing access to digital content from classification, indexing, and easy access to digital content, saving time, effort, and money for researchers.

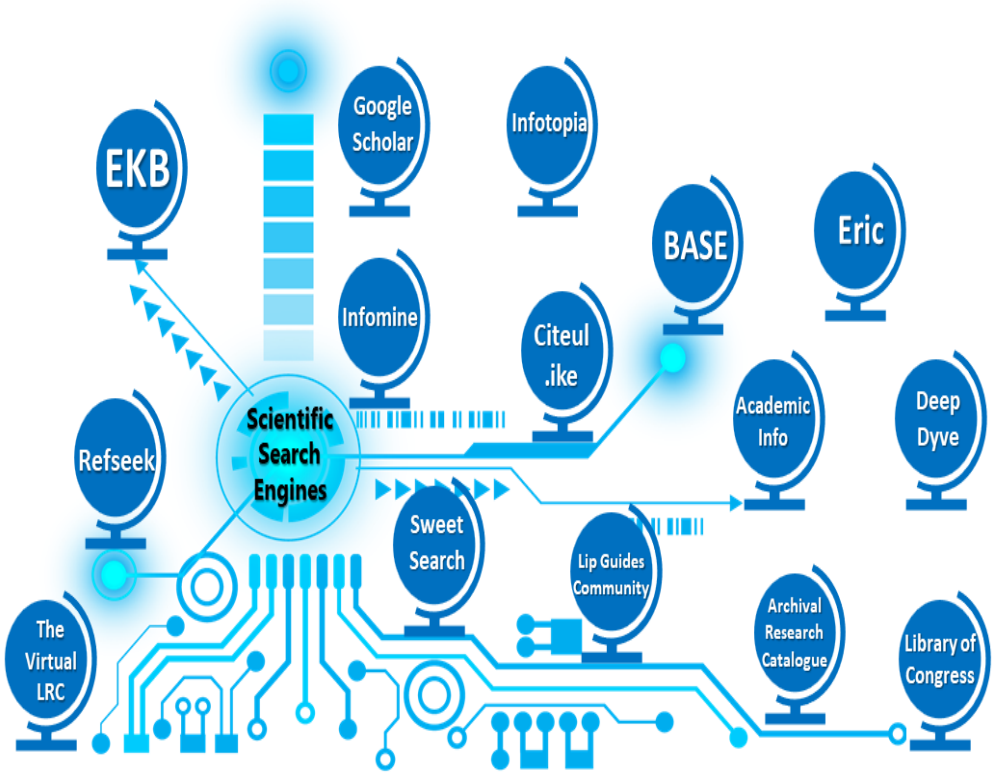


**Figure -2 Some academic scientific search engines (prepared by the researcher)**

There are many search engines (**Figure 2**) that carry within them a prolific digital content of the researcher considered specialized academic research sources as mentioned by Maoush Abdel Hamid and Makhloufi [6], the most important of which are:

1- *Lib Guides Community:* It is a site that offers the service of searching and exploring over 318968 research supervised by more than 53,731 librarians in 3,856 libraries worldwide "https://community.libguides.com".

2- *Academic Info***:** It provides the links and resources most relevant to the research topic in your field of specialization through a list of search results that are printed references or electronic sources. "http://www.academicinfo.net/subject-guides".

3- *Archival Research Catalogue* :It is the official signature of the National Archives and Documents Administration of the United States of America. It also provides research into documents that this institution preserves and documents and searches of references provided by some U.S. presidential libraries. "https://www.archives.gov/research/catalog".

4- *BASE***:** It is one of the world's most significant open electronic scientific resource search engines, and it is run by the German Bielefeld University Library."https://www.base-search.net/".

5- *CiteuLike***:** A free service for managing and discovering scientific references, offering approximately 7 million scientific materials and academic research. "https://citeulike.date/".

6- *Eric***:** It is a digital library of educational research supported by the Institute of Educational Sciences (IES) at the U.S. Department of Education. It offers simple access to academic resources and supports their use in enhancing instruction and instructional practices, guiding educational decisions, and disseminating research. "https://eric.ed.gov/".

7- *Infomine***:** A digital repository for university-related information about staff, students, and researchers. It includes crucial resources including databases, electronic magazines, electronic books, message boards, mailing lists, articles, researcher's aids, and other kinds of data."www.infomine.com".

8- *Infotopia***:** A search engine that provides information and archiving of the sites and topics of art, history, social sciences, and societal issues and problems."https://www.infotopia.info/".

9- *Google Scholar***:** sources, articles, dissertations, books, abstracts, and peer-reviewed views from academic publishers, professional associations, online repositories, universities, and other websites for in-depth study of the scientific content across many fields. It helps you collect scientific research work relevant to your topic worldwide, with a monthly visitor of more than 50 million. "https://scholar.google.com/".

10- *Library of Congress :*The Library of Congress provides you with a search service on primary sources of documents, including photographs, maps, manuscripts, and historical newspapers "https://www.loc.gov /".

11- *Refseek*: a search engine with over a billion items, including web pages, books, encyclopedias, periodicals, and newspapers, that is designed for students and scholars. "https://www.refseek.com/".

12- *The Virtual LRC*: Hundreds of the top academic information sites have been indexed to give students and instructors accurate information for academic assignments. Teachers and library experts chose these sites from across the world. "https://www.virtuallrc.com/".

13- *Sweet Search*: A website that assists students in gathering information fast, selecting the most pertinent discoveries from a list of reliable sources, and facilitating the discovery of primary sources away from unwelcome and unimportant sites lacking in academic quality. "https://www.sweetsearch.com/".

14- *Deep Dyve*: A site that allows you to search thousands of leading scientific journals such as Springer and Elsevier. Nature, IEEE, Wiley-Blackwell. "https://www.deepdyve.com/".

In addition to the Egyptian Knowledge Bank (EKB), the Egyptian Knowledge Bank is the most extensive digital library in the world "https://int.ekb.eg/" which grants unlimited resources to all Egyptians and is one of the national projects within the plan for the development of education in Egypt, where it aims to make available a vast and diverse amount of research and knowledge sources to the Egyptian citizen for free, and the website of the Egyptian Knowledge Bank contains four portals to include the student portal, The Knowledge Bank aims to raise the level of knowledge of the Egyptian people by providing a vast and diverse amount of audio, visual and read knowledge sources and is characterized by ease of use and availability at the level of the Arab Republic of Egypt in general and without conditions, in addition to many search engines that have recently appeared, including:

1- *Research Gate*: The Research Portal, a social network website and free collaboration tool aimed at scientific researchers from all disciplines of science, provides web applications including semantic research, file sharing, sharing of the Baya Nat database, forums, methodological discussions, groups, and subscribers can also create their blog in the network. "https://www.researchgate.net/".
2- *MICROSOFT ACADEMIC*: The academic search engine is Microsoft, which searches over 80 million scientific papers in all fields. "https://academic.microsoft.com/".
3- *ISEEK Education*: A scientific search engine that searches hundreds of thousands of reliable sources from universities, scientific institutions, and scientific research. "http://education.iseek.com/#/education".

4- *Science Direct*: It is a research news site and a powerful search engine, with search results reaching more than 10,000 research papers and 25,000 scientific books. "https://www.sciencedirect.com/".
5- *Internet Public Library IPL*: An extensive library with many sources compiled over 20 years."https://www.ipl.org/".
6- *Archive Hub*: It is a British institution that can be researched, as it is an absolute wealth of information for researchers. "https://archiveshub.jisc.ac.uk/".
7- *Academia.Edu*: It allows its users to create profiles, upload their work, and identify their areas of interest, and it has just over 99 million users. It enables researchers to share, monitor, and measure scientific research and outputs using particular academic metrics and allows users to follow scientists or research in specific fields. "https://www.academia.edu/".

## 1.2 The Role of The Sources of Electronic Content Storage Vessels In The Development Of Scientific Research

The researcher must periodically save his scientific product, and this preservation is through storage vessels; due to the rapid development in the field of information technology, these vessels have become digital most often due to their speed of preservation, ease of retrieval, and small size, where information is retrieved from them by computer or by devices dedicated to it, and their storage area is measured in different units of measurement starting with bits, which are the smallest standard unit, passing through bytes, kilobytes, and megabytes Bytes, gigabytes, which are considered the most common, then terabytes, beta-bytes, exabytes, zettabytes, and utasbits.

In addition to many forms of digital storage vessels that have emerged recently due to the urgent need to use them in the storage of digital data and information, which has benefited researchers and those working in the field of scientific research, which has helped the development of this field, increasing its efficiency and accelerating the pace of development and advancement, such as USB storage units or flash memory, which are the latest current technological inventions in the field of saving data or transferring it from one device to another, and are characterized by being small in size easy to use and readable Easily on computers and do not need other programs or devices to deal with them, but their disadvantage is the small storage capacity in them, also memory cards, which are the most common and used storage units in our time, and are represented in memory cards used to increase the storage space of

phone or tablet devices, and are characterized by their very small size, and perhaps the most prominent types of them are SD, MMC Despite its multiple advantages, it is easily susceptible to damage with wrong use, These vessels have evolved over the ages and times as reported by the Encyclopedia website [7] until they have taken different forms (**Figure 3**).

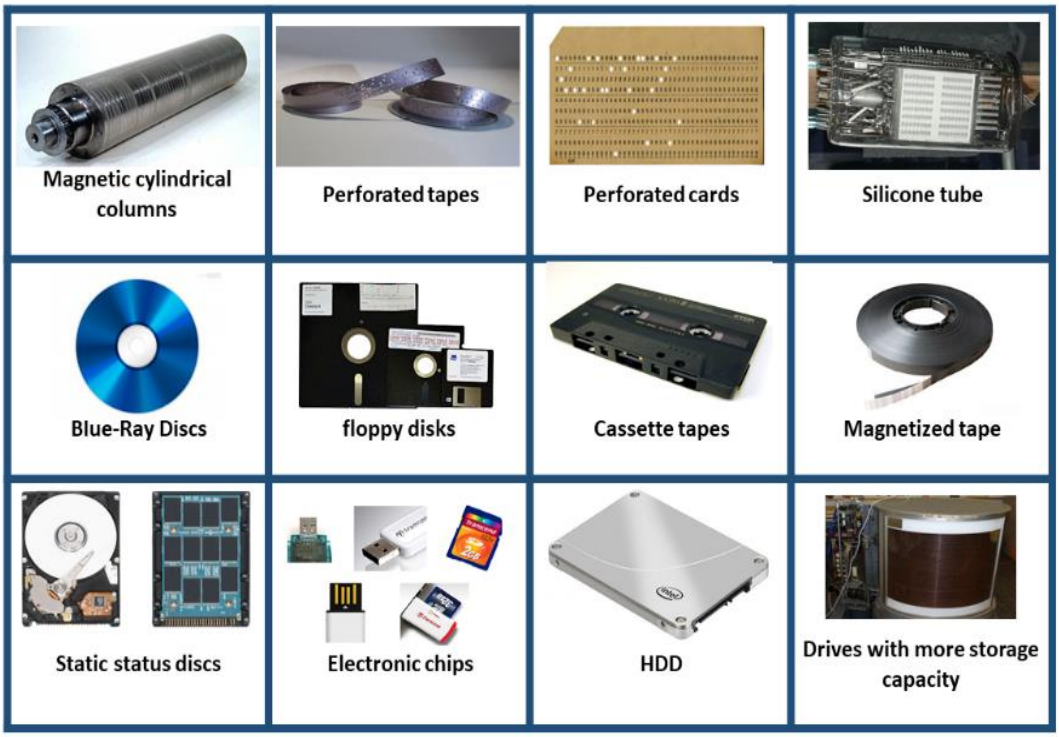


**Figure -3 The evolution of electronic content storage vessels (prepared by the researcher)**

## 1.3 The Role of Software Resources in The Development of Scientific Research

Software Resources are one of the most important sources of information and communication technology ICT used by researchers and scientific research workers, with all its operating systems System Software OS, Application Software, which is the most used part, and methods and methods of individuals using information systems, where these systems and software work by entering data Then process this data and then output the information products through the processes of adjustments and control of the performance of the system. Control of System Performance

Many applications and programs are indispensable for any researcher during his research career and appoint him in it, and where these programs play a great role, such as translation from any language into any language, converting illustrated papers into electronic files in multiple formats, recording and saving references, classifying and citing them within the research in several ways, converting sound into writing, which facilitates the researcher

physical effort and time, spelling review and language correction, statistical analysis of data, and many others mention some of these programs and applications:

1- *Producteev*: Organizes the researcher's time and prevents him from being distracted, by allowing the researcher to create a list of tasks he wants to do in his scientific research and ironing out the timelines.

2- *Libgen:* Allows free of charge many research papers, scientific research, master's and doctoral theses, sources, and references that the researcher needs for his research career, and the applications characterized by the speed of extracting the research that the student is looking for, which saves effort and time on it.

3- *Mendeley:* It collects all the research that the researcher wants to rent to while writing, the place of research within the reference, and access to the paragraphs that benefit the student in his scientific research, and enables him to take notes, which more than three million researchers will serve.

4- *Zotero*: This application organizes and manages scientific research according to the way the researcher wants, as it gives him many options, such as arranging them according to the name of the reference, the date of the pub, cation, or the publisher, and is characterized by its ability to read e-books.

5- *Grammarly*: corrects spelling and linguistic errors in research written in English and makes several suggestions for correction.

6- *World Cat*: The library database, which contains more than 74,000 libraries from 170 countries, thus allows a researcher to benefit from the global service while writing for research.

7- *Endnote*: A program to manage references and research sources and organize the references he used in his scientific research enables you to create a library for the researcher that includes the research he wants and arranges them according to the way the researcher wants.

8- *Paperrater*: This is a custom for evaluating the search, where it analyzes the research and then determines the percentage of citations contained in several sources quoted from it.

9- *Prezi*: This application allows the researcher to make presentations of his scientific research and is characterized by its ability to apply mind maps quickly, and add an unlimited number of images, text, and video.

10- *Microsoft translator*: has more than 70 languages, provides pronunciation with control of pronunciation speed, and provides translation service by entering text in writing, voice, or image.

11- *Cited*: Provides writing the master data of the reference to be documented, with the possibility of choosing the type of d augmentation, copying the documentation, and using it in the list of references.

12- *Assembly*: Design scientific posters, infographics, and logo designs, providing many formats to save work.

13- *Forms App*: The researcher can create forms (questionnaires – tests), share forms to get responses, provide illustrations of responses, and export response data as a file.

14- *Text scanner* converts Image texts into copied written text and supports 55 languages, including Arabic.

15- *Dict Plus*: It is characterized by providing ready-made and classified lessons, changing the dialect of the English language (British, American, Australian, and others), the possibility of translation in multiple ways (text, audio, image), and the availability of some services offline.

16- *Mappy*: Creates unlimited mind maps, adds images and emojis to the map, controls color selection, and supports Arabic.

17- *Office Suite & PDF editor*: This is comprehensive for all Microsoft Office applications (Word, PowerPoint, Excel), performs advanced PDF options, scans paper documents, converts them to digital using the camera, and provides support for cloud storage.

18- *AirDroid*: Sending different types of files between iPhone, Android, and Windows devices, and does not need an Internet connection.

19- *Recuva*: A PA program to recover deleted files from a computer.

20- *PDF converter*: A program to convert text file formats.

21- *Light shot*: A program to make a screenshot and save it as an image.

22- *Microsoft Word*: This is one of the essential programs that are relied on in the processing of various types of text, and it is a program commonly used among researchers in writing and coordinating research of various kinds because of the tools that the program contains to make the task of the researcher easier in doing the writing and formatting of texts adjust the margins and direction of the paper, paper measurement, printing options and more.

### 1.4 The Role of Microelectronics Sources in The Development of Scientific Research

Microelectronics **[8]** The goal of understanding them is to develop a comprehensive picture of the micro-level processes that occur in electronic devices, to assimilate the principles of controlling the flow of charge carriers in electronic devices, to gain knowledge about the physical processes involved in the operation of quasi-catalyst devices, to hone one's computational modeling abilities, and to develop one's critical thinking abilities. Study the characteristics of contemporary microelectronics' practical applications within the context of professional endeavors, as understanding the operation of modern computers is crucial for

researchers and other personnel engaged in scientific study; it comprises microelectronics from integrated circuits, memory, and central processing units, and is required to enhance scientific research and train future IT workers. Three ways and methods for gaining access to data and information kept in the computer's memory **[9]** will be discussed:

1- *Sequential Access*: The data is in the form of balanced units as a third, where the transition to a particular unit must pass all units between the current reading place and the required unit. Hence we note that the necessary time may reach minutes, for example, the recording bar.

2- *Direct Access*: This method divides memory into units that can be moved between them quickly without entering their contents, so the arrival time consists of two elements, namely the time of transition from one unit to another, which is relatively rendering, and the time of successive search within the unit, and the time of access reaches a fraction of a second, for example, the s stacking of steel and the s of integrated stacking.

3- *Random Access*: In this type of memory, each site has an address, the time it takes to read is equal and does not depend on the current location, and the access speed reaches nanoseconds. This method uses both the main memory RAM, permanent memory in both parts of read-only ROM, read-only and programmable PROM, and Cache Memory as follows:

- *RAM***:** Fixed RAM SRAM **&** DRAM animated RAM with three types: Simultaneous Mobile RAM SDRAM, Concurrent Moving RAM with Double Speed DDR-S DRAM, and Animated RAM R DRAM.

- *Cache Memory***:** In general, DRAM memory is slow compared to the speed of the CPU, so the computer developers used a memory called cache or SRAM cache, which is placed between the central processor and the main memory, where they are all connected by the main bus (**Figure 4**).

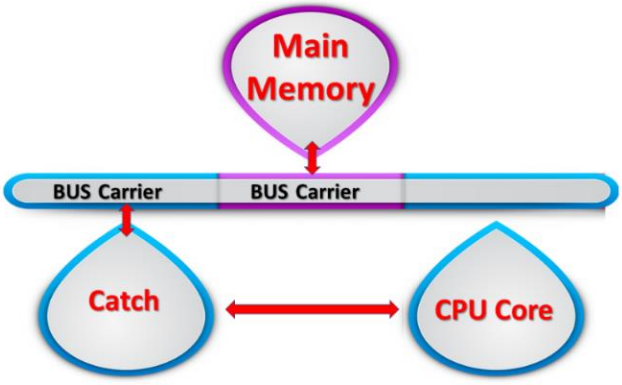


**Figure 4: Cache Memory (prepared by the researcher)**

- *Permanent ROM memory:* It is read-only, where the information is entered when manufacturing, and the information is not lost when the power is outraged.

- *Programmable ROM PROM*: Non-volatile information enters it during programming once. It is not a requirement in the manufacturing phase so it can be programmed by the user only once and then used for read-only.

## 1.5 The Role of Computer Resources in The Development of Scientific Research

Computer Hardware sources include computer systems and computer accessories. Every researcher who wants to use information technology in his academic career must get acquainted with the essential computer components so that he is aware of and understands what is happening inside this device and thus explain the technical problems that can be faced and overcome, the hardware of the computer system includes the motherboard Mother Board, GPU, CPU, PSU power supply, hard drive, and RAM (**Figure. 5**), Even though a computer can only function when its hardware and software cooperate, the speed of the system will largely depend on the hardware of the device, which helps the researcher to advance more quickly, saving time and effort, and improving scientific output. The following list summarizes the computer's most crucial hardware: CPU (Central Processing/Processor Unit), Random Access Memory (RAM), Hard Drive, Graphics Processing Unit (GPU**),** and Power Supply Unit (PSU).

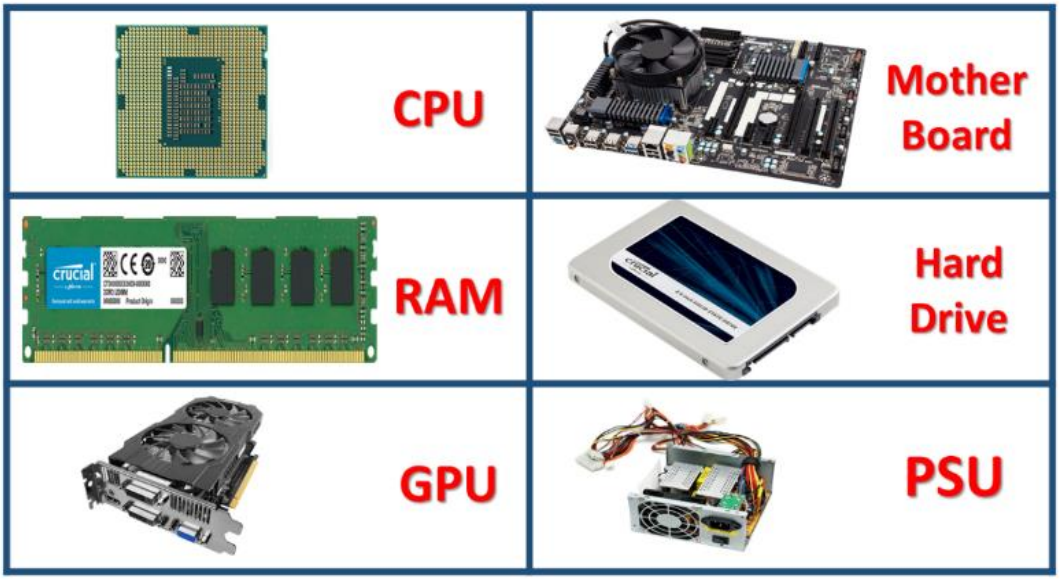


**Figure -5 Computer Hardware (prepared by the researcher)**

The motherboard serves as the computer's brain, controlling power when required, communication, and coordination between all other components of the computer, making it one of the most crucial parts of the devices in the computer. Therefore, it is critical to consider the ports of devices the motherboard provides when choosing a motherboard, even though it is only one component of the circuit. (USB 2.0, 3.0 and 3.1), The ports on the motherboard will also

assist you in determining whether additional devices will be compatible with the computer, in addition to the display ports utilized (HDMI, DVI, and RGB) and the number of ports per display port. Your computer's RAM **[10]** and graphics card type that you can utilize to meet your needs for specialized scientific study and your requirements.

### 1.6 The Role of Network Sources and Communication Systems in The Development Of Scientific Research

There are several types of computer networks, which the researcher must know to preserve his personal, research, and scientific information, primarily if he works within an institutional framework and computers own that institution. Still, he must warn of scientific thefts, especially if his specialization is accurate and rare.

Networks, which are the foundation of modern business and are used for everything from accessing the Internet to printing documents to downloading MLVs from emails, can refer to a small group of devices in a single room or millions of devices dispersed around the globe, depending on their purpose or size. Here, we review 11 different types of networks **[11]**: Personal Area Network (PAN), Local Area Network (LAN), Wireless Local Area Network (WLAN), Campus Area Network (CAN), Metropolitan Area Network (MAN), Wide Area Network (WAN), Storage-Area Network (SAN), The term is new, Passive Optical Local Area Network (POLAN), Enterprise Private Network (EPN), Virtual Private Network (VPN).

### 1.7 The Role of The Sources of Specialized Human Cadres of The System In The Development Of Scientific Research

ICT has helped researchers in many academic aspects during the different stages of writing scientific research and, finally, by publishing it and tracking its impact, and impact but has helped in identifying researchers and maintaining their scientific and academic identity, biography, and academic scientific output of each researcher through several sites and systems that each researcher must have an identity and record of his research output on these sites, it serves as a statistical record for researchers from all over the world, to get to know each other, and to see the scientific output of each other. Among them, but also for scientific communication between researchers, and between researchers and scientific and academic institutions, to produce joint research, and use the required expertise from all parts of the world, thus opening the horizon for researchers and academics to know and exchange experiences, but also the material benefit and material funding of research by the institutions concerned, and these sites include: ORCID "https://orcid.org/", Research Gate

"https://www.researchgate.net/", Google Scholar "https://scholar.google.com/", Publons "https://publons.com/about/home/", Scopus "https://www.scopus.com/", Academia "https://www.academia.edu/", Research rid "http://www.researcherid.com/", Arid "https://portal.arid.my/ar-LY/Account/Login", Slide Share "https://www.slideshare.net/", Mendeley "https://www.mendeley.com/newsfeed", Live DNA "https://livedna.net/form.php", Sc Profiles "https://sciprofiles.com/", Kudos "https://info.growkudos.com/", LinkedIn "https://www.linkedin.com/".

## 2. Conclusion:

Through this systematic presentation of the seven sources of information technology and its role in the development of scientific research, we recommend increasing the technological awareness of those affiliated with graduate studies and scientific research to increase the technological skills of this category and employ artificial intelligence tools and technological applications with the best use, taking into account the ethics of scientific research to accelerate the pace of academic development of scientific research, which will reflect positively on scientific development in all fields.

## 3. References


**[1]** Hadagali GS, Kumbar BD, Nelogal SB, Bachalapur MM. Use of electronic resources by graduate students at various Karnataka State universities. Int J Publ Inf Technol. 2012;2(3):189-95.

**[2]** Thabet TH, Rahman OTA. The role of information technologies in enhancing the efficiency of scientific research. 2020. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3547701.

**[3]** Nakhai A, Hashemi SAB, Ghafouri M. The feasibility of ICTs for better research. IJCSNS Int J Comput Sci Netw Secur. 2016;16(10):93-7.

**[4]** Annie OE. The accessibility and use of electronic information resources for research purposes and their impact on the productivity of faculty at selected Nigerian universities between 2005 and 2012. University of South Africa; 2013.

**[5]** Shaqour AZ. Promote Arabic digital content for scientific research for sustainable development. Arab Forum for Scientific Research and Sustainable Development, Beirut; 2015 Dec. https://www.researchgate.net/publication/286929130_tzyz_almhtwy_alrqmy_alrby_llbhth_allmy_mn_ajl_tnmyt_mstdamt.

**[6]** Hamid MA, Ali M. The development of information technology and the digitization of scientific research Scholar (Google Scholar), features, and uses. J Humanit Commun Sci. 2019;5(July 2019):52-72.

**[7]** Al Azizi H. Types of storage media and preservation of information and data. The site of the innovative encyclopedia; 2015 Sep 2. http://innoopedia.blogspot.com/2015/09/SSDVSHDD.html

**[8]** Semenikhina O, Drushlyak M, Lynnyk S, Kharchenko I, Kyryliuk H, Honcharenko O. About computer support for the "Fundamentals of Microelectronics" course by specialized software: the results of the pedagogical experience. TEM Mag. 2020;9(1):309-16.

**[9]** Science for everyone. Types of memory in the computer. Electronics for everyone; 2019 Jul 7. https://www.electronics212.com/2019/07/computer-memory-classifications.html

**[10]** Micron Technology. Crucial by Micron. 2017. https://www.crucial.com/articles/pc-builders/what-is-computer-hardware.

**[11]** Bourgeois S. Explained 11 types of networks: VPN, LAN, and more. Bilden; 2016 Jun 10. https://www.belden.com/blogs/network-types.