ICT IN LIBRARY AND INFORMATION SCIENCE

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ICT in Library
and
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CONTENT

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1. An Introduction to Smart Antenna for Wireless Power Transfer Technology & Cellular Phone Systems

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Abstract:

This chapter presents about the wireless structures which are simply an important part of modern-day society and are becoming extra as we flow towards the data society, call forget entry to greater information, more right away and in greater places. Concurrently, technological traits are making new applications viable, organizing up new markets, and promising huge monetary blessings. In all times, spectrum is an essential aid which notwithstanding the reality that reusable, can't be created to fulfill name for. It's miles therefore, increasingly crucial to enhance the performance with which use is fabricated from the spectrum. A novel method to recognize a smart antenna has been offered. The characteristics of smart antenna have additionally been defined. The performance of the simulated smart antenna has been studied. Smart antenna era provides range extension, expanded facts fee, higher network ability and better carrier exceptional.

Keywords: Smart antenna, cellular phone, Wireless power transfer & Spectrum.

1.1 Introduction:

In wireless power transfer, an idea at the start conceived by Nikola tesla in 1890s, energy is transmitted from a power source to a destination over the wireless medium. The usage of Wi-Fi energy switch can avoid the costly technique of planning and putting in energy cables in buildings and infrastructure. One of the challenges for imposing wireless power transfer is its low power transfer efficiency, as simplest a small fraction of the emitted energy can be harvested at the receiver due to intense course loss and the low efficiency of radio frequency (RF) - direct current (dc) conversion. Further, early digital gadgets, including first technology cell phones, had been cumbersome and suffered from excessive energy intake. [6]. The extensive kind of remote sensors utilized in its programs (loops, probe motors, radar, cameras, and so on.) is not as correct as a stationary analyzer transportation system [1]. Broadband wireless systems play an increasing number of crucial role in Intelligent Transportation Systems (ITS) by way of presenting high pace Wi-Fi hyperlinks between many its subsystems [2]. Smart antennas can extensively beautify the performance of wireless systems and satisfy the requirement of improving coverage variety, capacity, records charge and nice of company [3].

Obligation lies with the it's fashion designer to apprehend the running of a selected smart antenna in advance than it is used for the intended running surroundings. In the following sections we are able to speak types and running of clever antennas and the way they will be utilized in smart transportation structures and forte of the application of clever antenna technology, and in addition to cell communiqué systems.

1.2 Smart:

A smart antenna is a digital Wi-Fi communications antenna machine that takes benefit of range effect on the supply (transmitter), the vacation spot (receiver), or each. Range impact includes the transmission and/or reception of a couple of radio frequency (RF) waves to increase records pace and decrease the mistake price. The advent of effective low-price virtual sign processors (DSPS),trendy- reason processors (and ASICs), in addition to modern software program-based totally signal-processing techniques (algorithms)have made smart antennas sensible for mobile verbal exchange machine.[4] Today, when spectrally green solutions are more and more a business vital, those structures are presenting more insurance place for every mobile website online, better rejection of interference, and sizable capability improvements.

1.2.1 What are Smart Antennas?

Smart antennas (also referred to as adaptive array antennas, more than one antennas and, recently, MIMO) are antenna arrays with clever sign processing algorithms used to perceive spatial sign signature which includes directivity. The base stations are Omni- directional or sectored [5]. The power radiated in other directions could be experienced as interference with the aid of different users. The ideas of smart antenna is to use base station antenna patters that aren't fixed, but adapt to the perfect radio situations. This can visualized because the antenna directing a beam closer to the communication partner simplest.

1.2.2 Data Transmission in Smart Antenna:

A data transmission system using binary encoding transmits a sequence of binary digits, that is, l's and 0's. These digits may be represented in a number of ways. For example, a 1 may be represented by a voltage V held for a time T while a zero is represented by a voltage –V held for an equal time. In general the binary digits are encoded so that a 1 is represented by a signal sl (t) and a 0 by a signal s2 (t), where sl (t) and s2 (t) each have a duration T The resulting signal may be transmitted directly or, as is more usually the case, used to modulate a carrier. The received signal is corrupted by noise, and hence there is a finite probability that the receiver will make an error in determining, within each time interval, whether a 1 or a 0 was transmitted.

1.3 Baseband Signal Receiver:

Consider that a binary-encoded signal consists of a time sequence of voltage levels +V or –V If there is a guard interval between the bits, the signal forms a sequence of positive and negative pulses. [5-8] In either case there is no particular interest in preserving the waveform of the signal after reception.

We are interested only in knowing within each bit interval whether the transmitted voltage was +V or –V With noise present, the received signal and noise together will yield sample values generally different from ±V In this case, what deduction shall we make from the sample value concerning the transmitted bit? Suppose that the noise is Gaussian and therefore the noise voltage has a probability density which is entirely symmetrical with respect to zero volts. Then the probability that the noise has increased the sample value is the same as the probability that the noise has decreased the sample value. It then seems entirely reasonable that we can do no better than to assume that if the sample value is positive the transmitted level was + V, and if the sample value is negative the transmitted level was –V. It is, of course, possible that at the sampling time the noise voltage may be of magnitude larger than V and of a polarity opposite to the polarity assigned to the transmitted bit. In this case an error will be made as indicated in Figure 1.1. Here the transmitted bit is represented by the voltage +V which is sustained over an interval T from t1 to t2. Noise has been superimposed on the level +V so that the voltage v represents the received signal and noise. If now the sampling should happen to take place at a time t = t1 + Δt, an error will have been made.

We can reduce the probability of error by processing the received signal plus noise in such a manner that we are then able to find a sample time where the sample voltage due to the signal is emphasized relative to the sample voltage due to the noise. Such a processer (receiver) is shown in Figure 1.2. The signal input during a bit interval is indicated. As a matter of convenience we have set t = 0 at the beginning of the interval. The waveform of the signal s (t) before t = 0 and after t = T has not been indicated since, as will appear, the operation of the receiver during each bit interval is independent of the waveform during past and future bit intervals. The signal s(t) with added white Gaussian noise n(t) of power spectral density $\eta/2$ is presented to an integrator. At time t = 0 + we require that capacitor C be uncharged. Such a discharged condition may be ensured by a brief closing of switch SW1 at time t = 0– , thus relieving C of any charge it may have acquired during the previous interval. The sample is taken at the output of the integrator by closing this sampling switch SW2. This sample is taken at the end of the bit interval, at t = T The signal processing indicated in Figure 1.2 is described by the phrase integrate and dump, the term dump referring to the abrupt discharge of the capacitor after each sampling.

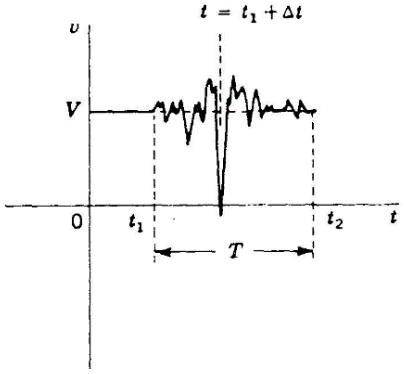

Figure 1.1: Illustration that noise may cause an error in the determination of a transmitted voltage level.

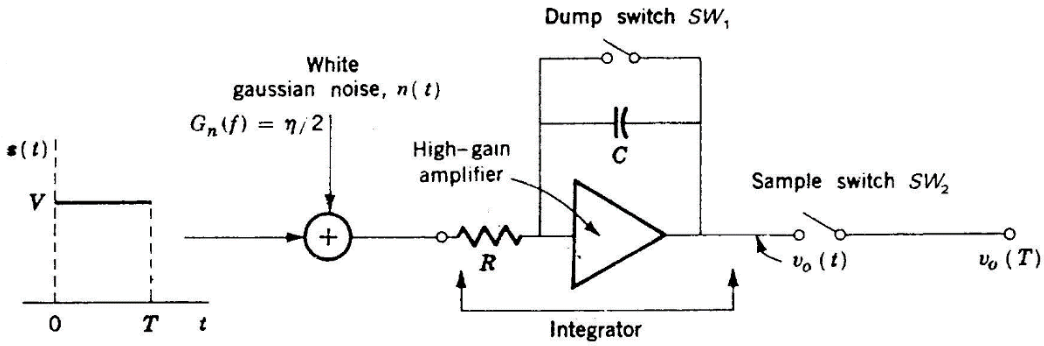

Figure 1.2: A Receivers for a Binary Coded Signal.

1.4 Pack Signal of Rms Noise Output Voltage Ratio:

The integrator yields an output which is the integral of its input multiplied by

$$\upsilon_0(T) = \frac{1}{\tau}\int_0^T [s(t) + n(t)]\,dt = \frac{1}{\tau}\int_0^T s(t)\,dt + \frac{1}{\tau}\int_0^T n(t)\,dt \qquad (1)$$

The sample voltage due to the signal is

$$s_0(T) = \frac{1}{\tau}\int_0^T V\,dt = \frac{VT}{\tau} \qquad (2)$$

The sample voltage due to the noise is

$$n_0(T) = \frac{1}{\tau}\int_0^T n(t)\,dt \qquad (3)$$

This noise-sampling voltage $n_0(T)$ is a Gaussian random variable in contrast with n(t), which is a Gaussian random process.

The variance of $n_0(T)$ was

$$\sigma_0^2 = \overline{n_0^2(t)} = \frac{\eta T}{2\tau^2} \qquad (4)$$

$n_0(T)$ has a Gaussian probability density.

The output of the integrator, before the sampling switch, is $\upsilon_0(t) = s_0(t) + n_0(t)$. As shown in Figure 1.3a, the signal output $s_0(t)$ is a ramp, in each bit interval, of duration T. At the end of the interval the ramp attains the voltage $s_0(T)$ which is $+VT/\tau$ or $-V\,T/\tau$, depending on whether the bit is a 1 or a 0. At the end of each interval the switch SW_1 in Figure 1.2 closes momentarily to discharge the capacitor so that $s_0(t)$ drops to zero. The noise $n_0(t)$, shown in Fig. 3b, also starts each interval with $n_0(0) = 0$ and has the random value $n_0(T)$ at the end of each interval. The sampling switch SW_2 closes briefly just before the closing of SW_1 and hence reads the voltage.

$$\upsilon_0(T) = s_0(t) + n_0(t) \tag{5}$$

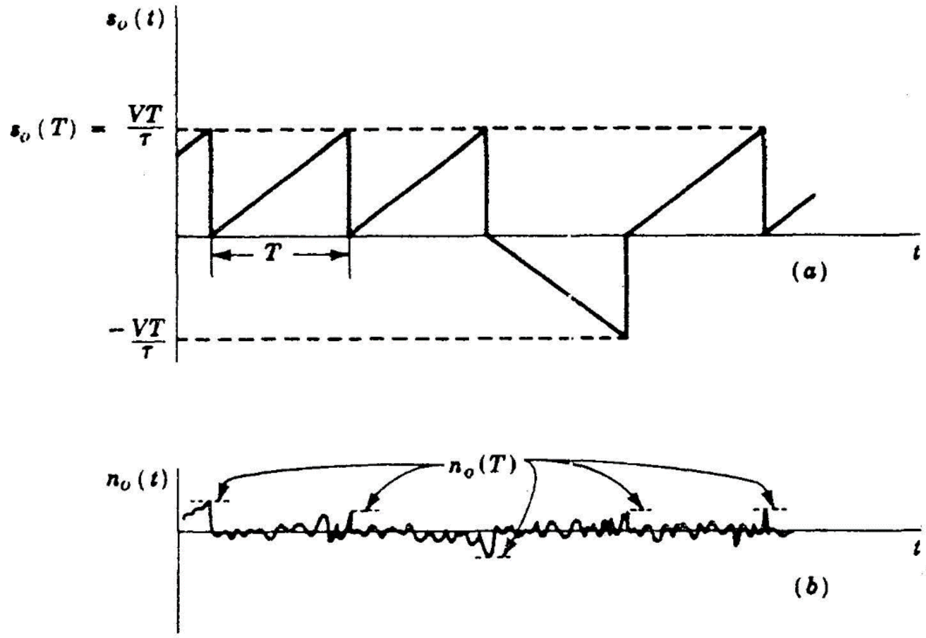

Figure 1.3: (a) The signal output and (b) the noise output of the integrator of Figure1.2

We would naturally like the output signal voltage to be as large as possible in comparison with the noise voltage. Hence a figure of merit of interest is the signal-to-noise ratio.

$$\frac{[s_0(T)]^2}{[n_0(T)]^2} = \frac{2}{\eta} V^2 T \tag{6}$$

This result is calculated from Eqs. (2) and (4). Note that the signal-to-noise ratio increases with increasing bit duration T and that it depends on V^2T which is the normalized energy of the bit signal. Therefore, a bit represented by a narrow, high amplitude signal and one by a wide, low amplitude signal are equally effective, provided V^2T is kept constant. It is instructive to note that the integrator filters the signal and the noise such that the signal voltage increases linearly with time, while the standard deviation (rms value) of the noise increases more slowly, as $\sqrt{T}$.

Thus, the integrator enhances the signal relative to the noise, and this enhancement increases with time as shown in Eq. (6) and table 1.1 shows the parameters for model communication system.

Table 1.1: Parameters for Model Communication System

Item	Values
Frequency Band	5.8 Ghz Band
Maximum Zone Length	100m
Maximum Zone Division	4
Maximum Zone Length	25m
I/O Port Number	2
Antenna Height	8m (Roadside) 1.5 M(Vehicle)
Required Beam Pattern	10

1.5 Conclusion:

Smart antennas can substantially enhance the overall performance of Wi-Fi communication structures utilized in its. Smart antenna era presents variety extension, increased data charge, higher community capability and higher carrier excellent. But, clever antenna represents many specific methods of the usage of a couple of antennas on one or both ends of the Wi-Fi link. Moreover, the paper suggests that the antenna can exchange the radiation sample, by way of adjusting simplest the load of detail beams used for street conversation, which leads to simplifying and dashing up the beam control procedure. This paper also highlights the data transmission principle by smart antenna.

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2. Information Storage and Retrieval System: An Evaluation

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Abstract:

For a wide variety of sensor network environments, location information is unavailable or expensive to obtain. We propose a location-free, lightweight, distributed, and data-centric storage/retrieval scheme for information producers and information consumers in sensor networks. Our scheme is built upon the Gradient Landmark-Based Distributed Routing protocol, a two-level routing scheme where sensor nodes are partitioned into tiles by their graph distances to a small set of local landmarks so that localized and efficient routing can be achieved inside and across tiles. Our information storage and retrieval scheme uses two ideas on top of the GLIDER hierarchy — a distributed hash table on the combinatorial tile adjacency graph and a double-ruling scheme within each tile. Queries follow a path that will probably reach the data replicated by the producer. We show that this scheme compares favorably with previously proposed schemes, such as Geographic Hash Tables, providing comparable data storage performance and better locality-aware data retrieval performance.

More importantly, this scheme uses no geographic information, makes few assumptions on the network model, and achieves better load balancing and structured data processing and aggregation even for sensor fields with complex geometric shapes and non-trivial topology.

2.1 Introduction:

Information retrieval is the activity of obtaining information resources relevant to an information need from a collection of information resources. Searches can be based on metadata or on full-text indexing. Automated information retrieval systems are used to reduce what has been called "information overload". Many universities and public libraries use IR systems to provide access to books, journals and other documents. Web search engines are the most visible IR applications. Making effective use of the vast amount of data gathered by large-scale sensor networks requires scalable and energy-efficient data storage and data dissemination algorithms. Queries on sensor networks may be content-based, in that users are primarily interested in data satisfying certain attributes, not in the details of which node currently contains the data.

An information producer generates data that may be of interest to multiple information consumers located in other parts of the network at a much later time. An information brokerage scheme is a mechanism that carries out data publication, data replication for the information producers and data retrieval for the information consumers in the sensor network setting, we formulate it as a mechanism to enable a network of nodes to self-organize and store the sensed data, cooperate to route and answer the query. The utility of a sensor network derives primarily from the data it gathers. Previous work has addressed data-centric routing and data-centric storage as efficient data management schemes for sensor networks. In data-centric routing, low-level communications are based on names that are external to the network topology and relevant to the applications. A typical data-centric routing protocol, directed diffusion, uses a flooding algorithm to distribute interests to match with data obtained at source nodes.

Matched data are delivered back to the sink (consumer) on reversed paths, the best of which will be reinforced for continuing future use. Little collaborative preprocessing is performed on the data gathered by the sensors in such schemes. Thus the discovery of the desired information has to rely on flooding the network. Information retrieval is the method of searching information in documents, documents themselves or metadata that describes these documents.

This definition is not dependent on method of document storage, or their type which determines the content of information being searched. This can be a search in the local database or in the Internet for text, images, sound, or data. Information retrieval is a loosely-defined term and the problem of information retrieval can be investigated under different aspects. This paper deals with the automatic information retrieval tasks of the information represented as text.

2.1.1 Information as a Resource:

Is considered an economic resource, somewhat on par with other resources such as labor, material, and capital. This view stems from evidence that the possession, manipulation, and use of information can increase the cost-effectiveness of many physical and cognitive processes. The rise in information-processing activities in banking industry as well as in human problem solving problem has been remarkable.

2.1.2 Information as a Commodity:

Complementary to definitions of information as a commodity is the concept of an information production chain through which information gains in economic value. The notion of information as a commodity incorporates “the exchange of information among people and related activities as well as its use” [8] implies buyer, sellers and a market. In contrast to the absence of power of information as a resource, information as a commodity has economic power.

2.1.3 Information as Perception of Pattern:

Here the concept of information is broadened by the addition of context. Information “has a past and a future, is affected by motive and other environmental and casual factors, and itself has effect [8].

The concept of information and its processes is broadened so much so that information in this sense can be applied to a highly articulated social structure. Information has a power of its own although its effects are isolated. The example given is of information reducing uncertainty but only in regard to a single question.

2.1.4 Information as process:

That is, when someone is informed, or what he or she knows is changed. Information in this sense refers to the act of informing or communicating knowledge or "news" of some fact.

2.1.5 Information as Knowledge:

That is, information, being new to a recipient, serves to reduce uncertainty and improves existing knowledge. Information in this sense refers to the knowledge communicated concerning some particular facts, subject or event, which, when assimilated, changes the recipients existing knowledge.

2.1.6 Information as Thing:

Used attributively for objects, such as data in documents, because they are regarded as being informative, or having the quality of communicating information or impacting knowledge. Usage of the concept of "information" also appears to have changed over time along revolutions in computer technology. In the 1950s and 1960s, it meant the amount of reduction on uncertainty, particularly in the context of communication signals and symbols. In the 1980s it meant decision-relevant data. Hence, focused on the effective use of information by humans to solve social problems. Later, and probably in conformity with the use of „data process in to mean everything processed by computer, the word „information came to be widely used to denote „processed dat. Today, with the computer being more and more widely used to support decisions through database systems, spreadsheets and graphics, information has, once again, come to mean information that can help its users to make better decisions.

2.1.7 Information Retrieval:

Information retrieval is the activity of obtaining information resources relevant to an information need from a collection of information resources. Searches can be based on metadata or on full-text (or other content-based) indexing. Information retrieval systems are everywhere: Web search engines, library catalogs, store catalogs, cookbook indexes, and so on. Information retrieval (IR), also called information storage and retrieval (ISR or ISAR) or information organization and retrieval, is the art and science of retrieving from a collection of items a subset that serves the user's purpose; for example:

- Web pages useful in preparing for a trip to Europe;
- Magazine articles for an assignment or good reading for that trip to Europe;
- Educational materials for a learning objective;
- Digital cameras for taking family photos;

- Recipes that use ingredients on hand;
- Facts needed for deciding on a company merger.

The main trick is to retrieve what is useful while leaving behind what is not. Need for information retrieval tools. Information retrieval system consists of three sub system, i.e. information sub-system, user's subsystem and retrieval sub-system. Information system contains a bundle of information. User subsystem is user interface through which users submit their query and retrieval sub-system acts as a mediator that takes the search query and matches it up with existing database and provides relevant information to the users. Fourth Law of Library Science states that "Save the time of the readers." This is possible only if information form databases and other sources are clearly analyses, classified, and organized in a proper manner. In an IR system, users submit their query in form of keywords or phrases and retrieval system matches it with indexed objects and serves such matched objects to the users.

2.2 Objectives of Information Storage and Retrieval System:

Traditionally, IR has concentrated on finding whole documents consisting of written text; much IR research focuses more specifically on text retrieval – the computerized retrieval of machine-readable text without human indexing. But there are many other interesting areas:

- Speech retrieval, which deals with speech, often transcribed manually or (with errors) by automated speech recognition (ASR).
- Cross-language retrieval, which uses a query in one language (say English) and finds documents in other languages (say Chinese and Russian).
- Question-answering IR systems, which retrieve answers from a body of text. For example, the question who won the 1997 World Series? Finds a 1997 headline World Series: Marlins are champions.
- Image retrieval, which finds images on a theme or images that contain a given shape or color.
- Music retrieval, which finds a piece when the user hums a melody or enters the notes of a musical theme.
- IR dealing with any kind of other entity or object: works of art, software, courses offered at a university, people (as experts, to hire, for a date), and products of any kind. Text, speech, and images, printed or digital, carry information, hence information retrieval. Not so for other kinds of objects, such as hardware items in a store. Yet IR methods apply to retrieving books or people or hardware items, and this article deals with IR broadly, using "document" as stand-in for any type of object. Note the difference between retrieving information about objects (as in a Web store catalog) and retrieving the actual objects from the warehouse.

2.2.1 Utility of Information Storage and Retrieval System:

Utility and relevance underlie all IR operations. A document's utility depends on three things, topical relevance, pertinence, and novelty. A document is topically relevant for a topic, question, or task if it contains information that either directly answers the question or can be used, possibly in combination with other information, to derive an answer or perform the task. It is pertinent with respect to a user with a given purpose if, in addition, it gives just the information needed; is compatible with the user's background and cognitive style so he can apply the information gained; and is authoritative. It is novel if it adds to the user's knowledge. Analogously, a soccer player is topically relevant for a team if her abilities and playing style fit the team strategy, pertinent if she is compatible with the coach and novel if the team is missing a player in her position. Utility might be measured in monetary terms: "How much is it worth to the user to have found this document?" "How much is this player worth to us?" "How much did we save by finding this software?" In the literature, the term "relevance" is used imprecisely; it can mean utility or topical relevance or pertinence. Many IR systems focus on finding topically relevant documents, leaving further selection to the user. Relevance is a matter of degree; some documents are highly relevant and indispensable for the user's tasks; others contribute just a little bit and could be missed without much harm (see ranked retrieval in the section on Matching). Evaluation studies commonly use recall and precision or a combination; whether these are the best measures is debatable. With low precision, the user must look at several irrelevant documents for every relevant document found. More sophisticated measures consider the gain from a relevant document and the expense incurred by having to examine an irrelevant document. For ranked retrieval, performance measures are more complex. All of these measures are based on assessing each document on its own, rather than considering the usefulness of the retrieved set as a whole; for example, many relevant documents that merely duplicate the same information just waste the user's time, so retrieving fewer relevant documents would be better.

2.3 Database:

The term or expression of database originated within the computer industry. A possible definition is that a database is a structured collection of records or data which is stored in a computer so that a program can consult it to answer queries. The records retrieved in answer to queries become information that can be used to make decisions. The computer program used to manage and query a database is known as a Database Management System (DBMS). The properties and designs of database systems are included in the study of information science. The central concept of a database is that of a collection of records, or pieces of knowledge. Topically, for a given database, there is a structural description of the type of facts held in that database: this description is known as a schema. The schema describes the objects that are represented in the database, and the relationships among them. There are a number of different ways of organizing a schema, that is, of modeling the database structure: these are known as database models (or data models). The model in most common use today is the relational model, which in layman's terms represents all information in the form of multiple related tables each consisting of rows and columns (the true definition uses mathematical terminology). This model represents relationships by the use of values common to more than one table. Other models such as the hierarchical model and the network model use a more explicit representation of relationships. The term database refers to the collection of related records, and the software should be referred to as the database management system or DBMS. When the context is unambiguous, however, many database administrators and programmers use the term database to cover both meanings.

Many professionals would consider a collection of data to constitute a database only if it has certain properties: for example, if the data is managed to ensure its integrity, if it allows shared access by a community of users, if it has a schema, or if it supports a query language.

However, there is no agreed definition of these properties. Database management systems are usually categorized according to the data model that they support: relational, object-relational, network, and so on. The data model will tend to determine the query languages that are available to access the database. A great deal of the internal engineering of a DBMS, however, is independent of the data model, and is concerned with managing factors such as performance, concurrency, integrity, and recovery from hardware failures. In these areas there are large differences between problems.

2.3.1 Types of Databases:

Databases are usually categorized according to their various models. Various techniques are used to model data structure. Most database systems are built around one particular data model, although it is increasingly common for products to offer support for more than one model. For any one logical model various physical implementations may possible, and most products will offer the user some level of control in tuning the physical implementation, since the choices that are made have a significant effect on performance.

An example of this is the relational model: all serious implementations of the relational model allow the creation of indexes which provide fast access to rows in a table if the values of certain columns are known. A data model is not just a way of structuring data: it also defines a set of operations that can be performed on the data. The relational model, for example defines operations such as select; project; and join. Be explicit in a particular query language, they provide the foundation on which a query language is built.

a. Flat Model:

This may not strictly qualify as a data model, as defined above. The flat (or table) model consists of a single, two-dimensional array of data elements, where all members of a given column are assumed to be similar values, and all members of a row are assumed to be related to one another. For instance, columns for name and password that might be used as a part of a system security database; each row would have the specific password associated with an individual user. Columns of the table often have a type associated with them, defining them as character data, date or time information, integers, or floating point numbers. The model is, incidentally, a basis of the spreadsheet.

b. Hierarchical Model:

In a hierarchical model, data is organized into a tree-like structure, implying a single upward link in each record to describe the nesting, and a sort field to keep the records in a particular order in each same-level list. Hierarchical structures were widely used in the early mainframe database management systems, such as the Information Management System (IMS) by IBM, and now describe the structure of XML documents. This structure allows one 1: N relationship between two types of data. This structure is very efficient to describe many relationships in the real world; recipes, table of contents, ordering of paragraphs/verses, any nested and sorted information. However, the hierarchical structure is inefficient for certain database operations when a full path (as opposed to upward link and sort field) is not also included for each record.

c. Network Model:

The network model (defines by the CODASYL specification) organizes data using two fundamental constructs, called records and sets. Records contain fields which may be organized hierarchically, as in the programming language COBOL). Sets (not to be confused with mathematical sets) define one-to-many relationships between records: one owner, many members. A record may be an owner in any number of sets, and a member in any number of sets. The operations of the network model are navigational in style: a program maintains a current position, and navigates from one record to another by following the relationships in which the record participates. Records can also be located by supplying key values. Although it is not an essential feature of the model, network databases generally implement the set relationships by means of pointers that directly address the location of a record on disk. This gives excellent retrieval performance, at the expense of operations such as database loading and reorganization.

2.4 Challenges of effective Information and Storage and retrieval System:

The intensive penetration of computers and other information and telecommunication technology in the former socialist countries- countries in transition has contributed to the automation of many information activities in organizations and enterprises and has changed considerably their ability to access and use information from distant information resources. This, however, has not changed the information behavior in these countries; it has not automatically triggered higher information awareness or changed the attitudes towards information and communication activities. In spite of the technological possibilities and an increased number of computer engineers and information systems professionals, most organizations continue to face serious information problems due to the lack of interdisciplinary knowledge required for an integrated approach to the complex information activities involved in every aspect of work and doing business. Neither librarians nor other information professionals have the interdisciplinary knowledge needed for organizing and managing information activities in a broader context.

Thus they cannot fully understand the information phenomenon and the implications of the global information societies and information highway trends. Under these circumstances an abundance of money is spent on expensive technology and gadgetry that is not exploited to the greater benefit of the organization. All organizations and enterprises, regardless of the socioeconomic and political systems in which they operate, need enormous amounts of information. This is particularly true for those in transitional economies. Many organizations and enterprises in countries in transition suffer from inefficient and ineffective administration and exploitation of their information resources. They have no organized special libraries, information centers or services of any kind and also suffer from a lack of suitably trained professional library information manpower. Relevant information, whether internally generated or externally available, is still not tapped. Management and operational functions both the macro and micro levels (in government and in private organizations) are performed without the benefit of timely, relevant and reliable information. In many organizations we find a great number of different information resources managed in a diffuse way. There are no vertical or horizontal connections and the resources are not applied in a synergistic way toward the fulfillment of strategic objectives [30].

As far as special libraries and information services are concerned, managers do not, as yet, recognize that locating; accessing, retrieving, processing and disseminating information are activities of great importance for the successful functioning of their organizations. Managers still tend to see the library/information Centre as a cost, rather than as a strategic, resource. The lack of appreciation of the role, functions and services of special libraries and information centers has led to a situation in which organizations have no proper instruments to make them aware of the wealth of domestic and foreign information sources that technically are now available in the countries in transition. Such a situation is very symptomatic when it is widely recognized that organizations need specialized help in dealing with information, as noted in a recent statement by Peter Ducker:

To think through what the business needs requires somebody who knows and understands the highly specialized information field. There is far too much information for any but specialists to find their way around. The sources are totally diverse. Companies can generate some of the information about themselves, such as information about customers and non-customers or about technology in one's own field. But most of what enterprises need to know about the environment is obtainable only from outside sources-from all kinds of data banks and data services, from journals in many languages, from trade associations, from government publications, from Would Bank reports, etc.

2.4.1 How Information Retrieval Systems Work:

IR is a component of an information system. An information system must make sure that everybody it is meant to serve has the information needed to accomplish tasks, solve problems, and make decisions, no matter where that information is available. To this end, an information system must actively find out what users need, acquire documents (or computer programs, or products, or data items, and so on), resulting in a collection, and match documents with needs. Determining user needs involves studying user needs in general as a basis for designing responsive systems (such as determining what information students typically need for assignments), and actively soliciting the needs of specific users, expressed as query descriptions, so that the system can provide the information Figuring out what information the user really needs to solve a problem is essential for successful retrieval. Matching involves taking a query description and finding relevant documents in the collection; this is the task of the IR system. Relevant items correctly retrieved all relevant items in the collection relevant items retrieved all items retrieved irrelevant items correctly rejected all irrelevant items in the collection.

2.4.2 Indexing: Creating Document Representations:

Indexing (also called cataloging, metadata assignment, or metadata extraction) is the manual or automated process of making statements about a document, lesson, person, and so on, in accordance with the conceptual scheme. We focus here on subject indexing – making statements about a document's subjects. Indexing can be document-oriented – the indexer captures what the document is about, or request-oriented – the indexer assesses the document's relevance to subjects and other features of interest to users; for example, indexing the testimonies in with Jewish-Gentile relations, marking a document as interesting for a course, or marking a photograph as publication quality.

Related to indexing is abstracting – creating a shorter text that describes what the full document is about (indicative abstract) or even includes important results (informative abstract, summary). Automatic summarization has attracted much research interest. Automatic indexing begins with raw feature extraction, such as extracting all the words from a text, followed by refinements, such as eliminating stop words (and, it, of), stemming (pipes Y pipe), counting (using only the most frequent words), and mapping to concepts using a thesaurus (tube and pipe map to the same concept). A program can analyze sentence structures to extract phrases, such as labor camp (a Nazi camp where Jews were forced to work, often for a company; phrases can carry much meaning). For images, extractable features include color distribution or shapes. For music, extractable features include frequency of occurrence of notes or chords, rhythm, and melodies; refinements include transposition to a different key. Raw or refined features can be used directly for retrieval. Alternatively, they can be processed further: The system can use a classifier that combines the evidence from raw or refined features to assign descriptors from a pre-established index language. To give an example from the classifier uses the words life and model as evidence to assign bioinformatics (a descriptor in Google's directory). A classifier can be built by hand by treating each descriptor as a query description and building a query formulation for it as described in the next section. Or a classifier can be built automatically by using a training set, such as the list of documents for bioinformatics in, for machine learning of what features predict what descriptors. Many different words and word combinations can predict the same descriptor, making it easier for users to find all documents on a topic Assigning documents to (mutually exclusive) classes of a classification is also known as text categorization. Absent a suitable classification, the system can produce one by clustering – grouping documents that are close to each other (that is, documents that share many features).

2.4.3 Query Formulation: Creating Query Representations:

Retrieval means using the available evidence to predict the degree to which a document is relevant or useful for a given user need as described in a free-form query description, also called topic description or query statement. The query description is transformed, manually or automatically, into a formal query representation (also called query formulation or query for short) that combines features that predict a document's usefulness. The query expresses the information need in terms of the system's conceptual schema, ready to be matched with document representations. A query can specify text words or phrases the system should look for (free-text search) or any other entity feature, such as descriptors assigned from a controlled vocabulary, an author's organization, or the title of the journal where a document was published. A query can simply give features in an unstructured list (for example, a "bag of words") or combine features using Boolean operators (structured query).

2.4.4 Matching the Query Representation with Entity Representations:

The match uses the features specified in the query to predict document relevance. In exact match the system finds the documents that fill all the conditions of a Boolean query (it predicts relevance as 1 or 0). To enhance recall, the system can use synonym expansion (if the query asks for pipe, it finds tubes as well) and hierarchic expansion or inclusive searching (it finds capillary as well).

Since relevance or usefulness is a matter of degree, many IR systems (including most Web search engines) rank the results by a score of expected relevance (ranked retrieval).

2.5 Relevance Feedback and Interactive Retrieval:

Once the user has assessed the relevance of a few items found, the query can be improved: The system can assist the user in improving the query by showing a list of features (assigned descriptors; text words and phrases, and so on) found in many relevant items and another list from irrelevant items. Or the system can improve the query automatically by learning which features separate relevant from irrelevant items and thus are good predictors of relevance. A simple version of automatic query adjustment is this: increase the weights of features from relevant items and decrease the weights of features from irrelevant items.

2.6 Experimental Design:

To support the workflow proposed in the beginning of the paper, which is shown in, experimental design should bind preparation phase with available workload, configured system and acquired measurements. Even having such a narrow scope, it has many aspects. And it is not possible to generalize on the experimental design for information retrieval systems evaluation in the wide sense. Most of such existing experiments use just one set of requests/queries to evaluate or compare a number of systems. It is called 'matched pairs' procedure when the efficiency of the systems is compared on the same request. Moreover, there is a clear statistical reason for such approach.

Any statistical significance testing will be much more efficient with this method. Again, this approach is oriented to decrease the influence of the bottle-neck of the whole evaluation process which is the amount of requests. With this approach it is possible to reuse the requests decreasing the need in the larger number of distinct requests. Therefore, experimental design can be quite simple. Each request/query is searched against every system or every system configuration. Since the searching part of the system is controlled by simple rules, there is no problem in relation to replicating searches or the order in which the systems are tried. The only matter of convenience in case of a single system evaluation is performing the evaluation for the whole request set for a single configuration, further reconfiguring the system and performing the complete course of evaluation for a new setup.

2.7 Measurements:

Now, we know how to perform experiment. In order to be able to answer the question we have posed at the beginning we need to perform statistical evaluation of the measurements taken in the course of experiment. There are number of ways to measure how well the retrieved information matches the intended one. We will use the standard recall, precision and measures.

2.8 Evaluation of Information Storage and Retrieval System:

IR systems are evaluated with a view to improvement (formative evaluation) or with view to selecting the best IR system for a given task (summative evaluation).

IR systems can be evaluated on system characteristics and on retrieval performance. System characteristics include.

The following:

- The quality of the conceptual schema (Does it include all information needed for search and selection?);
- The quality of the subject access vocabulary (index language and thesaurus) (Does it include the necessary concepts? Is it well structured? Does it include all the synonyms for each concept?);
- The quality of human or automated indexing (Does it cover all aspects for which an entity is relevant at a high level of specificity, while avoiding features that do not belong?);
- The nature of the search algorithm;
- The assistance the system provides for information needs clarification and query formulation; and
- The quality of the display (Does it support selection?).

Measures for retrieval performance (recall, discrimination, precision, novelty) were discussed in the section Relevance and IR system performance. Requirements for recall and precision vary from query to query, and retrieval performance varies widely from search to search, making meaningful evaluation difficult. Standard practice evaluates systems through a number of test searches, computing for each a single measure of goodness that combines recall and precision, and then averaging over all the queries. This does not address very important system ability: the ability to adapt to the specific recall and precision requirements of each individual query. The biggest problem in IR evaluation is to identify beforehand all relevant documents (the recall base); small test collections have been constructed for this purpose, but there is a question of how well the results apply to large-scale real-life collections. The most important evaluation efforts of this type today are TREC and TDT (see Further Reading).

2.9 Conclusions:

There is no such thing as a watertight method for evaluating an information retrieval system. Any existing approach to evaluating or comparing information retrieval systems will have to deal with heuristics to some extend only for the reason of this process been highly dependent on human factor. In this paper we discussed the approach to conducting evaluation of information retrieval system starting from preparation of workload, conducting experiment and finally statistical data analysis. This approach is suitable for comparison of two information retrieval models or evaluation of a single system under different configurations of the model used. The work reported in this paper can be treated as the set of instructions to take in order to perform quantitative evaluation of any information retrieval system. It is also possible to reuse some of the parts of the proposed approach or extend it to suit specific requirements. However, theoretical value of this work is in its completeness, thus future pure realization of the proposed approach is highly encouraged. Researchers in the information retrieval field have devoted a significant amount of time in developing good, standardized evaluation techniques.

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3. Preserving Global Research Data: Role and Status of Re3data in RDM

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Abstract:

Purpose: Considering that scientific data is being increasingly renowned as an important raw material for current and future technological advances, many research collaborators have joined together to create mechanisms to secure and preserve it. However, irrespective of the generation of rich analysis results, this study was undertaken to examine the RDM activities on the global Registry of Research Data Repositories platform (Re3data) to increase its level of visualization.

Design/Methodology/Approach: The study approached the Re3 website, a global registry of research data repositories to collect the data. The researcher specifically assessed the 9 alternative search strategies that are available in the Re3 database; namely subject, content, keyword, metadata standards, quality management, repository languages, software, repository types and country.

Findings: It is observed that behaviors related to structured study results are more evident in developed countries as opposed to developing countries, although the U.S. is placed first. Results also indicated that research data is more structured in the case of scientific and statistical formats and disciplinary databases, particularly the life sciences. Overall, the software is mainly used for processing data and the English language is strongly supported. Dublin core metadata is often used to increase the quality of data from analysis.

Originality/Value: This study presented an overall picture of the research data practices throughout the investigation on the Re3data platform. The research proposed best practices focused on RDM operations to improve the amount of Research Data activities.

Keywords:

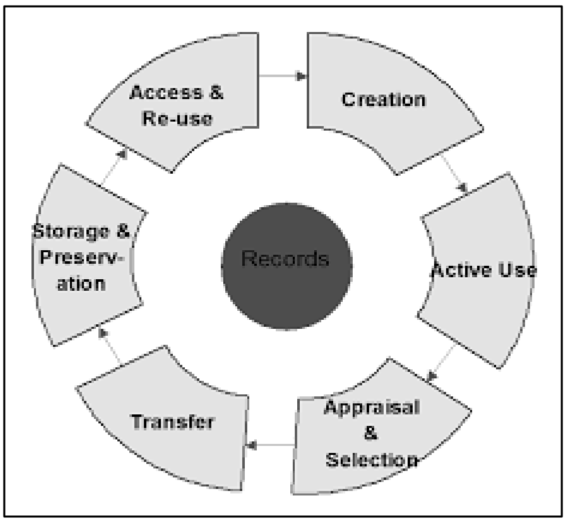
Research Data Management, Research Data, Scientific data, Re3data, Repository.

3.1 Introduction:

Research data is the data produced or generated in the form of pictures, tables, diagrams, videos, etc.(digital) and questionnaires, pictures, etc. (non-digital) as an important outcome of any research project (the University of Leeds, n.d). Long term preservation of research data contributes to more reliable research outcomes, more accessibility to research community and enhances quality and efficiency. There are repositories which are spread across the world actively engaged in preserving such valuable data. Re3 data is a global registry of global research data repositories, launched in 2012. The aim of the Re3data is to have permanent and long-term storage of research data in order to avoid duplication of work, sharing of data, to increase visibility of research data for the researchers, funding bodies, publishers and scholarly institutions. Re3data is a collective work of different types of organizations. Research Data Management (RDM) is 'the organization of data, from its entry to the research cycle through the dissemination and archiving of valuable results. It aims to ensure reliable verification of results and permits new and innovative research built on existing information' (Whyte & Tedds, 2011, Paragraph 4). It covers the managing, sharing, dissemination and reuse of data (Australian Research Council, 2018).

3.2 Research Data Life Cycle and RISE Framework:

Pennock (2007) gave a lifecycle approach to manage and curate digital information. The objective of the study was to maintain the authenticity and effectiveness of digital information for future reuse. Lifecycle comprises of 6 components i.e. creating data followed by processing data, analyzing data, preserving data, giving access to data, and reusing the data (Eynden, 2013). Data phase creation, approach for collecting and improving proper research data and metadata preparation followed by data processing that includes the input of the research data description with its metadata throughout the validity audit activities. Analyzing the data operation defines the performance well while preserving the data performs well-placed data storage plan, formatting, and medium research. Giving access to data means distributing data for reuse in line with copyright guidelines and proper citations.



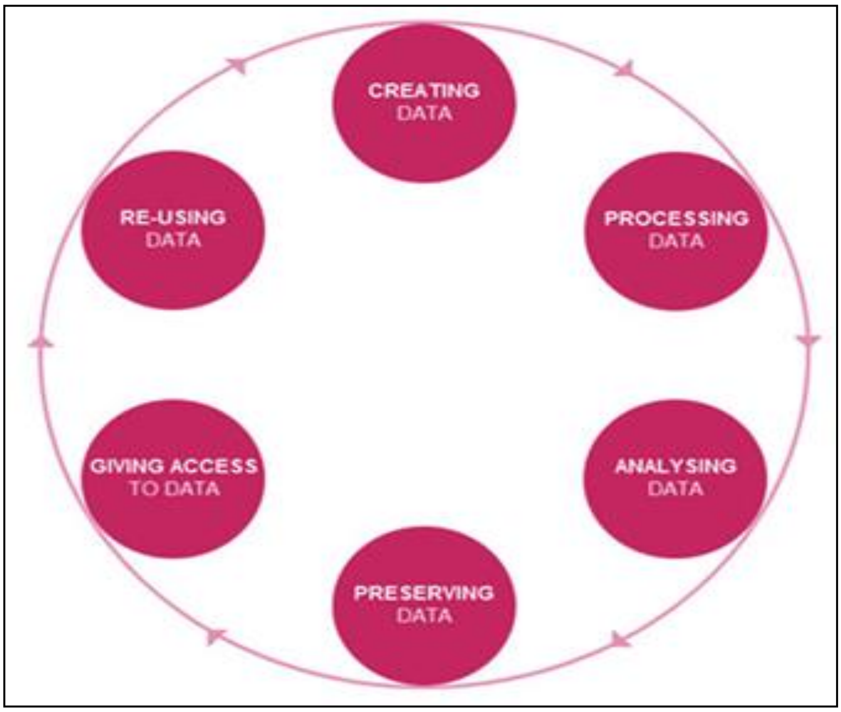


Figure 3.1: Lifecycle model (Pennock, 2007) and UKDA lifecycle model (Eynden, 2013)

Table 3.1: Lifecycle components (Chakravarty, 2015)

SN	Lifecycle components	Description
1	Creating Data	It contains data management planning, sharing and metadata creation.
2	Processing Data	It is about inputting data with its description at an appropriate location, checking its validity, and then saving it.
3	Analyzing Data	Regarding clarification of research output and understanding.
4	Preserving Data	It is about storing and getting data backup and its metadata in the appropriate location, format, and medium.
5	Giving access to data	It concerns the establishment of guidance on copyright, its distribution and promotion of saved records.
6	Re-using Data	It is about the reuse of data in supplying the copyright holder with adequate citation and quotation.

The six components approach to the life cycle is important to guide and develop the RDM services. The lifecycle approach starts from the planning stage of creating the data and metadata because digital materials are flexible and vulnerable to alteration throughout their life cycle from technical changes, so planning is a must. Library personnel, IT staff, and other stakeholders are involved in the processing, and analyzing the research data such as library which can provide a certified repository to preserve the data with its reliability. Reliable re-use of digital materials is possible only if materials are designed in such a manner as to maintain their quality and credibility (Pennock, 2007). The Research Infrastructure Self-Evaluation (RISE) framework was developed by the Digital Curation Center (DCC) in 2017 to facilitate RDM services planning and development at the institutional level, primarily for the Higher Education Institutions (HEIs). The framework has been divided into ten research data support services and 21 capabilities.

Figure 3.2: The RISE Capability Model (DCC, 2017)

Table 3.2: Research Infrastructure self- Evaluation (RISE) Framework (DCC, 2017)

Research Infrastructure self- Evaluation (RISE) Framework				
	Parts	**Level one**	**Level two**	**Level three**
RDM Policy and strategy	Policy development	Roles and responsibility of researchers, staff, other stakeholders, and funders expectation policy	Good RDM practice with its updated process	Promotion of RDM policies to increase its uses

Research Infrastructure self- Evaluation (RISE) Framework				
	Awareness raising and stakeholder engagement	Promotion of research data policies among its relevant stakeholders	Guidance regarding the practical implementation of policies to the institutional context	Marketing of policies
	RDM implementation roadmap	RDM structure is defined by fund requirements	RDM structure according to institution strategy and researcher priority	Roadmap needed to support RDM
Business plans and sustainability	Staff investment	About the responsibility of staff	Trained the staff to redesign their roles	RDM services by redesigned staff
	Technology investment	Investment in technical infrastructure	Coordinates with central technical services	Invest in technical infrastructure in all aspects of RDM
	Cost modeling	Grants for RDM services	Grant for standard RDM services	Support of cost modeling for RDM standard
Advisory services	Advisory services	Online guidance such as through helpdesk email. Content can be institutional specific	The orientation of services and policies to researchers	Guidance to fulfill the need for a specific institution
Training	Online Training	Online RDM courses	RDM courses with supplemented material and support	Regarding review and update of online material
	Face to Face training	Updated face to face RDM training on a request basis	Face to face training for all	Training based on the knowledge of researchers

Research Infrastructure self- Evaluation (RISE) Framework				
				and professional staff.
Data management planning (DMP)	DMP	Guidance regarding funder mandated DMP to researchers	Templates, research office may provide help to researchers to develop DMP	Institutional support service
Active data management	Scalability and synchronization	Service for manage and access of data through multiple devices	Additional storage on request	Automated additional storage services
	Collaboration support	External collaboration with local access rights	Collaborations through access to tools	Through a virtual research environment
	Security management	Prevention of data with its authenticity	Tools service for researchers to de-identifies encrypts or control access to data as required	Standard service to share and secure sensitive data
Appraisal and risk assessment	Data collection policy	Data deposit with legal compliance	Retention service of datasets to preserve long term value to the institution	Service regarding developing datasets that meet the needs of users
	Security, legal and ethical risk assessment	Ensure data collection according to legal and ethical criteria	Manage the legal and ethical risks relevant to its depositors and users	Guidance on risk assessment and solution to control the risk
	Metadata collection to inform decision making	To access the research data from the research project	Recording of metadata of research data describes its risks, cost, and benefits to the institution	Value addition in described metadata to fulfill the need of users

Research Infrastructure self- Evaluation (RISE) Framework				
Preservation	Preservation planning and action	Services to hold data, its metadata, and other related information	Regarding preservation plans such as migration	Tools and expert services to maintain the significance of data and its related information
	Continuity support	Automated storage support of one backup copy	Automated storage support of two backup copies, one online and another is offline	Service regarding automatic storage of data and metadata in multiple locations
Access and publishing	Monitoring locally produced datasets	About gathering of research project knowledge to satisfy funding decision criteria	Recording of metadata to enhance the quality of an institution's research output	Recording of metadata and to connect it with other activities and outputs to organize institution strategy
	Data publishing mandate	The minimum external requirement for access to metadata publicly	To access the data with proper citation	Support service to discover and review the data for user groups and organizations
	Level of data curation	A brief inspection of data and metadata for compliance purpose	To sustain the value of data	Maintain the quality of data on the time of customized it
Discovery	Cataloging scope of Metadata	Catalogues of metadata that can be easily searched, edited, and linked according to funder's expectations	Metadata catalogue service with best standard to enhance the value of institution data assets	Reuse of data according to leading standards

- **Description:**

The RISE framework describes 21 capabilities, distributed across ten Research Data Support Services (RDSS). The ten RDSS i.e. RDM policy and strategy followed by Business plans and sustainability, Advisory Services, Training, DMP, Active data management, Appraisal and risk assessment, preservation, access and publishing, discovery, all depending on the requirement of institutional context. RISE has three skill levels in each field which corresponds to specific service value levels. Level one is for compliance, level two is for providing locally-tailored services and level three is for sector-leading activity. Service rates differ according to administrative context.

3.3 Literature Review:

Piracha& Amen (2018) examined RDM policy and planning in the university libraries of Pakistan. The study aimed to evaluate the policy framework and planning regarding RDM. Data were collected from 30 higher education commission high ranking university libraries by using mixed method explanatory sequential design. The respondent rate was 78%. Results indicated that library heads just heard about RDM, while few libraries were at the planning stage due to lack of knowledge and awareness. The study concluded that library professionals had insufficient knowledge about RDM and there was a need for motivation, coordination with researchers, and skilled knowledge for the service provider.

Thielen & Nicholas Hess (2018) examined advanced RDM in the social sciences discipline. The aim of the study was to explore how a research data librarian and an educational librarian were collaborating to provide tailored RDM instructions for a previously unconsidered community of students: doctoral education students. The study was based on primary data, and a case study was conducted to collect the information. Results indicated that participants believed that practice concerning several data management practices covered by the librarians would change. The study concluded that social science librarians need to conduct workshops, practical suggestions, and training programs at their institutions to strengthen the advanced RDM.

L. Lang and. Al. (2018) performed a case study to analyze the crossroads research support: capability and partnership at the University of Willington in Victoria. The aim of the study was to reposition library services according to the researchers' needs and contextualize them within the lifecycle of the research without reducing other responsibilities. The study was based on primary data. To collect the information, a case study was conducted. The study found that new skills and competencies were needed and positive progress was achieved through collaborative participation throughout the university. The study concluded that providing skills to stakeholders in collaboration with the library can provide RDM services without any reduction in other library activities.

Shelly & Jackson (2018) examined the role of libraries to support RDM services. The aim of the study was to identify university groups and role of libraries to provide RDM services. The study was based on primary data and to collect the information. 13 Australian universities were examined using the content analysis method. The study showed that there was not a clear approach to RDM.

Generally, strong encouragement was given to secure and store research data during and after the project. But overall, there was a lack of practical assistance. The article concluded that libraries were quite active to support the RDM services. There was a need for advice and practical suggestion to researchers on RDM, particularly in the areas of creating metadata and loading data to repositories. Zhou (2018) examined the perceptions and practices of Academic libraries to provide RDM service. The purpose of the study was to explore the RDM services and effective recommendations for academic libraries to conduct data management services. The paper was based on summarizing and analyzing the implications of RDM. The study identified many core elements of RDM service practices such as policy design, architecture, service quality, funding model, and staffing. The study concluded as a whole that RDM service was still in its initial stage. It must go through links such as policy formulation, infrastructure building, service content design, service team formation, service user mining, and fundraising.

3.4 Study Scope:

For investigation and collection of data The Re3, Registry of Research Data Repository website is selected for various reasons: first, re3data has become the global database of knowledge about research data repositories. Second, it indexes and gives detailed information about more than 2450 research data repositories. Third, re3data has become the most comprehensive reference source for research data infrastructures globally. Fourth, it increases the accessibility and visibility of research data repositories from all over the world. Last, it promotes trustworthy, reliable and up-to-date research repositories.

The study seeks to enable librarians, research scholars and other stakeholders to become aware of numerous worldwide research data management activities.

3.5 Study Objectives:

Based on the scope of the study, the study strives to accomplish the following objectives:

a. To identify out the most approachable subject to exchange the research data.
b. To identify out the most recommended format of research data.
c. To assess the most adopted keyword analysis type.
d. To identify the most preferred metadata standard.
e. To assess the level of quality management.
f. To determine the preferred language.
g. To analyse the software type for analysis of research data.
h. To identify highly active contributor repository.
i. To find out the country that is most involved in sharing the study results.

3.6 Methodology

The Re3 website is chosen to collect, interpret and explore the findings. The study approached 9 search strategies that are available in the Re3database. These 9 approaches include subject, content, keyword, metadata standards, quality management, repository languages, software, repository types, and country. The data was analyzed using MS Excel.

3.7 Results and Discussion:

3.7.1 Subject Categories:

A total of 3843 research data repositories are registered, in the Re3 platform that can be broadly categorized into 4 major disciplines i.e. Life Sciences, Natural Sciences, Humanities & Social Sciences and Engineering Sciences. It was observed that Life Sciences accounted for the maximum repositories (35%) followed by Natural Sciences (32%),

Humanities and Social Sciences (22%) and Engineering Sciences (11%). It can be interpreted that RDM is more organized activity in case of Life Sciences and Natural Sciences in comparison to Humanities, Social Sciences and Engineering Sciences.

Table 3.3: Subject Categories

Rank	Subjects	Frequency	Percentage
1	Life Sciences	1336	35%
2	Natural Sciences	1238	32%
3	Humanities and Social Sciences	838	22%
4	Engineering Sciences	431	11%

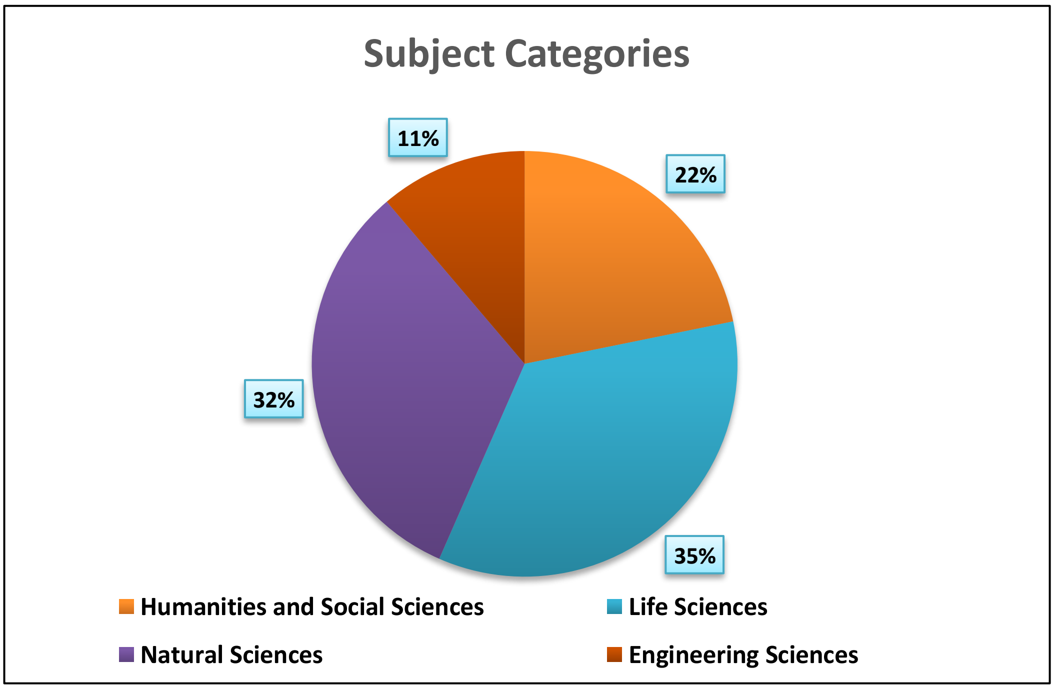


Figure 3.3: Subject Type

Research is not a monopoly of STEM but enjoys equal significance attached with it in AHSS.

In this context, the one of the primary responsibility of all the disciplines engaged in active research whether STEM or AHSS is to ascertain the preservation and availability of research data for posterity.

In the present case, however, lower contribution of Engineering in comparison to Humanities and Social Sciences is unforeseeable.

3.7.2 Content Types:

All registered databases on Re3 platform include 15 types of analysis data i.e. Scientific and statistical data formats (13%) followed by Standard office documents (13% approx.), Images (11%), Raw data (10%), Plain data (10% approx.), other (8%), structured graphics (8% approx.), structured text (7%), archived data (5%), databases (4%), audiovisual data (4%), software applications (4%), networked data (1%), source code (1%) and configuration data (1%).

This can be clarified that the maximum number of science and statistical data is handled while the minimum of one is handled for configuration data.

Table 3.4: Content Types

Rank	Content types	Frequency	Percentage
1	Scientific and Statistical data formats	1530	13%
2	Standard office documents	1512	13%
3	Images	1253	11%
4	Raw data	1104	10%
5	Plain text	1091	10%
6	Other	889	8%
7	Structured graphics	866	8%
8	Structured text	752	7%
9	Archived data	558	5%
10	Databases	513	4%

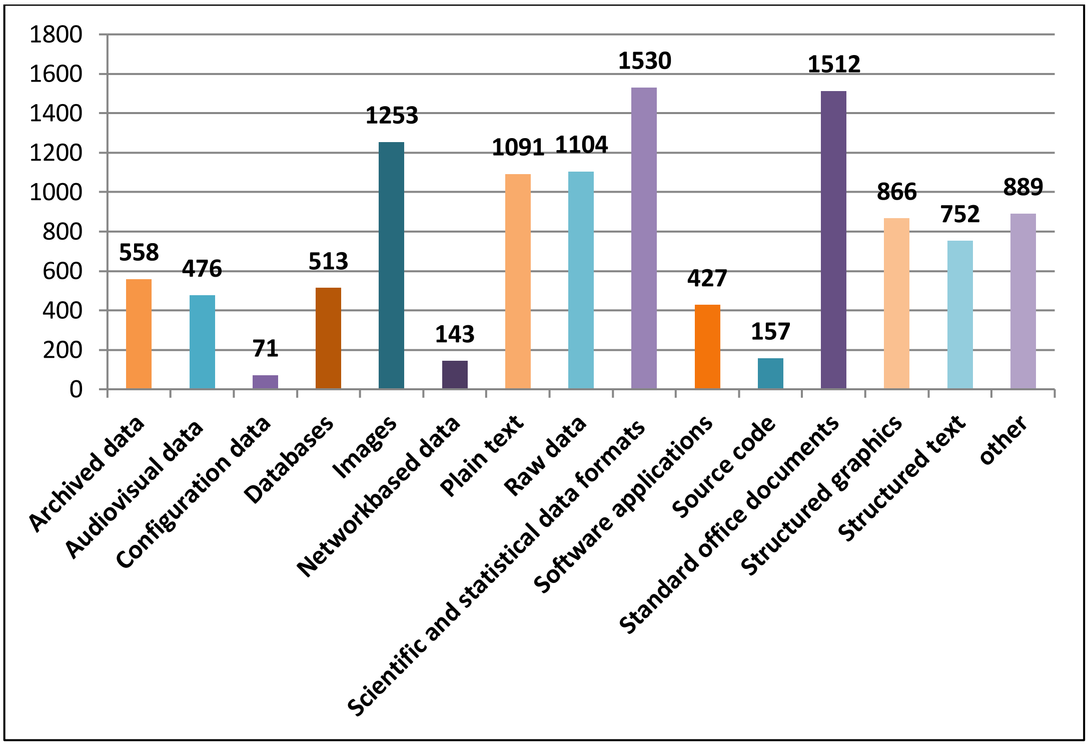


Figure 3.4: Content Types

All formats of research data are important whether these are photographs, plain data, standard office documents or formats of scientific and statistical data. Throughout this sense, the organizations, librarians, researchers and other stakeholders are largely responsible for handling all sorts of data formats.

In this present finding, configuration data, source code, networked data and database enjoy fewer contributions as comparison to scientific and statistical data formats.

3.7.3 Keywords Types:

All research data repositories registered in the Re3 platform are classified into 30 keyword categories. These categories include multidisciplinary followed by genomics, bioinformatics, genetics, health, biology, biodiversity, climate, DNA, atmosphere, meteorology, agriculture, FAIR, statistics, environment, cancer, climate change, ecology, weather, hydrology, economics, gene expression, ecosystem, education, oceanography, molecular biology, human, remote sensing, climatology, proteins.

It was analyzed that multidisciplinary repositories coordinate to organize maximum research data (11%) followed by genomics (6%) and bioinformatics (5%).

The atmosphere was observed as the least one category to organize the research data (3%) followed by DNA (4%) and climate (4%).

Table 3.5: Keyword Types

Rank	Keywords	Frequency	Percentage
1	Multidisciplinary	227	11%
2	Genomics	134	6%
3	Bioinformatics	113	5%
4	Genetics	109	5%
5	Health	99	5%
6	Biology	92	4%
7	Biodiversity	89	4%
8	Climate	79	4%
9	DNA	77	4%
10	Atmosphere	71	3%

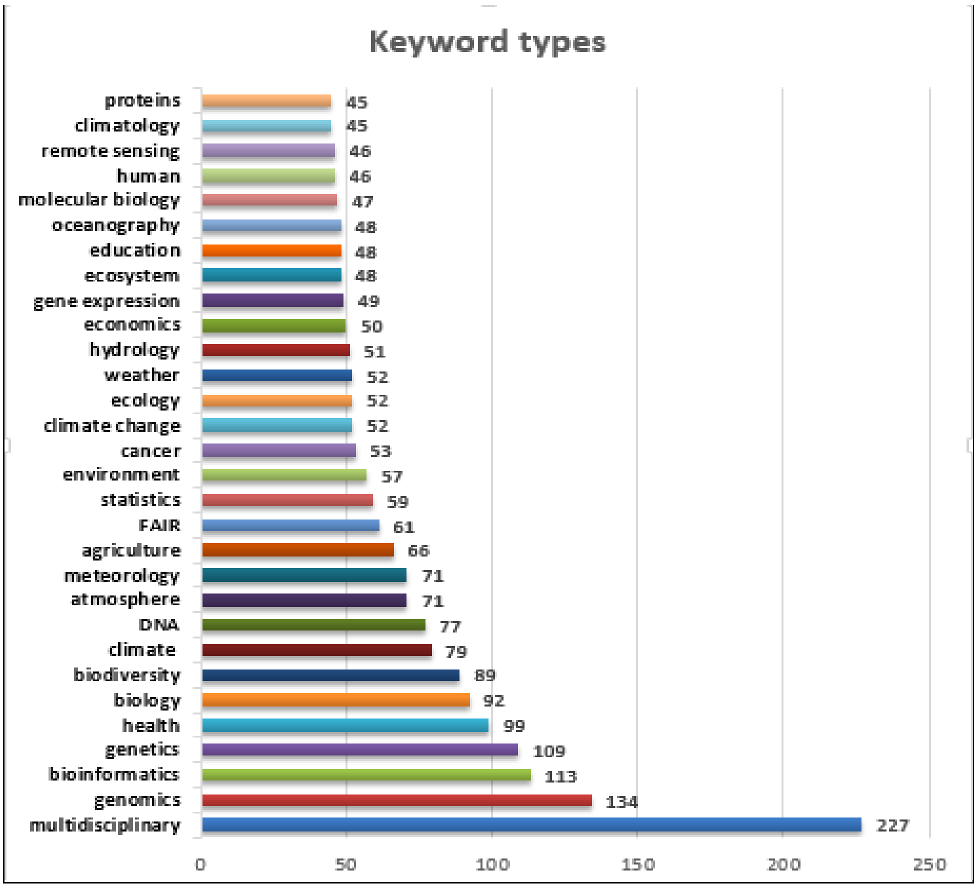


Figure 3.5: Keyword Types

The logical keyword gives maximum ways to find out any research data. In this context, it is important at the time of research data management, to select the most relevant keyword related to the research data. In the present output, the Atmosphere, DNA, and Climate keyword used minimum as comparison to the multidisciplinary keyword which contributes maximum.

3.7.4 Metadata Standards:

A reliable research data repository is either certified or supported to a metadata standard and the Re3data platform highly supports that standards. 28 kinds of metadata specifications are used in the Re3data application to consistently coordinate the analysis data i.e. Dublin Core, DDI - Data Documentation Initiative, Data Cite Metadata Schema, ISO 19115, Repository-Developed Metadata Schemas, FGDC/CSDGM - Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata, DIF - Directory Interchange Format, CF (Climate and Forecast) Metadata Conventions, other, EML - Ecological Metadata Language, SPASE data model, PROV, Genome metadata etc. It is evaluated that research Data was widely structured using the Dublin Metadata format (23%), while Genome metadata, SPASE data pattern, AVM- Astronomy Visualization Metadata and MIDAS heritage models used are as small as one (1%).

Table 3.6: Metadata Standards

Rank	Metadata Standards	Frequency	Percentage
1	Dublin Core	308	23%
2	DDI - Data Documentation Initiative	170	13%
3	DataCite Metadata Schema	168	13%
4	ISO 19115	150	11%
5	Repository-Developed Metadata Schemas	136	10%
6	FGDC/CSDGM - Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata	94	7%
7	DIF - Directory Interchange Format	40	3%
8	CF (Climate and Forecast) Metadata Conventions	38	3%
9	Other	37	3%
10	EML - Ecological Metadata Language	34	3%

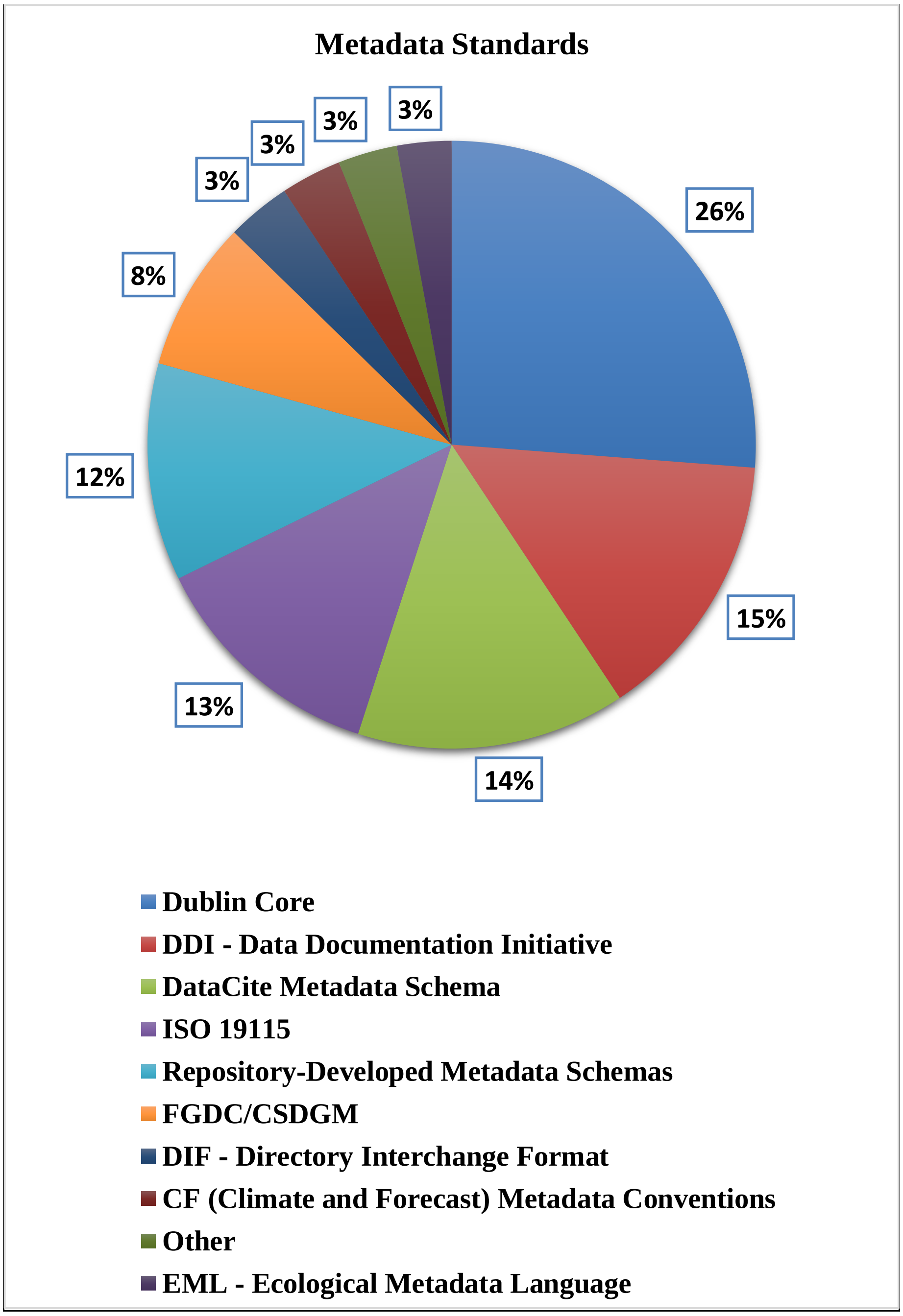


Figure 3.6: Metadata Standards

There are different kinds of metadata standards for defining the object of any data. Therefore much of the data management personnel's essential duty is to handle any element of data within acceptable metadata requirements. For this case, there is a lower contribution of SPASE data pattern, AVM- Astronomy Visualization Metadata, and MIDAS heritage as a comparison to Dublin Core metadata standards, DDI, and Data Cite metadata schema.

3.7.5 Quality Management Types:

Repositories that promote or do not support quality control are included in the quality management program division. Within the Re3 network, all licensed study data archives are grouped into three quality monitoring systems, i.e. Sure, Uncertain, and No. It has been found that 56% of repositories have information on quality control, 42% of repositories are uncertain whether or not they are assistance. Yet, 2%of databases do not have information relevant to quality control. It can be determined that most evidences from the study improve knowledge of quality control.

Table 3.7: Quality Management Types

Rank	QM	Frequency	Percentage
1	Sure	1393	56%
2	Uncertain	1050	42%
3	No	40	2%

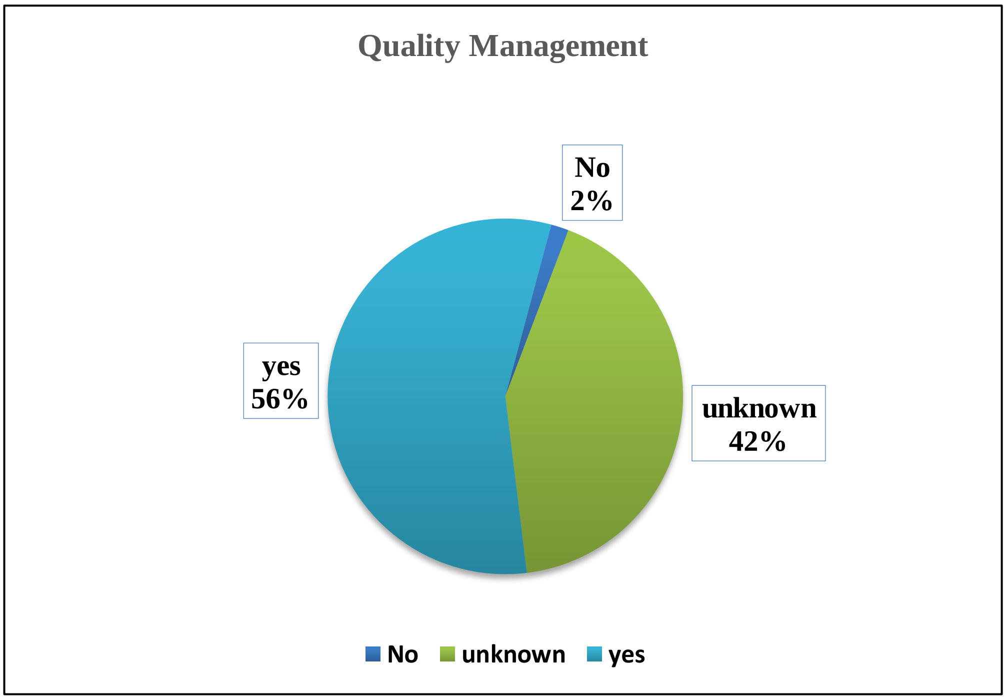


Figure 3.7: Quality Management Type

Reliability of research data repositories are depend on its quality management factor such as through issue of standard certification. Through this context, one of the organization's main obligations is to increase the consistency of data repositories. In the present output, 44% of total repositories are unknown or do not have a factor in quality control.

3.7.6 Language Types:

All databases listed on the Re3data portal support Multilanguage, i.e. a 60-language cluster. The researcher has divided all the languages into two categories namely English and other languages (a cluster of 59 languages). The highest number of repositories is evaluated to endorse English language, i.e. 8 percent of all languages. It can be considered that highly research data is organized in English language.

Table 3.8: Language Types

Sr. No.	Language	Frequency	Percentage
1	English	2411	8%
2	Other	27015	92%

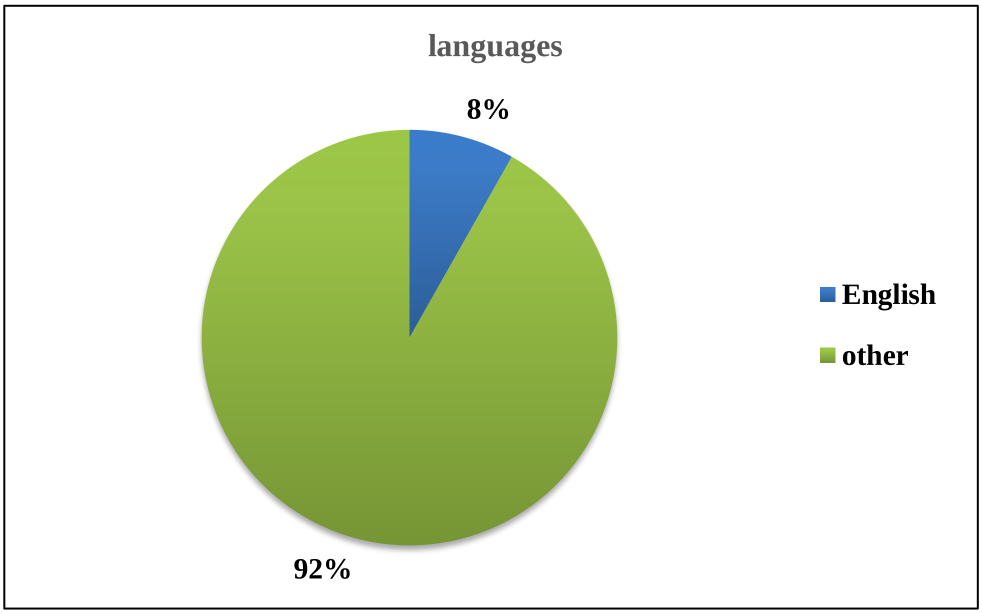


Figure 3.8. Language Types

The major role of any research is to provide more output and benefits to the society therefore, it is the duty of data management personnel to manage the research data into all regional languages. The librarians and other stakeholders can manage the research data into regional as well as international languages to avoid language barriers. In the present study, all languages are contributed fewer than the English language.

3.7.7 Software Types:

Technology is the best method for organizing, curating and archiving research results, and Re3 platform uses 13 software types, i.e. Unknown where the name of the package is not defined (58%), followed by Other (22%), DataVerse (4%), MySQL (4%), DSpace (4%), CKAN (3%), Fedora (2%), EPrints (2%), Nesstar (1%), eSciDoc, Digital Commons, dLibra and Opus (1%). It is examined that the maximum data of the research is arranged into software whose names are undisclosed. With the addition of uncertain and other types, DataVerse software has been identified as mainly used applications to handle data from analysis, while Opus is least used one.

Table 3.9. Software Types

Rank	Software types	Frequency	Percentage
1	Unknown	1233	58%
2	other	465	22%
3	DataVerse	87	4%
4	MySQL	78	4%
5	DSpace	76	4%
6	CKAN	71	3%
7	Fedora	37	2%
8	EPrints	32	2%
9	Nesstar	21	1%
10	eSciDoc, Digital Commons	3	1%

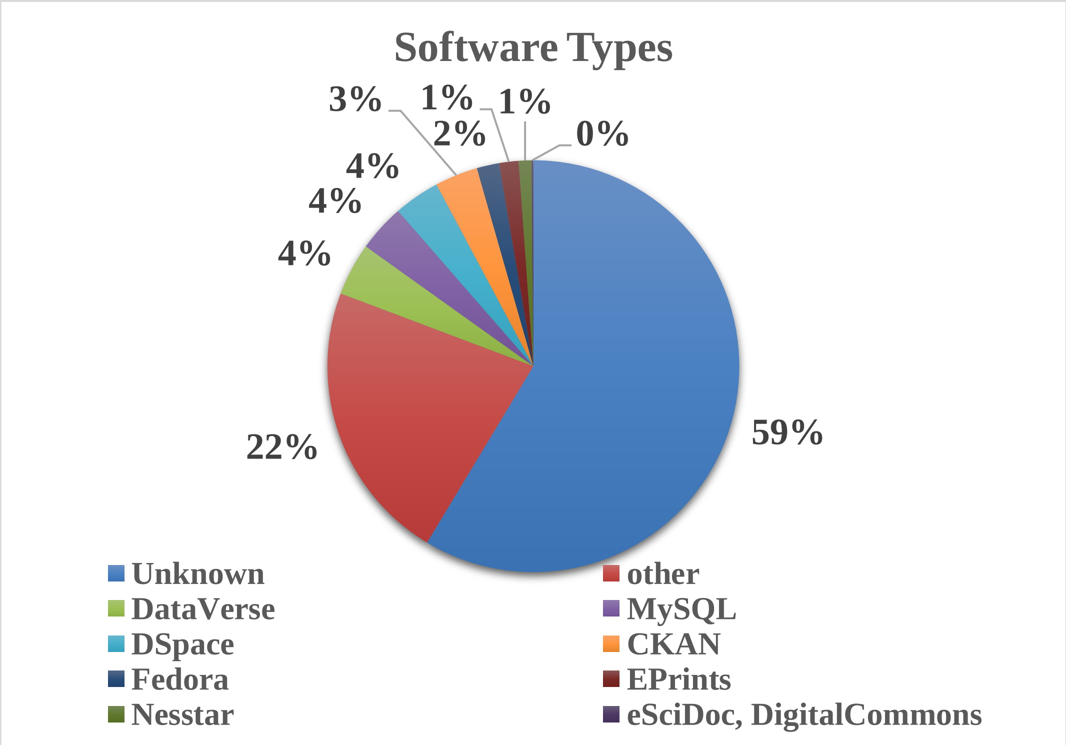


Figure 3.9. Software Types

Owing to different formats of research data, different types of software are needed. It means research data should be managed according to its type such as digital commons use for the institutional repository and Dataverse is kind of open source software. In the present case, eSciDoc, Digital Commons used as fewer than other softwares while a large part of the software is unknown.

3.7.8 Repository Types:

Three types of repositories i.e. Disciplinary, Institutional and Other, registered in the Re3 platform. Disciplinary repositories organized research data which is related to a specific subject. Institutional repositories contain research data management related to a specific institution or it is also known as green route of repository. Other repository types include organized data except disciplined and institutional types. It is observed that research data is more organized in case of disciplinary repository (69%), while other (10%) is least one.

Table 3.10. Repository Types

Number	Repository type	Frequency	Percentage
1	Disciplinary	1978	69%
2	Institutional	611	21%
3	Other	283	10%

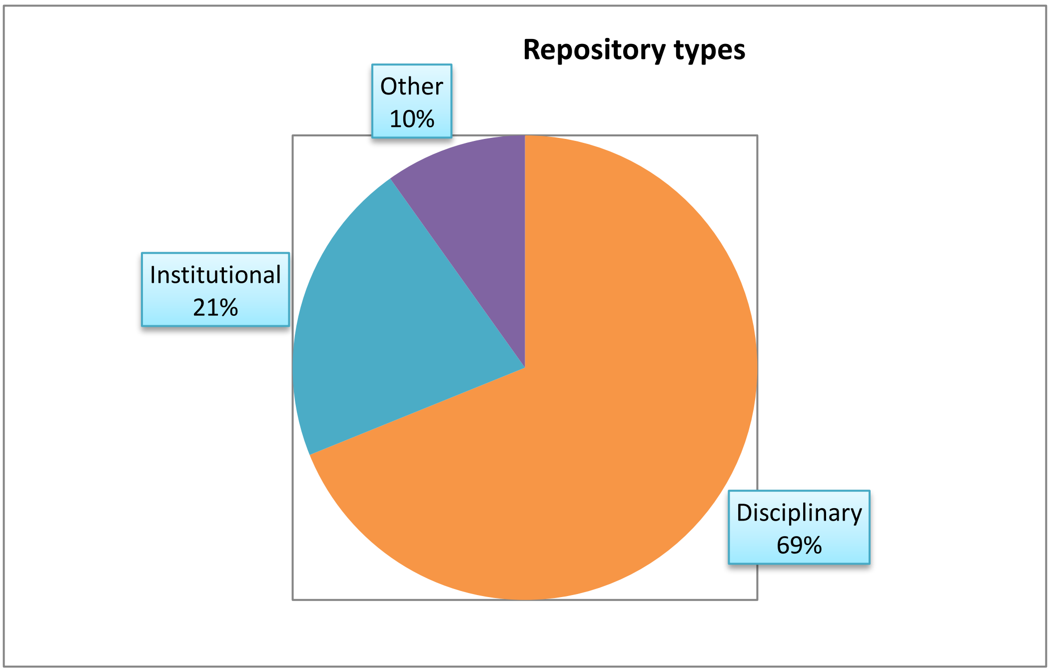


Figure 3.10: Repository Types

Stewardship and storage of research data content rely on the type of research data repository. In this context, if content of research data belongs to some specific subject so it would be manage into the discipline repository but if it belongs to a particular institution so it would be preserve into the institutional repository.

Hence, every data should mange into its category-specific repository. In the present case, the share of other and institutional repositories is fewer than the discipline-specific repository.

3.7.9 Country Types:

Seventy-nine countries are committed to the exchange of their research data on Re3data platform through registered repositories.

The United States with 36%, Germany (14%) and the United Kingdom (9%) ranked highest, while Egypt, Fiji, Iceland and Tunisia rated the least (1%) because of the differences in knowledge and comprehension.

There was still a RDM gap between developed countries and developing ones.

Table 3.11: Country Types

Ranking	Country	Repositories	Percentage
1	USA	1060	36%
2	Germany	403	14%
3	UK	281	9%
4	European Union	264	9%
5	Canada	255	9%
6	International	236	8%
7	France	103	4%
8	Australia	90	3%
9	Switzerland	69	2%
10	Japan	58	2%
11	Netherlands	56	2%
12	India	51	2%

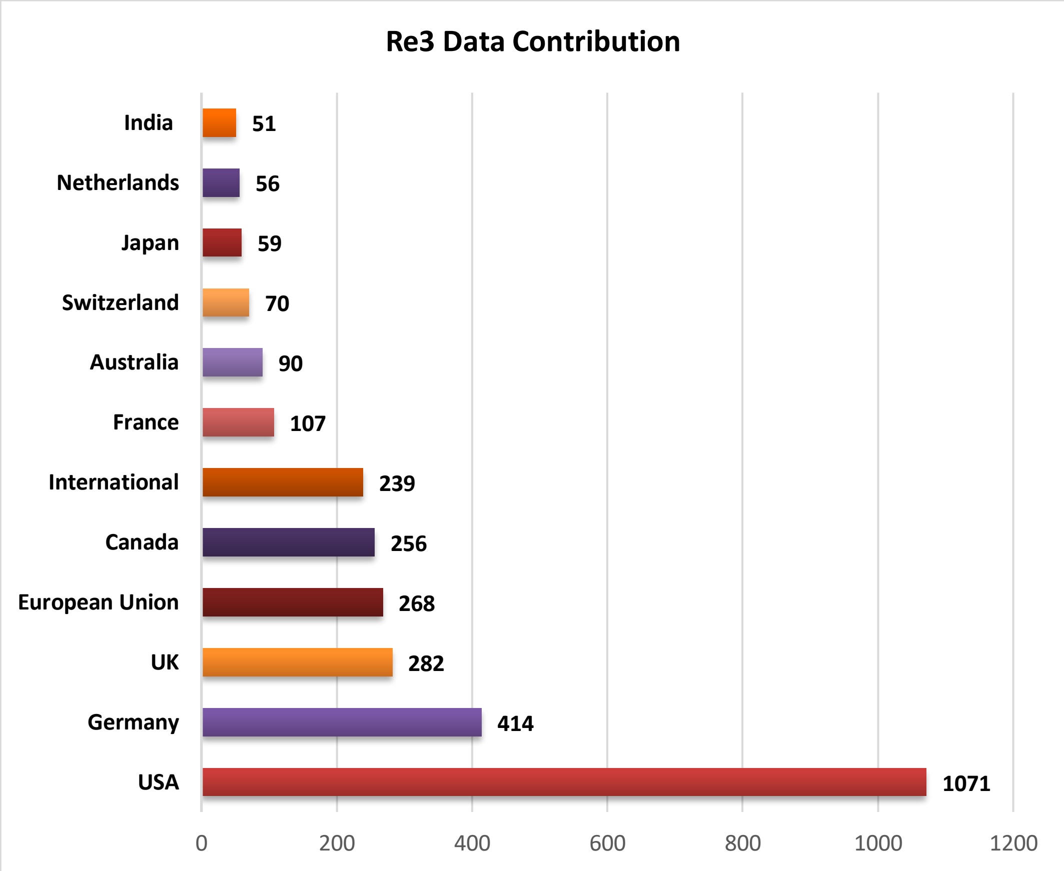


Figure 3.11: Country Types

Investment in Research data management can translate into national development. Hence, each country's primary and ultimate obligation is to handle the research data across all disciplines. In present findings, India's contribution, as opposed to the USA, is very small in the present findings.

3.8 Discussion:

Evidence from the Re3 database investigation discussed in this study suggests that developing countries are inactive to support RDM on the Re3 website. The research improves the standard of demonstrating to librarians and other stakeholders the complexities of RDM activities. Study shows that developing countries fall behind due to unawareness and lack of knowledge. The results addressed librarians and other stakeholders to handle their data with Dublin's core metadata requirements, scientific and statistical data formats, Discipline archives, and to enhance overall consistency in the English language. Ultimately, the results will fill the current gaps by providing data management activities for vogue research. The results cannot prove the best RDM software in all countries due to the lack of available data. Future studies should consider updated research data repositories criteria not only on the Re3 website but also on behalf of the institution's policy.

3.9 Conclusions and Recommendations:

The study shows that the Re3data platform played an important role in improving and organizing research data. In particular, it identifies how research data is organized in the Re3data platform in terms of contribution from subject type, content type, keyword type, metadata standard type, quality management type, language type, software type, repository, and country type.

The study concludes that maximum research data is organized in scientific and statistical format and the USA leads to highly research data being shared with 1060 repositories form the American continent. Europe contributes as much as possible to the exchange and organization of its research data across all the repositories of which Germany is the most relevant of all countries. Japan, from Asia, has highly organized research data, but a huge gap between Japan and the USA. Up to 8% of all research data details are structured in English language, which is also one of the international declared languages.

Disciplinary repository type especially Life Sciences manages the maximum data within 1336 repositories. Dublin core metadata standard is mostly used to define the entity of research data, while maximum software is unknown to processing data. 56% Research Data repositories are certain to support quality management and 11% use multidisciplinary keywords. On the basis of the research findings, the study recommends the following measures to strengthen and develop RDM practices in a sustainable manner:

a. In order to bridge the divide between Science, engineering and social science in particular, study data needs to be exchanged and coordinated across all disciplines.
b. Asian, African countries need to focus more on preserving, organizing, and sharing their research data individually and on the Re3 website to overcome the gap between developed and developing countries.
c. It is necessary to formulate national level data preservation policy and guidelines.
d. Study academics, librarians and other stakeholders need to be aware of RDM.
e. It is needed to develop research data repositories on institutions as well as on the center level.

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4. Impact of the ICT on Academic Libraries

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Abstract:

Continuing development is being undertaken in the fields of computer technology, communication technology and mass storage technology which shape the way libraries access, access, and store, manipulate, and spread information to users. In particular in the form of library collection development strategies, library building and consortia, the ICT has affected every field of academic library activity. ICT offers customers value-added information and access to a wide variety of digital information resources.

Keywords:

ICT, Libraries, Digital Library, Library Management, ICT Tools, Library Services, Librarians, Information Communication Technology.

4.1 Introductions:

The issue of national progress and development remained a catalyst for Information Communication Technology (ICT). Information: power is effectively an endless resource and an essential tool for all sectors of every nation to develop. The application in libraries is therefore important to address the information need of citizens. It is important to do this. Note that the evolution of ICT has had a significant impact on the quality of information supplied by libraries. It also allows library users of all disciplines to be provided with proper and adequate library services. In the 21st century it will not be possible to emphasize the dramatic role of ICT in library operations. Many library and manual routines and operations are now converted into computerized operations, which means ICT techniques to provide better and quicker services for end users. There is no access to information that would allow sustainable development of a country without functional libraries and information centers. In this global era, information gains its power through constant storage and wide-ranging distribution that ICT can achieve. The world is now experiencing a digital scenario according to Janakiraman and Subramaniah (2015), in which the ICT has changed the possibilities of library promotions and changed its anticipated library performance.

The nature of academic libraries has changed by ICT. A number of terms are used for the academic library, such as the hybrid, digital and virtual library. A digital library can be defined as a digital "managed data collection with its related services, which store and access information via the network." “Remote access to library content and services and other information resources combine a compilation of current, highly utilized materials, both in print and in electronic form with an electronic network, that gives access to and provides international library content and business information and knowledge sources from outside the world," the virtual library was defined. Hybrid libraries are libraries which provide both electronic and paper-based access." It is evident from the definitions that most academic libraries today fall into the hybrid category.

The internet provides simple and complex access to information and recovery. Information recovery systems are designed to meet the requirements of end users and thus try to simplify the process. At the same time, however, the user is overwhelmed by so many information and choices that the process is difficult.

- ICT enabled the creation of information in digital format.
- ICT enabled file transfers and on-line access.
- ICT enabled information resource networking and sharing.

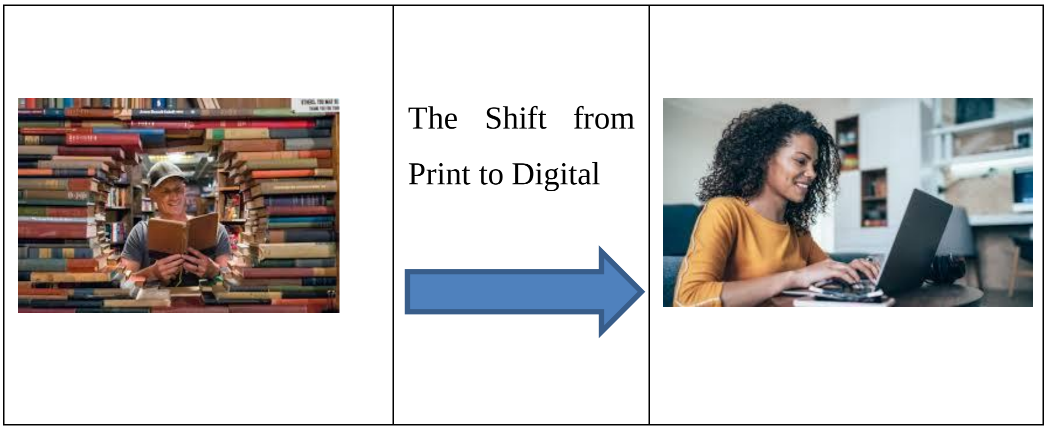

Figure 4.1: Impact of ICT to the Academic Libraries

The transfer from print to digital information has a significant impact on libraries, information centers and other institutions which directly engage in information processing. This shift is usually due to the fusion of computer technology, telecommunications and other industries. The ability of computers to carry out repetitive, error-free, high-volume tasks at speeds much faster than human beings has impregnated society, and recent developments in the areas of computing have made access to data possible in all situations.

The entire library scenario has changed with the developments and application of ICT. Traditional libraries are moved from traditional to hybrid. We see the emergence in the universe of knowledge of libraries with different nomenclatures. These libraries include automated libraries, electronic libraries, digital libraries, etc. The concept of Library 2.0 has been developed in the web environment. These library companies all use various IT applications to carry out activities from material acquisition to information dissemination.

4.2 Impact of ICT on Library Collection Management:

Electronic resources have become very complex and challenging management of collections at this time of information explosion.

The budget is constrained, there are numerous formats, and the user needs always change. Management of collections means participation in tasks such as need analysis, contract negotiation and resource assessment:

Electronic resources: The academic/college library collections changed fundamentally by ICT. The age has passed when the physical collection of the academic library has determined its stature. In the modern era of networked technology, the focus is shifted from ownership of physical resources to accessing global electronic resources.

E-Journals: The e-journal can be defined as a version of a traditional print or paper journal that is electronically distributed directly to the user in one form or another. The newspaper was the primary vehicle for communication between academics and researchers from its inception in 1665, but there have been substantial increases in journal subscription costs over the last decades. The average growth per journal subscription between 1986 and 1996 was 147%. The advent of the Internet transformed publication enabled it to be published radically at low cost. Access to the Internet was also universal. E-Books: E-Books are essentially digitized and electronically distributed books and reference materials. In terms of shelving, binding, circulation, overdue warnings and the management of fines, library library-based e-books save costs. Additional benefits include online accessibility, search capability for keywords, etc.

4.3 Impact on Library Users:

Academic library staff are well aware of the enormous value of printed and electronic resources for academic libraries students. Users don't have the insight necessarily. The users of the new generation library prefer to print resources for electronic resources. They want

- All resources should be fully textual and printable
- The library service should be accessible quickly and easily
- Library services available 24*7 hours
- All transactions in the library should be online

Effects on the user community of these developments

- Improves the literacy level of technology
- Increases demand for better and quicker access.
- It aggravates discrepancies between rich and poor information.

In their life, the users are now exposed to different applications of technology and expect access in their times of need. In libraries, users who know how to use computers and the internet for their research only need a computer with access to the internet. However, this cannot and does not apply to those who, owing to financial difficulties, lack access to such technologies. Two kinds of users, which libraries need to cover: 'has' and 'have-nots' have therefore emerged. In order for all users to have equal access to the data, a balance should be maintained when providing services for both groups. This can be done effectively by using powerful and appropriate technologies.

4.3.1 ICT's Impact on LIS Professionals or Librarians:

The use and use of library services had a new effect on computers and IT. ICT supported library and IT professionals in library services by providing value-added services and by providing more remote access to information resources. ICT can quickly collect stored information and turn our traditional library into a modern library.

Recent ICTs affect various facets of libraries and the information industry. The development of ICT and the widespread use of ICT lead to the replacement of and the dominant form of data storage and retrieval from digital information sources and digital media. It also survives and makes the true regulations for library science: "Each reader's book/information"; "Save the reader's time"; "Library is an organ that grows."

The high information source, fast transmission speed and easy access in the field of information and communication technology guarantee the user's satisfaction with a varied demand, overcome the distance and reduce the time it will take and guarantee correct information for the right reader in due time.

The demand for collection development in the library is also increasing and solving. In fact, it is an excellent tool for centers and libraries.

In order to meet evolving needs, the ICT has created complex challenges for librarians or LIS professionals. The changes must be managed by librarians or LIS professionals with the use of the latest ICT, thus improving performance.

In order to provide quality library services, they must improve the skills and knowledge how of new information and communication technologies.

4.4 Use of ICT Tools:

The emergence of the ICT information revolution has enabled libraries to formulate viable strategies to improve the delivery of services (Igwe, 2010). In order to provide its users with information, Library uses various technologies. Some of the ICT tools that are used mainly for various communication purposes are followed:

a. Communication Technology: Email is the best way to exchange messages and information in electronic format, it is the most effective way of formal communication. There have been revolutionary changes in communication since it is possible to send or receive from some corner of the globe various types of information such as personal message, letter, article, sound, computer programming files, pictures, etc.

This is currently the most useful tool for various communication types (personal, official communication, etc.). This tool can be used to provide the information required at the right time. Libraries are currently using this live tool to serve library users, which basically demands that library material be renewed or returned (check in). The medium for faster information can also be considered.

- Voice mail is the new and innovative mail technology development. We can also say it to email as an alternative. It helps to send the mail through the voice immediately.
- For personal users contact, telephone is used. Users usually ask questions concerning resources and reading room availability. Still, they use the telephone to book carrels in advance for reading and research.
- Fax is described as 'the telephonic transmission of scanned-in printed material (the text or images) usually on a phone number associated with a printer or another output device' by Rouse (2006) (a short fax for fax mail and sometimes called telecopies). The document is scanned by a fax machine which processes the contents as a fixed graphic image (text or pictures) into a bitmap.
- A video conference (or video conference) is explained as "a means by means of computer network transmission of audio and video data, for conducting a conference of two or more participants at different sites. For example, a video-conferencing system point-to-point (two-man) functions similarly to a video phone. Each participant has an on-computer video cameras, microphones and speakers. When they speak to each other, their voices will be transmitted through the networks to speakers of the other, and any pictures appear before the video camera will be displayed on the monitor of the other participant in the window (Beal, n.d.)."
- Internet: it's the ICT's main component. It is essentially a network of networks which connects the computers. The Internet is a communication medium that uses various online tools.

b. Remote Control Technology: Remote control offers a computer system to work with remote control. It is a major technological development. By using this technology, any type of services that are far from the destination are easily implemented. This ICT is generally used to remotely control, to meet online, to share desktops, to confer and to transfer files from one computer to another.

c. Social Media: The main focus for quickest dissemination of information has been social media such as Facebook, Twitter, Blogs, etc. Most libraries are promoting or marketing their e-resources using these social media. Blogs are essentially used to disseminate short-term library communication, while Facebook has become the most useful ICT tool for all kinds of dissemination.

d. Digital Library: Computer and computer network are a basis for digital library libraries because reading material cannot be processed without the computer and no books published can be altered digitally. Computers and networks also depend on the complete reading material in digital libraries such as PDF, HTML, audio, video, and services etc.

e. Use of Library Automation Software: Automating libraries is the excellent way to reduce library services' human participation. Today's automation technology seeks to deliver maximal services in the lowest possible time and cost. The application of ICTs in library and library services is library automation. Many library automation software such as Libsys, Koha, SLIM21, etc. are available for library operation.

The software functions include the authorization, cataloguing, circulation, serials management, inventory verification, etc. The library systems.

4.4.1 Factors That Affect Information Technology in Modern Librarianship:

Why has the technology not moved faster? There are obvious reasons for this:

a. Cost: There has been a lot of publicity recently about costs for libraries and publishers; we must not ignore the effect on users that can now be asked to pay for access to an online database or for searching for an optical disc file and printing out abstracts.
b. Lack of standards: Hardware producers have used different standards until recently. Until recently. Now the Sierra-High standard appears to facilitate CD-ROM processing for software publishers, but standards in other areas like facsimile are still to be developed.
c. Lack of market perception. Publishers do not perceive the new technologies-based library market for new products. For example, there are relatively few libraries and hardly any of their own optical disc or CDROM drives. The Bibliophile's creators sold the product on the drives, and the hardware and software technology now has several imitators. It's not a big market yet.
d. Disc content. There's also over 500 megabytes of a 5-inch CD-ROM. That's a lot of information and it is difficult for publishers to determine logical data groups to assemble on a disc.
e. Only now are graphics and colour becoming widely available.
f. Users are not yet ready to switch only to electronic data from the printed page.
g. Articles only in electronic form are not yet perceived as valid publishing or perishable contributions; these may not be subject to the same thorough academic review and electronic articles are not yet trusted in scholars.
h. Copyright: The Copyright Law of 1976 did not deal with emerging information technology and, in only some degree of success, the Library and Publishing Communities seek to make a joint commitment between the two parties. As full-texts become increasingly available in electronic form, the copyright issue will become even more intensive.
i. Lack of training for staff: Because most librarian personnel are not web-friendly, the application and some library units.

4.5 ICT and Library Services: Using information and communication technology (ICT) the following library services are available:

a. On-Line Public Access Catalogue (OPAC):

The practice of library cataloguing has revolutionized ICT. The holdings of the library collections can be viewed by OPAC users. This reduces the cost of keeping a catalogue of libraries. It also removes pen and paperwork and helps to prepare the union catalogue.

b. Reference/ ILL Service:

The reference service has become very easy by using computer and internet technology. Different types of information resources are available online to provide users with the information required by the encyclopedia, directories, dictionaries, databases, online library collections, maps, biographies, patents and online information resources.

c. Reprographic Service:

For reproduction of documents, reconstruction technology is used. It has become extremely easy and accessible to use technology, copy and reproduce documents. Printed papers are converted into digital form in this technology, followed by a photocopy. Computer and software are necessary for that purpose.

d. Selective Dissemination of Information (SDI) Services:

Hensley (1963) stated that "SDI uses the computer to select those which are of interest for each of the several users from a flow of new documents. The inverse of information retrieval can be considered for this process. A user searches for a file of documents in order to obtain information. In SDI, the search for a standing file of user interests begins with a document."

e. Document Delivery Service:

Due to financial constraints, the library is difficult to acquire all kinds of published resources globally. Thus, it is very important to exchange library resources like books, reviews, etc. among libraries. Computer and the Internet have made a big contribution to DDS to overcome these problems.

f. Bibliographic Service:

Bibliographic services have become practical through the computer. Bibliographic services are now available to users in libraries and publishers. The lists of referrals for the research are helpful for bibliographic software such as EndNote, RefWorks, Zotero and Mendely.

g. Translation Service:

With the help of ICT, mechanical translation is performed. In order to be able to translate from foreign languages into English and vice versa various online instruments like Bablefish translator and Google translator.

h. Database Search Guide:

Databases are currently the focus of the research problem on various types. For their research work, researchers utilize data bases enormously. In the ICT environment it has become very easy to search and retrieve online resources or database data.

4.6 Conclusion:

Effective library application of IT transmits user satisfaction. The current scenario requires updated technology for quicker and more accessible library services. New technologies are gradually being developed so that our abilities and ability to provide improved library services need to be developed. A large amount of library resources must be used.

The success of a library and the professional library always depends on the service quality. ICT's emergence is the new paradigm for extending the operational level of libraries and services. So the library professionals must inevitably be updated with the technology for their very existence.

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5. Application of Blockchain Technology in Library Service: A Study

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Abstract:

Blockchain Technology is incredibly advanced and new tech within the field of library services. This paper aims to analyze the applications of blockchain technology in modern-day libraries. Information for the study was collected extensively from on-line sources. The study found that blockchain technology are often adopted in libraries in numerous ways that like for making associate increased data system, protective digital initial sale right, peer to peer sharing so on. Finally a broad discussion on major advantage and disadvantage of using blockchain technology in the field of library as well as all the area where this technology applicable and it may faces these challenges.

Keywords:

Blockchain Technology, Architecture, Library, Application of Blockchain Technology in Library service.

5.1 Introduction:

Societal changes have created teams of individuals who area unit off from their residency on a permanent or temporary basis thanks to status, statelessness, employment (business-related or seasonal work) or travel, and access to data as provided by libraries has to move with these people. Individuals of all ages who area unit homeless, transient, immigrants, displaced, or off from their usual home base want all sorts of data resources that embody support for acquisition, community integration, new talent development, employment services, research, disaster relief, and amusement. Libraries will give services to those communities that they cannot get anyplace else; but, in most instances these people cannot get a identity card and area unit ineligible to require materials out of the library. This downside will be resolved through the employment of associate practical blockchain-based system that crosses all sorts of library systems and a secure verified digital identity which will be employed in taking part libraries to realize access to data. Blockchain are going to be wont to give unencumbered access to digital content and print collections to all or any potential users in taking part library systems whereas managing risk to confirm that the privacy and private identity of every user is secure. Sovereign Identity (SSI) could be a blockchain application that allows a private or organization to own sole possession and management of their digital and analog identities. Data acquisition and digital inclusion efforts are going to be increased as users gain access to all or any resources in those libraries through the creation of their secure and personal digital identity.

5.1.1 Literature Review:

A literature review was conducted using different websites, blogs and journals through internet. The focus was on articles which outlined what Blockchain technology was, how it could be used, how it is being used, the legal implications of using Blockchain in contracts and the implications for libraries. (Hoy, 2018) noted the potential use of Blockchain for libraries and medical records. (Nowinski & Kozma, 2017) Discuss how Blockchain may be used to "disrupt the existing business models and to explore how this may occur".

The blockchain project of San Jose State University explores the technology for building an enhanced metadata system for the libraries, protecting digital first sale rights, host digital peer- to- peer sharing (Ways to Use Blockchain in Libraries, 2017). (Coghill J. G., 2018) Noted the possibility ofblockchain for the transfer of fund from libraries to vendors and maintaining electronic receipts as digital evidence.

5.1.2 Objective of the Study:

- To know about the basic concept of Blockchain Technology?
- To know how does Blockchain Work?
- Technical architecture view of blockchain
- Application of Block chain technology in Library Service
- Advantage and Disadvantage of Blockchain in Library services

5.1.3 Methodology & Limitation of the Study:

Blockchain technology concept, in its entirety, is new to the field of Library & Information Science. This study is done by collecting and collating information from websites and some renowned journals. It is observed that sufficient information related block chain technology application in library is not available. Therefore, in this study all comprehensive information pertaining to Blockchain Technology is not provided.

5.2 What is Block Chain Technology?

Blockchain, typically named as Distributed Ledger Technology (DLT), makes the history of any digital plus unalterable and clear through the utilization of decentralization and science hashing. a straightforward analogy for understanding blockchain technology may be a Google Doc. after we produce a document and share it with a bunch of individuals, the document is distributed rather than traced or transferred.

This creates a decentralized distribution chain that offers everybody access to the document at a similar time. Nobody is latched out awaiting changes from another party, whereas all modifications to the doc area unit being recorded in period of time, creating changes fully clear. Blockchain is associate particularly promising and revolutionary technology as a result of it helps cut back risk, stamps out fraud and brings transparency in a very ascendible method for myriad uses (builtin.com) (What is Blockchain Technology? How does it work?).

5.2.1 How Does Blockchain Work?

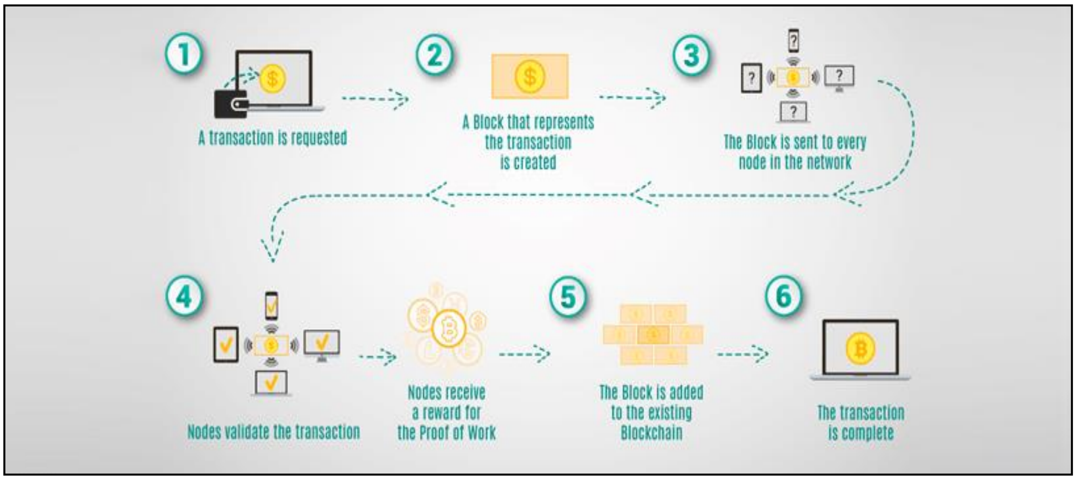

Figure 5.1: Source: https://www.zignuts.com/blogs/how-blockchain-architecture-works-basic-understanding-of-blockchain-and-its-architecture/

5.2.2 Technical Architecture View of Blockchain:

In general, a blockchain system consists of a number of nodes, each of which has a local copy of a ledger. In most systems, the nodes belong to different organizations. The nodes communicate with each other in order to gain agreement on the contents of the ledger and do not require a central authority to coordinate and validate transactions (builtin.com).

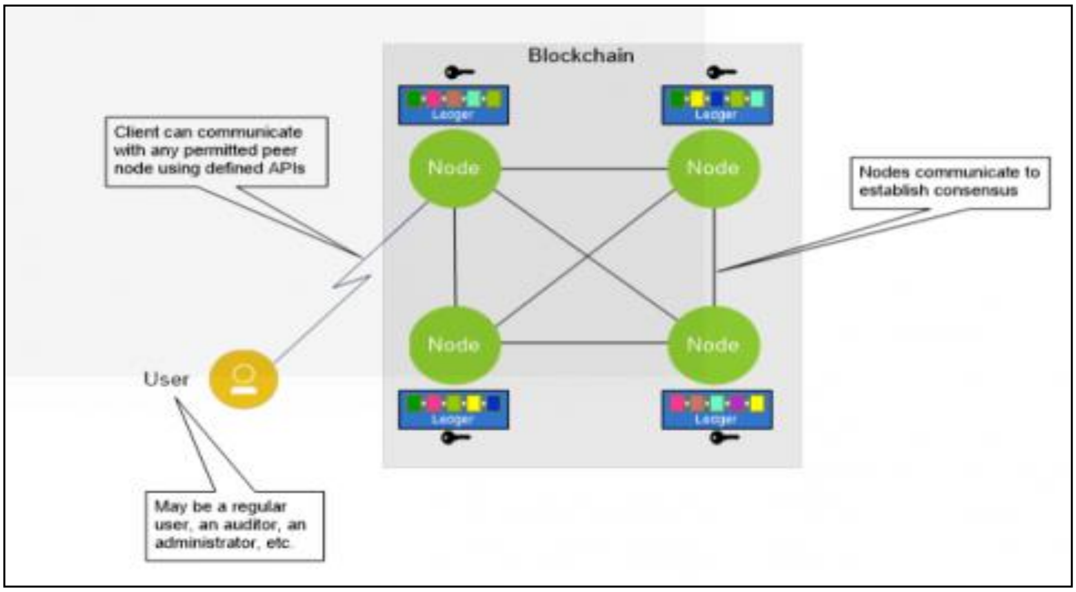

Figure 5.2: Source: https://www.zignuts.com/blogs/how-blockchain-architecture-works-basic-understanding-of-blockchain-and-its-architecture/

The process of gaining this agreement is called consensus, and there are a number of different algorithms that have been developed for this purpose. Users send transaction requests to the blockchain in order to perform the operations the chain is designed to provide. Once a transaction is completed, a record of the transaction is added to one or more of the ledgers and can never be altered or removed. This property of the blockchain is called immutability (ZIGNUTS, 2018).

5.2.3 Different Types of Block Chain:

a. Public Blockchain:

A public Blockchain network or permission less Blockchain network is totally open-ended and anyone willing to participate during this quite network will participate with none permission. This can be the foremost and solely distinction between public and personal Blockchain network. Anyone will participate within the permission less network, execute the accord protocol and maintain the shared open public ledger. Benefits of Public Blockchain: safer than non-public network. Disadvantages of Public Blockchain: Low Privacy, immense process power and energy is needed, less eco-friendly (ZIGNUTS, 2018).

b. Private Blockchain:

A Private Blockchain Network needs letter of invitation to participate within the network. The invite should be valid either by network starter or by the rules/conditions placed by the network starter. Permission Blockchain Network puts restriction to the entry of participant and permits solely the type of participant that's needed within the network. Benefits of Public Blockchain: exaggerated privacy, Environment-friendly as less process power is needed to realize the accord. (as within the case of Public Network). Disadvantages of personal Blockchain: Less secure as compared to public network (ZIGNUTS, 2018).

5.2.4 Why Blockchain Technology Used in Library?

Libraries have a major opportunity to use blockchain technology to advance privacy for users, increase collaboration, and transform the way they work with each other and their communities. By keeping up to date, libraries can evaluate blockchain opportunities and make the best use of this technology. (Meth, 2019)

5.2.5 Application of Block Chain in Library:

Build associate increased information System for Libraries, information Centres: Building a distributed, permission-less information archive has maybe the foremost tumultuous potential. As a result of blockchain operate as a kind of informational ledger that doesn't need a centralized gate keeping organization, they may be accustomed build a really distributed information system for libraries and connected organizations. A blockchain OCLC, if you may such a system would be accessible to any organization, who wishes, with no further expenditures. The system would scale cleanly, whereas still maintaining quality of information through selective reading/output alternative supported hash linguistic communication.

a. Protect Digital Initial Sale Rights: Another probably disruptive plan for data ecosystems is that of the Digital initial Sale as results of obvious possession and digital scarceness. A rights management system engineered on blockchains is clear and at the centre of the many current blockchain comes. Of interest to libraries, specifically, is that the potential for these comes to be a lever for digital initial sale rights.

Mythical being Griffey is within the method of researching such associate degree argument with associate degree internationally-regarded copyright skilled, and can be performing on a paper declaring such over the summer 2017. Whereas DRM of any type isn't fascinating, if by victimization blockchain-driven DRM we have a tendency to trade for the flexibility to possess recognized digital initial sale rights, it's going to be a worthy discount for libraries.

For example: Blockchain involves E-Books, DRM enclosed, https://decent.ch/en/decent-use-case-for-e-book-blockchain-distribution

b. Host Digital Peer-To-Peer Sharing: Library facilitation of peer-to-peer sharing on the far side simply books through blockchain technology might facilitate members of the community attest the supply of various tools or services for a lot of economical sharing economy.

Once fitting meets, performing on necessary project, or fitting reports, blockchain offers folks the tools required for it. It associate degree approach to networking, once eager to file share, may be a distinctive approach. Tho' blockchain makes it tougher to alter these shared documents, it will facilitate in creating it safer.

c. Connect to a Network of Libraries/Universities: Libraries and universities would possibly use the blockchain for the Inter-Planetary classification system (IPFS), a peer to see protocol for a future web that uses bit Torrent, unpleasant person and Blockchain. IPFS circumvents the gate keeping of ISPs and huge web firms. The system would wish seeders on the net to stay copies of internet sites on their computers.

A network of libraries/universities might serve to validate the credentials of a given copy of any website–similar to what miners do for Bitcoin.

d. Facilitate Partnerships across Centres/Organizations: Libraries will partner with museums, universities, and government agencies to share brandy records, authority management, and user-generated content through a blockchain framework.

e. Support Community-Based Collections: A protocol for supporting community-based assortments and borrowing might extend the standard library collection on the far side its walls into the community.

Libraries might deploy a blockchain-based system bedded with “smart contract” code to facilitate the compartmentalisation and sharing of community things (tools, cars, expertise) in a very sharing network. The blockchain would govern who has borrowed things, who originally loaned them, etc. this might be a partnership with code developers and businesses.

5.3 Re-examine Expectations for methods Public Libraries Contribute to town Service:

Examination of civic innovations mistreatment blockchain technology and development of a explanation for why the library can be a perfect home for such initiatives. Libraries have sturdy community trust and voters can connect the aim of libraries to the goals of those new innovations.

a. Give Badges for Skills training: Blockchain may support “badging” for skills nonheritable through coaching. Libraries may attest the content of private skills portfolios.

b. Advantages of Blockchain: Blockchain may be wont to develop a world interlibrary loan pilot for the International Federation of Library Association’s (IFLA) voucher system. IFLA provides re-usable vouchers to assist libraries simply obtain international interlibrary loan requests. Every voucher represents a typical payment for one dealing. Blockchain would lend itself well to international sick due to the foreign currency transactions that happen as a part of this Interlibrary Loan exchange (blockchain would create foreign monetary transactions easier) and thanks to transactional nature of interlibrary loans typically.

Blockchain may be wont to verify the accuracy and consistency (validity) of information over its lifecycle. This is able to involve comparison the hash of the initial records with a hash recorded on the blockchain. If the 2 hashes don't match, the records are altered in a way (Blockchain and also the way forward for libraries: an interview with Sandra Hirsh and Susan Alman).

c. Accuracy of the Chain: Transactions on the blockchain network area unit approved by a network of thousands of computers. This removes most human involvement within the verification method, leading to less human error associated a correct record of data. Even though a pc on the network was to create a process mistake, the error would solely be created to at least one copy of the blockchain. So as for that error to unfold to the remainder of the blockchain, it ought to be created by a minimum of fifty one of the network’s computers—closes to impossibility for an outsized and growing network the dimensions of Bitcoin’s.

d. Cost Reductions: Typically, shoppers pay a bank to verify dealings, an official to sign a document, or a minister to perform a wedding. Blockchain eliminates the requirement for third-party verification and, with it, their associated prices. Business homeowners incur atiny low fee whenever they settle for payments victimization credit cards, for instance, as a result of banks and payment process corporations ought to method those transactions. Bitcoin, on the opposite hand, doesn't have a central authority and has restricted dealings fees.

e. Decentralization: Blockchain doesn't store any of its info in an exceedingly central location. Instead, the blockchain is derived and unfold across a network of computers. Whenever a replacement block is another to the blockchain, each pc on the network updates its blockchain to mirror the amendment. By spreading that info across a network, instead of storing it in one central information, blockchain becomes harder to tamper with.

If a duplicate of the blockchain fell into the hands of a hacker, solely one copy of the data, instead of the whole network, would be compromised.

f. Efficient Transactions: Transactions placed through a central authority will take up to some days to settle. If you conceive to deposit a check on Friday evening, for instance, you'll not really see funds in your account till weekday morning. Whereas monetary establishments operate throughout business hours, 5 days every week, blockchain is functioning twenty four hours each day, seven days every week, and one year a year. Transactions are often completed in as very little as 10 minutes and might be thought-about secure once simply some hours. This can be notably helpful for cross-border trades, which sometimes take for much longer due to time-zone problems and also the undeniable fact that all parties should ensure payment process.

g. Private Transactions: Many blockchain networks operate as public databases, which mean that anyone with an online association will read a listing of the network's dealings history. Though users will access details concerning transactions, they cannot access characteristic info concerning the users creating those transactions. It's a standard misperception that blockchain networks like Bitcoin area unit anonymous, once if truth be told they're solely confidential.

That is, once a user makes public transactions, their distinctive code referred to as a public key, is recorded on the blockchain, instead of their personal info. If an individual has created a Bitcoin purchase on associate exchange that needs identification then the person's identity continues to be coupled to their blockchain address, however a dealings, even once tied to a person's name, doesn't reveal any personal info.

h. Secure Transactions: Once dealing is recorded, its believability should be verified by the blockchain network. Thousands of computers on the blockchain rush to verify that the small print of the acquisition area unit correct. Once a pc has valid the dealings, it's another to the blockchain block. Every block on the blockchain contains its own distinctive hash, together with the distinctive hash of the block before it. Once the data on a block is emended in any means that block's hashcode changes— however, the hash code on the block once it might not. This discrepancy makes it very troublesome for info on the blockchain to be modified by surprise.

i. Transparency: Most blockchains area unit entirely ASCII text file software system, this suggests that anyone and everybody will read its code. This offers auditors the power to review Cryptocurrencies like Bitcoin for security. This additionally implies that there's no real authority on who controls Bit coin's code or however it's emended. Due to this, anyone will counsel changes or upgrades to the system. If a majority of the network users agree that the re-creation of the code with the upgrade is sound and worthy then Bitcoin is often updated.

5.4 Disadvantages of Blockchain:

The challenges are having the time and resources to develop use cases which will offer direction to libraries for mistreatment blockchain as a thought tool.

Blockchain is associate untested construct in libraries, and there'll still be scepticism and reluctance to pursue its use till there are credible samples of the ways in which blockchain will be used successfully for library processes. Alternative problems impacting the implementation of blockchain involve standards, privacy, and legalities, and every of those are highlighted within the book.

While there are vital upsides to the blockchain, there also are vital challenges to its adoption. The roadblocks to the appliance of blockchain technology these days aren't simply technical.

The $64000 challenges area unit political and regulative, for the foremost half, to mention nothing of the thousands of hours (read: money) of custom software system style and back-end programming needed to integrate blockchain to current business networks. Here are a number of the challenges standing within the method of widespread blockchain adoption.

a. Technology Price:

Although blockchain will save users cash on group action fees, the technology is much from free. The “proof of work” system that Bitcoin uses to validate transactions, for instance, consumes Brobdingnagian amounts of process power.

Within the globe, the facility from the voluminous computers on the Bitcoin network is on the point of what Kingdom of Denmark consumes annually. Assumptive electricity prices of $0.03~$0.05 per kilowatt-hour, mining prices exclusive of hardware expenses area unit concerning $5,000~$7,000 per coin.10

Despite the prices of mining Bitcoin, users still come on their electricity bills so as to validate transactions on the blockchain. That’s as a result of once miners add a block to the Bitcoin blockchain; they're rewarded with enough Bitcoin to form their time and energy worthy. Once it involves blockchains that don't use cryptocurrency, however, miners can got to be paid or otherwise incentivized to validate transactions.

Some solutions to those problems area unit starting to arise, for instance, Bitcoin mining farms are created to use solar energy, excess fossil fuel from fracking sites, or power from wind farms.

b. Speed Unskillfulness:

Bitcoin may be a excellent case study for the potential inefficiencies of blockchain. Bit coin’s “proof of work” system takes concerning 10 minutes to feature a brand new block to the blockchain. At that rate, it’s calculable that the blockchain network will solely manage concerning seven transactions per second (TPS).

Though alternative Cryptocurrencies like Ethereum perform higher than Bitcoin, they're still restricted by blockchain. Inheritance whole Visa, for context, will method 24000 TPS.

Solutions to the present issue are in development for years. There are presently blockchains those are self-praise over 30,000 transactions per second.

c. Illegal Activity:

While confidentiality on the blockchain network protects users from hacks and preserves privacy, it conjointly permits for banned commerce and activity on the blockchain network. The foremost cited example of blockchain getting used for illicit transactions is perhaps the Silk Road, a web "dark web" drug marketplace operational from Gregorian calendar month 2011 till October 2013 once it had been pack up by the Federal Bureau of Investigation.6

The website allowed users to browse the web site while not being half-tracked mistreatment the Tor browser and build banned purchases in Bitcoin or alternative Cryptocurrencies. Current U.S. laws need money service suppliers to get info concerning their customers after they open associate account, verify the identity of every client, and make sure that customers don't seem on any list of celebrated or suspected terrorist organizations. This method will be seen as each a professional and a con. It offers anyone access to money accounts however conjointly permits criminals to a lot of simply interact. Several have argued that the nice uses of crypto, like banking the unbanked world, outweigh the dangerous uses of cryptocurrency, particularly once most criminal activity continues to be accomplished through untraceable money.

d. Regulation:

Many within the crypto area have expressed issues concerning government regulation over Cryptocurrencies. Whereas it's obtaining more and more troublesome and close to not possible to finish one thing like Bitcoin as its localized network grows, governments may on paper build it banned to have Cryptocurrencies or participate in their networks. Over time this concern has full-grown smaller as massive firms like PayPal begin to permit the possession and use of Cryptocurrencies on its platform.

5.4 Findings & Conclusion:

Blockchain technology is one in all the latest technology trends in libraries. It's undisputed that blockchain has wonderful potential applications in trendy libraries. It's primarily a ledger technology that uses cryptanalytic techniques and distributed agreement algorithms to induce the options of traceability and un-changeability (Chen etal, 2018). These options are benefitted the libraries for winding up varied operations like protective and sharing authoritative info, preventing copyright problems and digital peer- to- peer sharing etc. It is a immense and untapped space of study that creates each challenges and opportunities to the future educators, researchers and developers. By coming back days, the technology are a lot of visible in libraries as several of the libraries globally have started engaged on a way to harness these in libraries (Babu & Babu, 2020).

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