



Master's Degree in Library and Information Science (MLIS)



INFORMATION COMMUNICATION AND SOCIETY

PART - I

“शिक्षा मानव को बन्धनों से मुक्त करती है और आज के युग में तो यह लोकतंत्र की भावना का आधार भी है। जन्म तथा अन्य कारणों से उत्पन्न जाति एवं वर्गगत विषमताओं को दूर करते हुए मनुष्य को इन सबसे ऊपर उठाती है।”

— इन्दिरा गांधी



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“Education is a liberating force, and in our age it is also a democratising force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances.”

— Indira Gandhi



MLI-101 Information, Communication and Society

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COURSE INTRODUCTION

Information, Communication and Society forms the first course of MLIS Programme of IGNOU. In this course **MLI-101**, aspects of interrelated themes of information and communication are discussed together, considering the symbiotic relationship of those fields and the broader context of information-based society. The entire course is planned to be completed in four blocks.

Block-1 is entitled Information: Nature, Property and Scope and comprises four units. The units are: (i) Data, Information and Knowledge: Intellectual Assets; (ii) Data: Definition, Types, Nature, Properties and Scope; (iii) Information: Definition, Types, Nature, Properties and Scope; and (iv) Knowledge: Definition, Types, Nature, Properties and Scope.

In the first Unit, a clarification of the distinction between data, information and knowledge is presented as a comparative study. In this regard, it has been mentioned that there are numerous definitions of data, information and knowledge in literature. While it is recognised that there are differences between data, information, and knowledge, definitions and the boundaries between them depend on author's perspective. Much confusion can occur by the interchangeable use of these terms. Defining data would appear to be relatively straightforward. According to one author (Haris, 1996), the lowest level of known facts is data; data have no intrinsic meaning, data represent unstructured facts. However, while there is no inherent meaning in data, they are important because they are the raw material for the creation of information. It has been emphasised that when data are sorted, grouped, analysed, and interpreted, they become information. However, rather than reviewing data, information, and indeed knowledge as being discrete, it is perhaps more beneficial to consider a continuum from data through information to knowledge, with the decision as to where a particular item resides being determined both on an individual level, and situationally by its specific context. The Unit emphasises the general meaning, interrelatedness and specific distinctions as these are the tangible forms which can be served in libraries and information centres. The role of libraries and information centres is analysed with reference to four specific situations.

In the second Unit, we learn the meaning and types of data and its pervasive nature throughout human activity, particularly its use in science and technology. It has been stated that data sources form an important part of library resources.

The third Unit presents 'information' from two main perspectives. In the first, 'information' is seen as an element of 'Knowledge Spectrum' with all its implications as a central theme of study. This approach has given rise to the development of a number of disciplines, each of which has a specific focus on 'information'. The definitions of 'information', have a wide ranging variety and no single definition has emerged as common to all disciplines.

In the second perspective, the nature and definition of information, as has been expounded by some of the authorities on the subject is discussed. The study analyses, compares, and critiques a set of writings that have treated and examined the information phenomenon and the way various discourses and understanding of information have been utilised in the field of library and

information studies. The Unit also examines the properties of 'information' in the light of general, scientific and technical and economic and political points of view.

The fourth Unit is concerned with knowledge in all its dimensions. Perhaps the greatest confusion lies in distinguishing between information and knowledge, and some authors use them interchangeably. One view of knowledge, is that it is information combined with context, experience, interpretation, and reflection. However, as knowledge is an interdisciplinary field incorporating many views and definitions. Indeed, there are a number of different types of knowledge discussed in literature. In fact, this Unit captures some of them. It is useful to be able to identify and categories are more amenable to management than others. This Unit briefly discusses the nature of knowledge and its types. It brings out the distinction between personal and public knowledge, and tacit and explicit knowledge rather clearly. It has been emphasised that a key aspect of knowledge is that it is dynamic and thrives on being supplemented, adapted and applied iteratively. Also, it has been pointed out that use and utilisation of knowledge are the final goals of generation of knowledge for the human advancement and this is enhanced by the developments taking place in Information and Communication Technology (ICT). The Unit concludes with a brief discussion on the modes of formation of knowledge. It is hoped that the contents of this block provide useful material to the candidates pursuing the MLIS Programme.

The second block is named Information Generation and Communication. It comprises the following Units: Information, Communication Process, Media and Diffusion (Unit-05), Generation of Information: Models and Forms (Unit-06); Information Theory: Measure and Contents Evaluation (Unit-07); and Digital Information (Unit-08).

Let us try to understand what these units propose to explain us. The first of these Units (Unit-05) Information, Communication Process, Media and Diffusion addresses four important aspects Information, Communication Process, Media and Diffusion of Information.

The concept of information is, without doubt a peculiar one and resisted numerous attempts at both definition and measurement. However, this Unit discusses significant concepts such as information as commodity resource; information as data in the environment; information as representation of knowledge; and information as part of communication process.

The second topic covered in the Unit, is related to the concept of communication. In this regard, attempt has been made to explain the meaning of communication, its forms and channels, and the media of communication in a lucid manner. The third significant aspect described and discussed in the Unit is related to information diffusion. Here again, attempt has been made to draw the attention of the learners to the important features of diffusion process as also to its significance in the design and implementation information systems and services.

The second (Unit-06) unit of this block, presents generation of information in all its ramifications. It has been emphasised that the generation of information follows different paths in different subject areas and is associated with different

modes. To illustrate this point, information generation process in subject areas such as classification, philosophy, and religion has been described and discussed.

Unit-07 entitled Information Theory: Measure and Contents Evaluation, starts emphasising the need for a theory of information by bringing out the importance of information in the present-day society. Different theoretical perspectives of information and different approaches to information theory are then discussed. Syntactic information theory also known as mathematical theory of communication is then taken up for study.

As a first step information is defined and placed in perspective in the context of human thought process. After that, an information measure based on an element of unexpectedness is evolved. Shannons' equation for information measure is derived. The concept of information entropy, and the method of calculating the same has been explained in a simple language. Then the problem associated with efficiency and reliable communication has been addressed. The significance of techniques like source coding and channel coding for improving communication efficiency and reliability have been discussed. Attempt has also been made to explain the basic aspects of semantic information theory. In this regard, semantic-centric, context-dependent and recipient central approaches are discussed. Different approaches to measuring information content are described and explained. It has been stated that Shannon's approach does not concern itself with the semantics of information in messages while semantic information theory places emphasis on substantial information content in messages.

It must be noted here that mathematical theory of communication is the model of communication by Shannon and Weaver. "Through this theory they sought to identify the quickest and most efficient way to get a information transfer from one point to another. Their goal was to discover how communication messages are converted into electronic signals most efficiently and how those signals could be transmitted with a minimum of error. In studying this, Shannon and Weaver developed a mechanism for mathematical model of communication, known as the Shannon Weaver model of communication".

According to the theory, transmission of the message involved sending information. It discusses representation of different kinds of information in digital form. It has been brought out that 'information' is multimedia in nature comprising text, picture, drawings, audio, video, animation and computer graphics. When represented in digital form, information of any kind appears to us as a string of ones and zeros (1s and 0s). This type of representation helps in building systems that are capable of handling ones and zeros only. In fact, this is the underlying principle for adopting digital technology. The Unit also addresses the two distinct aspects of digital fundamentals namely digital coding and binary number system. It also discusses the method of representation of text in digital form as also conversion of textual information in print form, to digital text. Different standards that are currently used for representing multimedia information components along with legal and copyright aspects of digital information are discussed with implementation details. In short, this block contains a lot of useful reading material, which will benefit the learners and forms a programmed text for distance learners.

The third block of the course is named "Information Society". It comprises five units (Units: 9,10,11,12 and 13). The Units are: "Social Implications of Information", "Information as an Economic Resource", "Information Policies: National and International", "Information Infrastructure", and "Information Society", respectively.

The first Unit (i.e. Unit-09) examines the impact of information and knowledge on society in its changing contexts. It may be noted that information and knowledge are deemed to be social wealth and the benefits of this wealth should be available to all the members of the society. The social wealth is available in a variety of physical forms and contents. Improved access to information, through an expanded validity to find and use information effectively and the convergence of technologies, is transforming society. This Unit has addressed several aspects including socio-cultural, political, and technological developments taking place as a result of the impact of information and knowledge in different sectors. The Unit also depicts succinctly the Indian scenario in this regard.

The second Unit (i.e. Unit-10) entitled "Information as an Economic Resource" presents information and knowledge as the key resources for the economic growth and development of the country. The Unit first attempts to differentiate between the two development of the country. The Unit first attempts to differentiate between the two concepts "Information Economics" and "Economics of Information" and emphasises the fact that Information Economics at the micro level deals with problems of information in terms of uncertainty, asymmetry of information between buyers and sellers, in different types of markets such as products, insurance, and job markets. On the other hand, "Information Economics" perceives information/knowledge resource as a factor of production, growth, and development both at macro and micro level of economics. It is also stated that in non-market situations dealing with public goods and services, information operates as a vital factor. The distinction made in recent years, between information and knowledge economics has also been explained by emphasising the fact that information technology has brought about this transformation. The Unit also discusses the new set of paradigms that are evolving keeping knowledge as a basic economic resource as also the scenario obtained in India in this context.

Unit-11, addresses almost all aspects and issues of national information policy. The need of a national information policy is examined with reference to (a) information and knowledge as sources of economic and political power, (b) diversified groups who have a variety of information needs, (c) organised methods to develop information institutions.

There are many issues that need attention while formulating a national information policy. The issues concern access to information and include policy and ethical concerns to who should have access to what information, who should be responsible for information provision, who should pay for what information and topics like information resources, organisation, and structure, user categories, standardisation and international issues of exchange, transborder flow of information, Intellectual Property Rights (IPR) coordination and cooperation at different levels and particular attention to the widening gap between the information rich and information poor. It may be stated that to

meet these challenges will require strengthening existing and building new partnerships across organisational and institutional boundaries and across national boundaries. The Unit includes a brief account of the efforts made by organisational and professional associations in formulating National Information policy. The two significant events of Freedom of Information Act, 2002, and the Information technology Plan of the Special Task Force, which are expected to have far reaching implications as regards the formulation of future National Information Policy, have been briefly discussed in the Unit.

The Unit-12 of this block is about infrastructure that is required at national and international level to support the emerging Networked Electronic Information Society (NEIS). The Unit starts with a discussion on the emerging NEIS, and explains the five goals of NEIS. The goals are: anyone, anytime, anywhere, any information and any format. The impact of NEIS on various societal concepts like education, work culture and environment are discussed. Different information management aspects like acquisition, storage, dissemination, etc. have been briefly described. The Unit also explains the overall architecture of GII briefly. It is stated that the five key issues of GII are: connectivity, capacity, contents, culture, and cost. Further, the Unit briefly mentions the management components of GII and describes different components like access networks, home networks, office networks. Explanation has also been provided for the three corporate networks such as Intranet, Extranet, and VPN. The Unit concludes with a discussion on GII applications and security aspects. The final Unit of Block-3 is "Information Society".

It must be mentioned here that the "Information Society" is a term often used without adequate definition; politicians, those in the media and (sometimes academics) will use it as a "buzz word" to describe the impact of Information and Communication Technologies (ICT). In reality, the information society is much more than that: it can be a set of theoretical perspectives outlining the recent changes in society, it can be used to analyse different scenarios for current and future developments in society, and it can be used by information professional to understand the impact that these changes are having on their role and the changing needs of their users. The Unit discusses the theoretical perspectives and considers impacts for current and future developments in society. Apart from the above aspects, the Unit touches upon the impact of information society from a government and policy perspective. Finally, the Unit examines the practical consequences of the impact that these changes would have on the role of the information professional.

Block-4 happens to be the last block of course MLI-101. It is named Knowledge and Society and comprises three (14,15,16) Units. The first of these units (i.e. Unit-14) is 'Knowledge Society'; the second (i.e. Unit-15) is 'Knowledge Management: Concept and Tools', and the third (Namely Unit-16) is 'Knowledge Profession'.

The first of the Units (Unit-14) examines the features of emerging "Knowledge Society". It may be stated that the transformation of existing societal structures- by knowledge as a core resource for economic growth employment and as a factor of production, constitutes the basis for designating advanced modern society as a "Knowledge Society". In a "Knowledge Society" the older measures

of competitiveness such as labour, costs, resource endowments and infrastructure, get superseded by dimensions such as patents, research and development, availability of (or availability to afford) knowledge workers. In fact, knowledge incubates in the 'human mind' and when applied innovatively becomes a factor of growth and development.

The transformation of global economics to knowledge economics however does not guarantee economic growth with "equity" either within or between nations. This is because knowledge (inspite of its public good characteristics) becomes a much-valued resource to be possessed and harnessed for its economic benefits. Further, the value accrued to individual users through the availability of information is different and this has the potential to further widen the economic and knowledge gap-as people are often not conscious of the global value of what they know or the potential value of absorbing the available information. In other words to create a knowledge society with 'equity' we have to work towards a perfect knowledge society where all forms of knowledge get recognised and valued especially from where they originate, and also end up benefiting that society. In a perfect knowledge society all people have:

- open and timely access to information and knowledge;
- the capacity to absorb and interpret information; and
- avenues and opportunities to use knowledge for informed decision-making and for transformation to higher quality of lives.

The Unit also mentions that Indian economic growth and development derives its strength from the western model adopting ICT as the main operating mechanism. The efforts being made in India are briefly mentioned.

The Second Unit (i.e. Unit-15) is about Knowledge Management: Concepts and Tools. The past decade has been earmarked by a significant transition into the "knowledge era". The knowledge advantage is the only sustainable advantage for organisations in the information age. The increasing competitive pressures in the knowledge era, induced by rapid change, increasing complexity, voluminous information, and increasing uncertainty, compel an organisation's decision-makers to adhere to two imperatives. The first is to learn at rate faster than current and unforeseen competitors and then to capture or incorporate that learned knowledge into the organisation's knowledge bases. The second, to manage the valuable knowledge gleaned from organisational learning into business models, products, services and systems so that the organisation's value propositions are more attractive to customers than the value propositions of competitors. As a consequence, the processes of knowledge creation and knowledge management have become an essential component for organisations competing in to-day's highly competitive environments. Knowledge Management (KM) is defined as "The explicit and systematic management of vital knowledge and its associated processes of creating, gathering organizing, diffusion, use, and exploitation".

However, to fully utilise the KM process requires enabling technologies. The enabling technologies must support knowledge capture, organisation, retrieval, distribution and maintenance. The enabling technologies for KM must also support the various forms (verbal, video, graphic, audio, and even virtual reality)

in which knowledge can be represented and communicated. This Unit discusses some of these aspects in detail.

The last Unit (i.e. Unit-16) relates to “Knowledge Profession”. It starts with the explanation as to what constitutes a profession and its normative principles and goes on to explain the concept of knowledge profession. Knowledge workers are those people in an organisation whose primary work activities include creating using, and distributing information and knowledge. The focus of our attention will be on the worker as also on knowledge profession. KM involves three professional domains: the business domain, the information content domain, and the information technology infrastructure domain. Members of organisation, drawn from each of these domains play different roles in KM. Business experts are those with expert knowledge in the business domain. Their role is knowledge creation, knowledge acquisition and knowledge use to achieve the organisational business objectives. Information content experts are information professionals, records managers, and database managers. They are concerned with acquisition, organisation and transfer of data, information and knowledge themselves if they are experts in business domain, or they may act as intermediaries for others. The role of information technology experts is to provide the technical infrastructure that enables KM processes, which meet the demands of the organisation. All the three types of people are “Knowledge Workers” and therefore belong to “Knowledge Profession”. The Unit deals with the categorisation of knowledge workers and their special characteristics in detail.

To conclude, as we enter into the knowledge era we are witnessing different professions converging on the “Emerging Community of Knowledge Practice” and thus we are seeing the emergence of specialist knowledge professionals with a variety of new titles and job responsibilities appearing in a variety of functions: - knowledge engineer, knowledge editor, knowledge gatekeeper, knowledge brokers, knowledge handyman, knowledge asset manager, knowledge steward, etc. connected with Knowledge Management.

All the three Units of this block (block-4) furnish us with information on the new developments taking place in the information profession and form a helpful text to the learners.

Block 1

INFORMATION: NATURE, PROPERTY AND SCOPE

UNIT 1 DATA, INFORMATION AND KNOWLEDGE: INTELLECTUAL ASSETS

Structure

- 1.0 Objectives
- 1.1 Introduction
- 1.2 Value and Importance of Information
 - 1.2.1 Central and Pivotal Role of Information Today
 - 1.2.2 Information – A Network of Related Concepts
- 1.3 Data, Information and Knowledge
 - 1.3.1 Characteristics and Interrelationships
 - 1.3.2 Comparative Study
- 1.4 Libraries and Data, Information and Knowledge
- 1.5 Summary
- 1.6 Answers to Self Check Exercises
- 1.7 Keywords
- 1.8 References and Further Reading

1.0 OBJECTIVES

After reading this Unit, you will be able to:

- perceive the value, pervasive role and importance of information in today's context of national development;
- distinguish the meaning, distinctive characteristics and interrelationships of data, information and knowledge; and
- recognise the role of libraries servicing data, information and knowledge in different contexts.

1.1 INTRODUCTION

From the primitive days of human civilisation to the present day, information has always been a component of growth and improvement in living standards. In modern societies of today, however, information is closely interlocked with growth and development which is reflected in many ways, as seen in the growth of economic, political, social, occupational, cultural and other sectors. But the concept of information has to be understood in its relation to many other associative concepts such as data, fact, observation, intelligence, skill, knowledge, experience, wisdom and similar others to perceive the impact of information on modern societies. All these concepts, indeed, are very much the creation of human mind. It is, in fact the combination of these concepts and their applications for human resources development that, in effect, contribute to the growth and prosperity of a society. Information and knowledge are, therefore, deliberately being created to meet a variety of challenges posed

to human living. A sea change is taking place in society due to the application of information and knowledge for development. Information Technology with all its spectacular advances has been, in fact, the chief instrument of these revolutionary changes, leading societies to an information age. Creation of new knowledge and information, their processing, storage, retrieval, dissemination, distribution, etc. have become critical areas for industrial investments. Indeed today, information industries are emerging as a major group among modern industries.

Being aware of these fast and sweeping changes taking place in society, libraries are making serious efforts to gear themselves to meet the new challenges of handling and servicing information. In this Unit, we shall study all these aspects with particular focus on the characteristics, interrelationships and comparative utility of data, information and knowledge and their values as human intellectual capital in the context of servicing them through libraries.

1.2 VALUE AND IMPORTANCE OF INFORMATION

All societies ancient, medieval or modern have functioned and prospered on the basis of information and knowledge in their various stages of developments. In the past, the creation of new knowledge, innovations and inventions have been the efforts of a small number of individuals with a passion for and dedication to such activities and, therefore, growth of new knowledge has largely been sporadic and incidental. Application of the new information and knowledge was largely accidental; consequently, progress in terms of material advancement of life had been slow. But from the beginning of this century, more particularly in the last half a century, information has come to occupy the central position, to be reckoned as a driving force for all human development. Let us examine the causes for such a reckoning.

1.2.1 Central and Pivotal Role of Information Today

Some of the factors attributed to the current value of information and knowledge, which have contributed so much to socio-economic developments, are discussed below:

Research and Development (R & D)

It is increasingly realised and recognised that information and knowledge and their application for transformation of non-resources into value-added economic resources are the real driving power for human material progress. This assessment has resulted in the creation of institutions exclusively for Research and Development (R & D) in the last two centuries in the western countries, although initially R & D activities were mostly individual efforts. The output of these R & D activities has been the generation of new information and knowledge. These efforts in science and technology in particular, and the application of this new knowledge for industrial and economic development have brought to the people of the western countries a high standard of life. The infrastructure built for this purpose by these countries has indeed become a model for developing countries to emulate.

Fusion of Science and Technology (S & T)

In the last half a century, there has been a fusion of science and technology that has begun to transform the character of technology itself. For a long time, science has grown independently without relation to technology. But as science developed in association with technology, and integrated framework of reference (conceptual as well as theoretical) resulted offering much greater explanatory power. For instance, the development of solid-state physics, which is the foundation of the electronic revolution, arose out of the work of metallurgists and physicists on the structure of conductor devices. Since technology is the instrumental mode of rational action, Daniel Bell, the well known sociologist, has characterised this new methodological development as **“intellectual technology”** which constitutes a set of algorithms that are embodied in a computer program to represent a formalisation of judgements. Their routine application to many situations is becoming predominant in the management of organisations and enterprises today.

Science and Technology (S & T) and Societal Information

Another important point to note is the last quarter of a century is the increasing emphasis on the application of science and technology to social and economic developments. The organising principle for information systems and services today is a mix of Science, Technology and Societal Information (STSI) for all socio-economic developments. Development, being a complex and multi-dimensional process, involves, information and knowledge inputs of science and technology and their applications. They combine with other forms of society-related information such as political, economic, sociological, demographic, occupational, health, legal, regulatory and environmental information to provide a complete information universe. Development is said to be not merely cultivating the physical resources, but also human resources as well. Any imbalance in these development approaches weakens the overall capacity of a society to transform itself. All these aspects have further reinforced the importance and value of information and knowledge.

Information Technology

The rapidly developing information technology has revolutionised information processing, storage, dissemination and distribution and has been the chief instrument and a major contributing factor to change in society. These technologies are not merely rapidly developing, but they also are converging and integrating, giving an unprecedented push to growth and development in everything.

Information Demand

The demand for information from laypersons to sophisticated specialists and scholars has phenomenally increased in recent decades. Almost every person needs information for some purpose or the other. Access to and availability of information, therefore, has become very crucial.

There are number of pressures that have brought about the demand for information. Some of these pressures and their consequent demand for information are shown in figure 1.1:

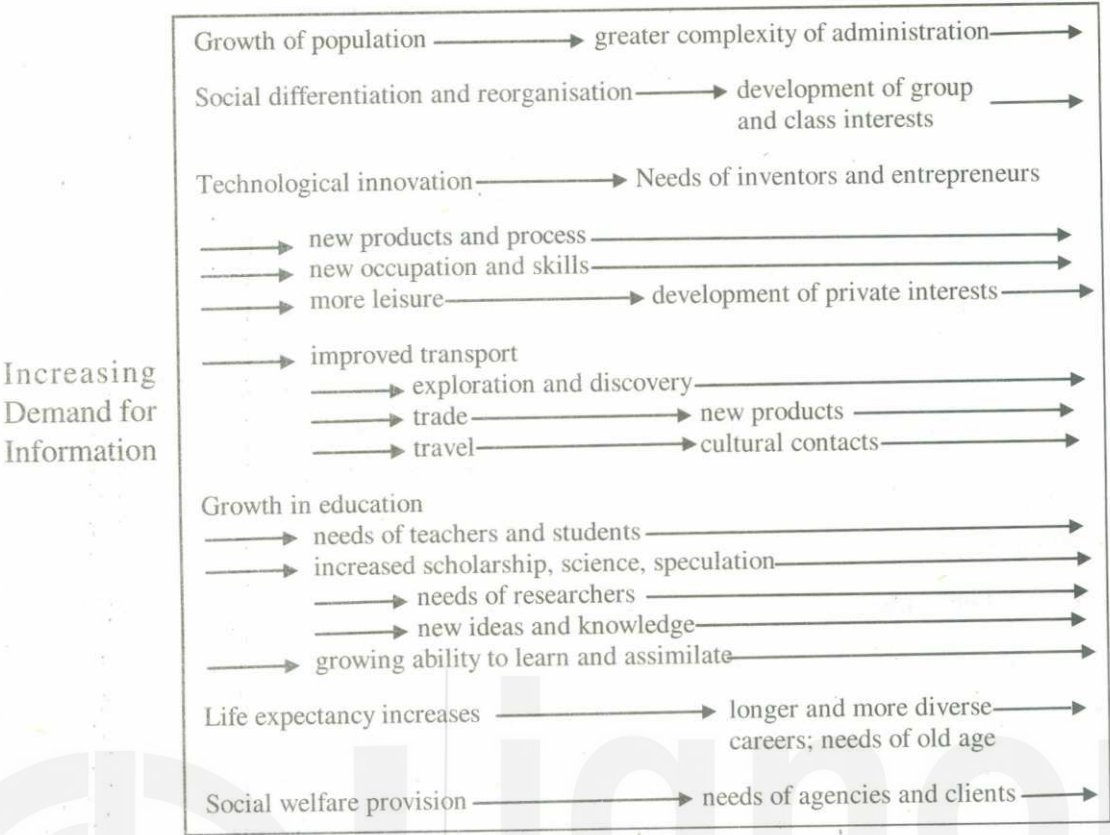


Fig. 1.1: Pressure and Consequent Demand for Information

Power Shift

Information and knowledge have become a tremendous source of economic and political power as they have become the principal driving force for the acquisition of wealth, political strength and more knowledge. Information-rich countries of today are becoming even more powerful than the colonial powers of the nineteenth and early twentieth centuries on account of their expertise in creating new information and knowledge and exploiting them for their advantages.

Self Check Exercise

- 1) Give at least three reasons as to why information has acquired an importance and significance today.

Note : i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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1.2.2 Information – A Network of Related Concepts

You can easily make out from the above that information and knowledge are as essential to development as they have been to sources of power.

Information and knowledge, however, have to be understood in their widest connotation to grasp fully their impact on society. A network of concepts are associated with information and knowledge, such as data, facts, intelligence, know-how, skills, experience and wisdom. It is the combination of all these concepts that go to provide the necessary creative capabilities and competence to transform a non-resource into a value-added economic resource. We shall study in the next section the essential characteristics, interrelationships, value and use of data, information and knowledge, as these are the ones which are most tangible and could be serviced in libraries in whatever physical form they are available.

Self Check Exercise

- 2) Describe the factors contributing to the enhancement of the value of information.

Note : i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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1.3 DATA, INFORMATION AND KNOWLEDGE

Data, information, knowledge and wisdom are the products of the mind that are acquired and perfected. They are not of equal value in terms of utility and application. Rather, they (Data, Information, Knowledge) are evaluated in an ascending scale of values, data having the least value, wisdom the greatest. These concepts in their totality constitute valuable human intellectual assets and hence, serve as the most precious human capital in all developmental processes.

1.3.1 Characteristics and Interrelationships

Data is usually an observed fact, obtained on the basis of a systematic survey or study, relating to a certain activity. For example, social data with reference to urban life and civic amenities, government statistics relating to trade, excise duties, taxes, etc. census figures of population, records of scientific experimental findings and similar others. These have value with reference to studies on subjects connected with these data. These data are analysed and synthesised to derive indicators, provide projections and arrive at valid inferences with

reference to any event or activity and so on.

Information is obtained through processing of data. The storage, retrieval and processing of data become the essential resource for all economic and social exchanges. These include:

- 1) **Data processing of records:** payrolls, government benefits (e.g., social security), bank clearances, credit clearances and the like.
- 2) **Databases:** characteristics and features of population as shown by census data, market research, opinion, surveys, election analysis, bibliographic data and the like.
- 3) **Data processing for scheduling:** airline and railway reservations, production scheduling, inventory analysis, document delivery priorities in libraries and information centres, and the like.

Knowledge, on the other hand, is an organised set of statements of fact or an idea, presenting a reasoned judgement or an experimental result, which is transmitted to others through some communication medium in some systematic form. Knowledge consists of new judgements (research and scholarship) or presentation of older judgements as exemplified in textbooks, in teaching and learning, and collected as library and archival materials. The interrelationship of the three concepts could well be understood from the chart given below:

Data	Raw Material	Cotton
Information	Intermediary	Yarn
Knowledge	Finished Product	Cloth

Note: This example of cotton, yarn, cloth is given here merely to illustrate the interrelationship of data, information, and knowledge. In the context of dressmaking cloth may be a raw material, the finished product may be a suit.

It must be clear from the above descriptions of data, information and knowledge, that these three concepts are interrelated, in the sense that one is the building block of the other. Data is the building block for information and information is the building block of knowledge.

Much of the confusion arises because these distinctions are ignored in common and popular usage of these words. They are used interchangeably, very often, information standing for knowledge or data. But as information professionals we have to understand their distinctions and interrelationships and serve them according to the needs of users.

Self Check Exercise

- 3) Distinguish between data, information and knowledge with an illustrative example.

Note : i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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1.3.2 Comparative Study

Information is news, facts, statistics, reports of contemporary events and activities, legislation, tax-codes, judicial decisions and the like.

Knowledge is interpretation in context, exegesis (critical explanations and interpretations, especially of scriptures), relatedness, conceptualisation and forms of argument. The results of knowledge are theories; the effort to establish relevant relationships or connection between facts, data and other information in some coherent form and to explain the reasons for these generalisations.

Both in everyday use or in the usage of these words among specialists, however, knowledge is universally regarded as a much wider concept than information or data. Knowledge is a summation of many bits of information or data, organised into some sort of a coherent entity. Comprehension and understanding result from the acquisition of information.

Fritz Machlup, the well known scholar in this field, says that information is a process, a flow of messages involving, the act of telling or being told, and knowledge is a state or sense of knowing, an accumulated stock. So we talk of flow of information and stocks of knowledge.

The distinctions between information and knowledge are summed up below as described by Fritz Machlup:

Information	Knowledge
is piecemeal, fragmented, particular;	is structured, coherent and often of enduring significance;
is timely, transitory, perhaps even ephemeral; and	is a stock, largely resulting from the flow, inputs of information; and
is flow of messages	may affect the stock of knowledge by adding to it, restructuring it or changing it in any way.

None of these distinctions relate to practical usefulness; neither information nor knowledge needs to be useful or valuable in all contexts. Nor are we concerned in libraries about popular knowledge or technical knowledge, pedestrian or scholarly knowledge, and useful or useless knowledge. Stocks in libraries are built up on the basis of the needs of users and not based upon any judgement made on them, although we do recognise outdated, obsolete, unused information and knowledge in building up collections and servicing them in libraries in relation to user needs.

Wisdom is an individual trait which comes to one through acquisition of sound knowledge and the related virtues by age and experience. This trait among others may comprise ability to see far ahead into the future, have a vision of things to come and judgement in selecting the right alternatives among several others available for making a decision and so on. While this is the highest form of knowledge, this knowledge cannot be transferred; it is only acquired.

Self Check Exercise

- 4) Why does Machlup consider information as a flow and knowledge as a stock?

Note : i) Write your answer in the space given below.
ii) Check your answer with the answers given at the end of the Unit.

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1.4 LIBRARIES AND DATA, INFORMATION AND KNOWLEDGE

In so far as libraries and information centres are concerned, while these distinctions between data, information and knowledge are useful and necessary to determine the types of services that can be planned and offered, user's information needs are really the determining factor in building up a collection or in serving the clientele. Libraries or information centres are built in support of information needs of the parent organisation, which is involved in some activities. We have taken four typical areas to illustrate these points. These are:

- Education, training and skill developments, research and development;
- Government affairs;
- Business and industry; and
- Mass communication.

We are indicating in figure 1.2 the type of data, information and knowledge that libraries and information centres handle in organising services in the four typical areas mentioned above. In these examples, we are indicating only the broad canvas of data, information and knowledge rather than any specific guidance for organising library and information services. The nature of the end products that may be obtained as a result of the information services is also shown in the figure.

It is also to be noted here that these data, information and knowledge discussed in their respective contexts are not mutually exclusive. In fact any of these types may be of use in any other context.

Education, Training, Skill Development

(Schools, Colleges, Universities, Professional Institutions, R&D establishments)

- Students Learning
- Teachers Teaching & Guiding
- Researchers R&D, Publishing

Government (all developmental activities with a goal of establishing a welfare state)

(Ministries, Councils, Commissions, Departments, Directorates, Bureau etc.)

- Executives, Parliamentarians, Judges, Bureaucrats, Technocrats, Specialists etc.

Industry & Business

Production, Trade & Commerce

(Industrial & Business Undertakings, Financial Institutions)

- Industrialists, Technologists, Economists, Finance Specialists, Legal & regulatory staff etc.

Mass Communications

Current Affairs - events, activities & personalities (national & global)

(News agencies & newspapers, Broadcasting & TV stations, Video/Audio cassette production units etc.)

Editors, Reporters, Column Writers, Production Staff & Disseminators

Data S & T, Social - Abstracts & Original
Info Guides, HD Bks, Manuals, Articles....
Knlg Txt Bks, Monographs, Treatises...

Data All Govt. data with reference to development
Info Articles, Reports, Analysis....
Knlg Consolidated Tech Repts, White Paper, Policy Docs, Plan Repts..

Data Internal, External on Mkts, sales, finance, competitions
Info Articles, Anal. Reports, Briefs & Digests.....
Knlg Consolidated Tech Repts, White Paper, Regulatory Docs

Data On Shares, Weather....
Info News Analysis, Newspaper Articles....
Knlg Consolidated Repts, Press Info Repts, TV & Broadcasting specialised Repts....

Fig. 1.2: Data, Information and Knowledge in Four Different Context

Self Check Exercise

5) Give examples of data, information and knowledge served by libraries and information centres in the context of mass communication.

Note : i) Write your answer in the space given below.
ii) Check your answer with the answers given at the end of the Unit.

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1.5 SUMMARY

In this Unit, we have learnt why information has acquired a strategic significance today, although its role in all societies throughout the past has always been to provide for growth and development. The reasons attributed to the present status of information are:

- The realisation and recognition of information as a vital component in socio-economic development;
- Creation of exclusive R & D institutions, especially in science and technology, to generate new information and knowledge;
- The fusion of science and technology and its synergetic impact under which Information Technology is rapidly advancing;
- The organising principle of information today is a mix of science, technology and societal information, the focus being on socio-economic development;
- Information Technology and its fast increasing impact on changes in society causing, in the process, to transform the society itself into an 'Information Society' as some scholars have maintained; and
- Ever increasing demand for, and supply of information contributes to raising the level and reorganisation of information into a strategic source of economic and political power.

Information has to be examined in its relationship with other concepts, which together constitute the intellectual capital which is the driving force for changes in the society.

While many concepts are associated with information, the three concepts of data, information and knowledge are studied with reference to their general meaning, interrelatedness and specific distinctions as these are the tangible forms which can be served in libraries and information centres.

Finally, the role of libraries and information centres (that handle and service data, information and knowledge) is analysed with reference to four typical situations:

- i) education, training and skill development, research and development;
- ii) government affairs;
- iii) business and industry; and
- iv) mass communication with reference to:
 - a) typical institutions in each of these four areas above;
 - b) categories of users in these institutions; and
 - c) illustrative examples of data, information and knowledge serviced in libraries and information centres attached to these institutions.

1.6 ANSWERS TO SELF CHECK EXERCISES

- 1) The three reasons why information has acquired a special importance and significance today are:
 - i) The realisation and recognition that a good mix of Scientific, Technical and Societal Information is vital to socio-economic development.
 - ii) The demand for information from a lay person or a sophisticated scholar has phenomenally increased today on account of various pressures such as population, social differentiation, technological innovation, education and research, use of leisure, human longevity of life, etc.
 - iii) Information has become the most crucial weapon for acquisition of economic and political power.
- 2) The factor contributing to the enhancement of the value of information are:
 - i) **Research and Development:** The output of various research and development activities results in generation of new information and knowledge. It is being increasingly realised that information and knowledge and their application for transformation of non-resources into value-added economic resources are the real driving power for human material progress.
 - ii) **Fusion of Science and Technology:** Fusion of science and technology has begun to transform the character of technology itself. technology has become the instrumental mode of rational action and their routine application to many situations is becoming predominant in the management of organisations and enterprises today.
 - iii) **Science and Technology and Societal Information:** The increasing emphasis on the application of science and technology to social and economic developments is another factor contributing to the enhancement of the value of information. The organising principle for information systems and services today is a mix of Science, Technology and Societal Information (STSI) for all socio-economic developments.

- iv) **Information Technology:** The rapidly developing Information Technology has revolutionised information processing, storage, dissemination and distribution. It is the chief instrument and a major contributing factor in the enhancement of the value of information.
 - v) **Information Demand:** The demand for information from lay persons to specialists and scholars have increased phenomenally in recent decades. Access to and availability of information, therefore, has become very crucial.
 - vi) **Power Shift:** Information and knowledge have become a tremendous source of economic and political power as they have become the principal driving force for the acquisition of wealth, political strength and more knowledge for development.
- 3) Data is undifferentiated observation of facts in terms of words, numbers, symbols, etc. For example, scientific data collection in a laboratory experiment, social data with reference to population, or trade statistics, price index, etc.

Information is processed data. For example, analysis of population data with reference to scientific and technical personnel in a country, weather forecasting based on the data collected on atmospheric conditions built up on the high seas, inferences obtained on the properties of materials acquired from moon, etc.

Knowledge is consolidated and structured information as in encyclopaedic articles, state-of-the-art reports, textbooks, etc.

- 4) By definition, information is piecemeal, unstructured, timely, etc. and the main purpose of information is to inform. The communication aspect is implied in information which flows from a sender to a receiver. Knowledge is a consolidation of validated data and information that constitutes a body of coherent and structured reservoir. To this body is added further knowledge and hence, this keeps on increasing as a stock, at times leading to modification of existing knowledge.
- 5) **Data**, e.g., trade and industrial statistics, price index, entertainment announcements, etc.

Information, e.g., processed information of weather to warn farmers during times of monsoons, stock exchange information for investments, reports of music concerts, news about national and international events, etc.

Knowledge, e.g., press responsibilities vis-à-vis democratic institutions in the form of a report, international information order as exemplified by the third world countries meetings, the books such as '*Many Voices One World*' published by UNESCO, etc.

1.7 KEY WORDS

Algorithm

: Instructions for carrying out a series of logical procedural steps in a specific order.

- Human Intellect** : Skills of all variety necessary for all round development.
- Information Age** : A period characterised by domination of information.
- Information Industry** : Market place created by the convergence of computers, telecommunication and micro-electronics.
- Information Technology** : Acquisition, processing, storage and dissemination of information by a combination of base technologies such as microelectronics, computers and communications.
- Synergetic Effect** : An effect produced as a result of combination of two or more forces representing more than their mere summation.

1.8 REFERENCES AND FURTHER READING

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UNIT 2 DATA: DEFINITION, TYPES, NATURE, PROPERTIES AND SCOPE

Structure

- 2.0 Objectives
- 2.1 Introduction
- 2.2 Meaning of Data
- 2.3 Types of Data
 - 2.3.1 Types of Data in Sciences
 - 2.3.2 Types of Data in Social Sciences
- 2.4 Nature and Properties of Data
 - 2.4.1 Types of Data in Social Sciences
 - 2.4.2 Properties of Data
- 2.5 Scope of Data
- 2.6 Summary
- 2.7 Answers to Self Check Exercises
- 2.8 Keywords
- 2.9 References and Further Reading

2.0 OBJECTIVES

After reading this Unit, you will be able to:

- explain the meaning of data;
- describe their types, nature and properties;
- examine the scope of data in different fields; and
- assess the place of data in library services.

2.1 INTRODUCTION

Having studied the preceding Unit, you are now in a position to distinguish between data and information, and between information and knowledge. You have reached a stage where you will be able to recognise the place of data in total research.

A study of this Unit will be useful in getting yourself acquainted with the meaning of data, their types, nature and properties. It will also enable you to assess the scope of data in different fields of knowledge and to recognise how important it is to acquire data in order to enrich library service.

2.2 MEANING OF DATA

The word 'data' is Latin in origin, and literally, it means anything that is given. Different sources have defined the word in different ways. *Webster's Third*

New International Dictionary defines data as “something given or admitted; facts or principles granted or presented; that upon which an inference or argument is based, or from which an ideal system of any sort is constructed”. According to *Oxford Encyclopaedic English Dictionary* data are “known facts or things used as a basis for inference or reckoning”. These dictionaries also state that even though data is the plural form of datum, it is often treated as a singular collective noun. Hence, its treatment as a singular noun is equally acceptable. For the sake of consistency, however, the word is used in this Unit as the plural form of *datum*.

UNESCO defines data as ‘facts, concepts or instructions in a formalised manner suitable for communication, interpretation or processing by human or automatic means’. Robert A. Arnold, in his *‘Modern Data Processing’* [Wiley, 1972], has defined the terms in the context of commerce as a function of business and accounting. *Dictionary of Modern Economics* defines data as “observations on the numerical magnitude of economic phenomena such as national income, unemployment, or the retail price”.

Data are defined in *McGraw-Hill Encyclopaedia of Science and Technology* as ‘numerical or qualitative values derived from scientific experiments’. While another definition of data in Sciences is obtainable from CODATA (Committee on Data for Science and Technology) as quoted by Luedke and others in ARIST, 12, 119-181. CODATA defines data as a “crystallised presentation of the essence of scientific knowledge in the most accurate form”. According to this definition, clarity and accuracy are two essential attributes of data. One also learns of yet another attribute of data from the CODATA definition. That is to say, data are the essence of the matter. The phrase ‘essence of scientific knowledge’ in this definition is synonymous with ‘qualitative values derived from scientific experiments’ as given in the McGraw-Hill definition.

In social sciences, data are stated as values or facts, together with their accompanying study design, code books, research reports, etc. and are used by researchers for the purpose of secondary analysis. At one extreme, economics and demography have been heavily quantitative materials or observations. Sociology and, more recently, political science, fall between these two extremes. The change in research orientation in the subject can be seen with changing data, especially with data relating to public opinion.

In humanities, the text such as Biblical materials or Shakespeare’s drama deals with a fixed quantity of data represented by a finite amount of text to be interpreted. Clashing interpretations may be irresolvable, since each interpretation views the text differently, while the text to be interpreted may be finite and fixed. However, in sciences, the total text is to be interpreted and the text of data is not fixed before interpretation. The text of fact is constantly expanding. Scientists not only observe facts but also use instruments to generate more systematic data.

In Information Science, Shuman [BASIS, 1975, 1(7), 11-12,34] defines data as “quantitative facts derived from experimentation, calculation, or direct observation”. Shuman opines that a more meaningful definition of data is “the symbolisation of knowledge”.

To understand further, we can say that data or facts have no shape that is relevant to a particular viewpoint. It must be given relevance, arrangement, coherence, usefulness within a definite framework of meaning, intent or interest.

Self Check Exercise

1) Write a paragraph explaining the meaning of data.

Note : i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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2.3 TYPES OF DATA

In order to understand the nature of data it is necessary to categorise them into various types. Different categorisations of data are possible. The first such categorisation may be on the basis of disciplines, e.g., Sciences, Social Sciences, etc. in which they are generated. Within each of these fields, there may be several ways in which data can be categorised into types. For the sake of convenience we shall discuss the types as present in sciences and then in social sciences.

2.3.1 Types of Data in Sciences

The CODATA Task Group on Accessibility and Dissemination of Data (CODATA/ADD) recognised in 1975 the need for categorising data while working on its report on the problems of accessibility of data. The Task Group evolved a scheme according to which the following categories of scientific data are formed:

- i) **Data with reference to time factor:** Based on time factor, data can be classified into the following two types:
 - a) ***Time-independent data*** – The term refers to the data, which can be measured repeatedly, e.g., data in geosciences and astronomy such as geological structures, rocks, fixed stars, etc.
 - b) ***Time-dependent data*** – These can be measured only once, e.g., certain geophysical or cosmological phenomena like volcanic eruptions and solar flares. Likewise, data pertaining to rare fossils are time-dependent data.
- ii) **Data with reference to location factors:** Data with reference to location factor can be categorised as follows:
 - a) ***Location-independent data*** – These are independent of the location of objects measured, e.g., data on pure physics and chemistry.

- b) **Location-dependent data** – These are dependent on the location of objects measured. Data in earth sciences and astronomy normally belong to this category. Data on rocks are also location dependent.
- iii) **Data with reference to mode of generation:** There are three types of data under this category. These are:
 - a) **Primary data** – Data are primary when obtained by experiment or observation designed for the measurement, e.g., values of velocity derived by measuring length and time.
 - b) **Derived (reformatted) data** – These data are derived by combining several primary data with the aid of a theoretical model.
 - c) **Theoretical (predicted) data** – These are derived by theoretical calculations. Basic data such as fundamental constants are used in theoretical calculations, e.g., data concerning solar eclipses are predicted with the use of celestial mechanics.
- iv) **Data with reference to nature of quantitative values:** These are categorised into the following two classes:
 - a) **Determinable data** – Data on a quantity, which can be assumed to take a definite value under a given condition, are known as determinable data. Time-dependent data are usually determinable data, if the given condition is understood to include the specification of time.
 - b) **Stochastic data** – Data relating to a quantity, which take fluctuating values from one sample to another, from one measurement to another, under a given condition are referred to as stochastic. In geosciences, most data are stochastic.
- v) **Data with reference to terms of expression:** The categorisation in this case yields three classes of data:
 - a) **Quantitative data** – These are measures of quantities expressed in terms of well-defined units, changing the magnitude of a quality to a numerical value. Most data in physical sciences are quantitative data.
 - b) **Semi-quantitative data** – These data consist of affirmative or negative answers to posed questions concerning different characteristics of the objects involved, e.g., in biology, classification of organisms is based upon a set of 'Yes' and 'No' responses to questions concerning morphological, biochemical and other characteristics of species. Such data are regarded as semi-quantitative. 'Yes' and 'No' can be coded as '1' and '0' (zero) for obtaining numerical data.
 - c) **Qualitative data** – The data expressed in terms of definitive statements concerning scientific objects are qualitative in nature. Qualitative data in this sense are almost equivalent to established knowledge.
- vi) **Data with reference to mode of presentation:** These are categorised as numerical, graphic and symbolic data.
 - a) **Numerical data** – These data are presented in numerical values, e.g., most quantitative data fall in this category.

- b) **Graphic data** – Here data are presented in graphic form or as models. In some cases, graphs are constructed for the sake of helping users grasp a mass of data by visual perception. Charts and maps also belong to this category.
- c) **Symbolic data** – These are presented in symbolic form, e.g., symbolic presentation of weather data.

These are, six basic types of scientific data based on the nature of data. Within these six types, there exist fifteen different classes of data.

Self Check Exercise

- 2) Write a note on the parameters used in categorising data in Sciences.

Note : i) Write your answer in the space given below.

- ii) Check your answer with the answers given at the end of the Unit.

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2.3.2 Types of Data in Social Sciences

As in sciences, data in social sciences are also organised into different types so that their nature can be easily understood. The following categorisation is normally observed in social sciences:

- i) **Data with reference to scale of measurement:** Based on the scale of measurement, data can be categorised as follows:
 - a) **Nominal data** – The nominal scale is used for assigning numbers as the identification of individual unit. For example, the classification of journals according to the discipline they belong to, may be considered as nominal data. If numbers are assigned to describe the categories, the numbers represent only the name of the category.
 - b) **Ordinal data** – It indicates the ordered or graded relationship among the numbers assigned to the observations made. These numbers connote ranks of different categories having relationship in a definite order. For example, to study the responsiveness of library staff a researcher may assign '1' to indicate poor, '2' to indicate average, '3' to indicate good and '4' to indicate excellent. The numbers 1, 2, 3 and 4 in this case are set of ordinal data which indicate that 4 is better than 3 which in turn is better than 2 and so on. The ordinal data show the direction of the difference and not the exact amount of difference.
 - c) **Interval data** – Interval data are ordered categories of data and the differences between various categories are of equal measurement.

For example, we can measure the IQ (Intelligence Quotient) of a group of children. After assigning numerical value to the IQ of each child, the data can be grouped with interval of 10, like 0 to 10, 10 to 20, 20 to 30 and so on. In this case, '0' does not mean the absence of intelligence and children with IQ '20' are not doubly intelligent than children with IQ '10'.

- d) **Ratio data** – Ratio data are the quantitative measurement of a variable in terms of magnitude. In ratio data, we can say that one thing is twice or thrice of another as for example, measurements involving weight, distance, price, etc.
- ii) **Data with reference to continuity:** Data with reference to continuity can be categorised as follows:
- a) **Continuous data** – Continuous data are an infinite set of possible values. Between a range there are infinite possible values. For example, height of an individual is not restricted to values like 155 cm. and after that to 156 cm. It can be 155.59 cm. or 155.99 cm. – continuous value.
 - b) **Discrete data** – The discrete data are finite or potentially countable set of values. For example, the number of members in a library. It can be 2,575 or 2,599 but certainly not 2,599½. Similarly, the number of citizens in a country, the number of vehicles registered is the examples of discrete data.
- iii) **Data with reference to number of characteristics:** Data can also be categorised on the basis of number of variables considered. These are:
- a) **Univariate data** – Univariate data are obtained when one characteristic is used for observation, e.g., the performance of student in a given class.
 - b) **Bivariate data** – Bivariate data result when instead of one, two characteristics are measured simultaneously, e.g., height and weight of tenth class students.
 - c) **Multivariate data** – Multivariate data consist of observations on three or more characteristics, e.g., family size, income and savings in a metropolitan city in India.
- iv) **Data with reference to time:** There are two types of data under this category. These are:
- a) **Time series data** – Data recorded in a chronological order across time are referred to as time series data. It takes different values at different times, e.g., the number of books added to a library in different years, monthly production of steel in a plant, yearly intake of students in a university.
 - b) **Cross-sectional data** – This refers to data for the same unit or for different units at a point of time, e.g., data across sections of people, region or segments of the society.

- v) **Data with reference to origin:** Data under this category can be put as follows:
 - a) **Continuous data** – The data obtained first hand from individuals by direct observation, counting, and measurement or by interviews or mailing a questionnaire are called primary data. It may be complete enumeration or sampling, e.g., data collected from a market survey.
 - b) **Secondary data** – The data collected initially for the purpose and already published in books or reports but are used later on for some other purpose are referred to as secondary data. For example, data collected from census reports, books, data monographs, etc.
- vi) **Data with reference to characteristic:** Data can be categorised on the basis of the characteristics as follows:
 - a) **Quantitative data** – When the characteristic of observation is quantified we get quantitative data. Quantitative data result from the measurement of the magnitude of the characteristic used. For example, age of a person, price of a commodity, income of a family, etc.
 - b) **Qualitative data** – When the characteristic of observation is a quality or attribute, we get qualitative data. For example, sex or colour of a person, or intelligence of a student.

Self Check Exercise

3) How are data categorised in social sciences?

Note : i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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2.4 NATURE AND PROPERTIES OF DATA

2.4.1 Types of Data in Social Sciences

To understand the nature of data, we must recall, what are data? and what are the functions that data should perform on the basis of its classification? The first point in this is that data should have specific items (values or facts), which must be identified. Secondly, specific items of data must be organised into a meaningful form. Thirdly, data should have the functions to perform. Furthermore, the nature of data can be understood on the basis of the class to which it belongs. We have seen that in sciences there are six basic types within which there exist fifteen different classes of data. However, these are not mutually exclusive. There is a large measure of cross-classification, e.g., all

quantitative data are numerical data, and most data are quantitative data. With reference to the types of data; their nature in sciences is as follows:

Numerical data: All data in sciences are derived by measurement and stated in numerical values. Most of the time their nature is numerical. Even in semi-quantitative data, affirmative and negative answers are coded as '1' and '0' for obtaining numerical data. Thus, except in the three cases of qualitative, graphic and symbolic data, the remaining twelve classes yield numerical data.

Descriptive data: Sciences are not known for descriptive data. However, qualitative data in sciences are expressed in terms of definitive statements concerning objects. These may be viewed as descriptive data. Here, the nature of data is descriptive.

Graphic and symbolic data: Graphic and symbolic data are modes of presentation. They enable users to grasp data by visual perception. The nature of data, in these cases, is graphic.

Likewise, it is possible to determine the nature of data in social sciences also. We can do this again with reference to the types of data in social sciences, which are not necessarily mutually exclusive. The data in social sciences can be either enumerative or descriptive in nature. Whenever the data are derived by enumeration, their nature is enumerative. The data that describe the phenomena are descriptive.

Enumerative data: Most data in social sciences are enumerative in nature. However, they are refined with the help of statistical techniques to make them more meaningful. They are known as statistical data. This explains the use of different scales of measurement whereby they are graded.

Descriptive data: All qualitative data in social sciences can be descriptive in nature. These can be in the form of definitive statements. However, if necessary, numerical values can be assigned to descriptive statements, which may be reduced to numerical data.

In the context of social sciences, it is possible to examine the nature of data in library science. Their nature can be either bibliographic or non-bibliographic. The former is descriptive while the latter is enumerative. All cataloguing and indexing data are bibliographic, whereas all management data such as books acquired, books lent, visitors served and photocopies supplied are non-bibliographic.

Having seen the nature of data, let us now examine the properties, which the data should ideally possess.

2.4.2 Properties of Data

For examining the properties of data, reference to the various definitions of data discussed in Section 2.2 is necessary. Reference to these definitions reveals that following are the properties of data: 1) amenability of use, 2) clarity, 3) accuracy, and 4) the quality of being the essence of the matter. Each of these may be discussed further.

Amenability of use: From the dictionary meaning of data it is learnt that data are facts used in deciding something. In short, data are meant to be used as a

base for arriving at definitive conclusions. They are not required, if they are not amenable to use. The use may differ with the context. Amenability to use nevertheless remains a characteristic of data.

Clarity: According to the CODATA definition, data are a crystallised presentation. This means data should necessarily display so essential for communicating the essence of the matter. Without clarity, the meaning desired to be communicated will remain hidden.

Accuracy: Data should be real, complete and accurate. Accuracy is thus, an essential property of data. Since data offer a basis for deciding something, they must necessarily be accurate if valid conclusions are to be drawn.

Essence: In social sciences, large quantities of data are collected which cannot be presented, nor is it necessary to present them in that form. They have to be compressed and refined. Data so refined can present the essence or derived qualitative value, of the matter. Data in sciences consist of observations made from scientific experiments, these are all measured quantities. Data, thus, are always the essence of the matter.

Besides the above four properties, three more properties are evident, more particularly in social sciences. They are the properties of being aggregated, compressed and refined.

Aggregation: Aggregation is cumulation or adding up. For example, monthly data are added up to form a consolidated annual cumulation. Cumulative percentages are always worked out in data presented on a variable in tabular form. In social sciences, aggregation is of great importance. For instance, production figures, crop yield, export and import statistics and census data are cases of aggregation.

Compression: Large amounts of data are always compressed to make them more meaningful. To present the essence of the matter, it is necessary to compress data. Compressed data are manageable and can be grasped quickly. There exist a number of techniques to compress data to a manageable size. Graphs and charts are some examples of compressed data.

Refinement: Data require processing or refinement. When refined, they are capable of leading to conclusions or even generalisations. This refinement can then discover new facts. Bradford's bibliography denoting the scatter of a subject or Garfield's historiography denoting the development of a discipline are two examples of data refinement. Conclusions can be drawn only when data are processed or refined.

Self Check Exercise

4) Write a note on data as a crystallised presentation.

Note : i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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2.5 SCOPE OF DATA

Scope of the data can be studied from the following points of view:

Utility of Data – Data have great utility of their use in the growth of knowledge. No research, investigation, experiments, etc. is possible without reference to data already existing. Nor does any research end without generating new data. No decision-making system can work, nor can a problem be solved, without adequate use of data. No planning is conceivable without enough data. For want of sufficient data research results or conclusions drawn from an enquiry are automatically rendered untenable.

Data also alter concepts and remove uncertainty. Data, then, are indispensable in research and in planning and decision-making. The importance of data is no less in managing libraries and library services.

Size of Data – Size of the data involves the coverage of the subject under study, data elements, and data population covering documents, data banks, and field survey methods (questionnaire, interview, observations, etc.). In science what already exists is in the form of data. According to an Aslib statement, scientific data include:

- the properties and attributes of an individual entity;
- the values of one property over many entities;
- variations of one property of one entity under different conditions;
- classification of entities based on properties; and
- quantitative relations between two or more entities.

There are equations and formulae, properties and values, actions and reactions and conditions and variations. All these, when stated, form data. There also exist numerous data banks, e.g., Chemical Formulary and British Pharmacopoeia. The scope of data in sciences is, thus, very vast.

All world governments are involved in socio-economic upliftment. Most applied research all over the world, therefore, is being conducted nowadays at the behest of the state. Every government has established its own data system for collecting and organising data concerning all human activities. We, in India, have a number of agencies responsible for organising data in their respective fields, e.g., Indian Meteorological Department, Survey of India, Indian Statistical Organisation, National Sample Survey, Census of India and several others. Governments cannot frame policies and formulate plans unless large amounts of data are available as a basis. This explains the establishment of National Information Centre.

There also exist international bodies like International Monetary Fund, International Labour Organisation and scores of other UN agencies that collect

and organise data as an indispensable aid in policy research. Management and administrative data called operational data are gathered by institutions, public or private, national or international, in the performance of their functions. No worthwhile socio-economic programme nor pure economic planning is possible without a supportive data system. Social Sciences are known for a plethora of data banks. Thus, data are pervasive in all human endeavours in all fields of knowledge.

Period of Data – Data collection for any research problem must indicate the time span. It should be clearly stated whether data period is current or cumulative. In Sciences the interpretations and conclusions are mainly drawn keeping in view the whole text of the subject. In Social Sciences and Humanities, however, the cumulative period is not taken into account for data collection.

The importance of data in library service is manifold. Librarians are users of data in more than one way. They collect bibliographic data for providing services and generate and use non-bibliographic data for managing these services. Apart from these, they are required to make available data to researchers and planner according to their subject interests. It is, thus, necessary to ensure that relevant data sources are available in the library in order that the users may be assisted with appropriate and adequate data in their decision process. It is seen that there exists no field of knowledge, no human activity where data can be dispensable. All investigations begin and end with data. In intellectual pursuits data are all pervasive, only their nature varies with the event.

Self Check Exercise

5) ‘Data pervade all human endeavour’. Elaborate.

- Note :** i) Write your answer in the space given below.
ii) Check your answer with the answers given at the end of the Unit.

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2.6 SUMMARY

‘Data’ literally, means anything that is given. They are facts or information used in discussing or deciding something. In short, the term ‘data’ includes facts, figures, letters symbols, words, charts or graphs that represent an idea, object or condition. The term, thus, connotes diverse things. Unlike codes, data are measured quantities or derived qualitative values. Data constitutes the basis for drawing conclusions, taking policy decisions and formulating and implementing plans.

Amenability to use, clarity, accuracy, and essence of the matter, aggregation, compression and refinement are the properties of data. Because of these properties, data are usable in investigative studies. In order to know the nature of data, it is first necessary to categorise them into various types. While there is one set of data types in sciences, there is another in social sciences. Dependent upon the characteristic and categorisation used, different data types can be derived.

By nature, data are either quantitative or qualitative. Quantitative data are numerical and qualitative data are descriptive. It is possible to transform qualitative data into numerical values. Additionally, in sciences, data can also be graphic in nature. In social sciences, however, the nature of data is either enumerative (quantitative) or descriptive (qualitative). Enumerative data can often be statistical in nature. Graphic data also exist in social sciences. In the context of library science, data are either bibliographic or non-bibliographic.

The scope of data is truly vast. Data pervade all sciences, all investigations, all human activities, planning and implementation. They provide the basis for conclusions drawn. All techniques used in research are aimed at collecting objective data, which lead to the creation of new knowledge. The scope of data in library service cannot be over emphasised. Data sources form an equally important part of library resources.

2.7 ANSWERS TO SELF CHECK EXERCISES

- 1) Literally, the word 'data' means anything that is given. Data are facts or information used in discussing or deciding something. The term connotes diverse things. In sum the term includes facts, figures, letters, symbols, words, charts, and graphs that represent an idea, object or condition. Data are measured quantities or derived qualitative values. Data forms the basis for drawing conclusions, taking policy decisions and formulating and implementing plans. As a rule, data have the attributes of clarity, accuracy and usability. They present the essence of the matter.
- 2) For categorising data in sciences, certain parameters are used. There are six parameters using which six basic types of data are derived. Within each of these types there are two or three classes. The parameters for categorisation used in sciences are: 1) time factor, 2) location factor, 3) mode of generation, 4) quantitative values, 5) terms of expressions, and 6) modes of presentation. It is easy to understand the nature of data after first categorising them on the basis of these parameters. In all, one finds fifteen classes of data in sciences as a result of applying these parameters.
- 3) As sciences, data are categorised in social sciences in several ways: On the basis of characteristics of observation, data in social sciences are categorised into two types, viz., quantitative and qualitative. Another categorisation of data is according to the origin of data, which yields two types: primary and secondary. Cross-section data and time series data are yet another categorisation in social sciences. Here, the parameter used is time factor. Using scales of measurement we get either continuous data or discrete data. Besides, there are four scales or levels used for deriving nominal, ordinal, interval and ratio data. Lastly, dependent upon the

number of characteristics observed, we get univariate, bivariate, or multivariate data. This is how data are categorised in Social Sciences.

- 4) According to the CODATA definition, data are a 'crystallised presentation of the essence of knowledge in the most accurate form'. In the opinion of CODATA, clarity is an essential attribute of data. We learn from the UNESCO definition that data are concepts in a formalised manner suitable for communication and interpretation. Unless data display clarity, neither communication nor interpretation is possible. If there is no clarity, the meaning desired to be communicated will remain hidden and the purpose of presenting data will be defeated. Many presentation techniques exist for lending clarity to data.
- 5) Data are required in all scientific, socio-economic and management operations. With the increased applied research for socio-economic and technological development, the importance of data has increased now all the more. All socio-economic programme, scientific investigations, planning activities and operational work require large measures of data of various types. Every decision problem calls for data. The first step in any research design is data collection. Neither enquiry can be conducted, nor problem solved without reference to available facts on the variables involved. Data are the basis upon which the hypotheses are formulated and tested and theories are built. The importance of data in library services is truly immense.

2.8 KEYWORDS

Observation	: A recording of a single datum.
Phenomenon	: Fact or occurrence (Phenomena is the plural form).
Population	: An aggregate of individual units, whether composed of people or things, having the characteristic under study.

2.9 REFERENCES AND FURTHER READING

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UNIT 3 INFORMATION: DEFINITION, TYPES, NATURE, PROPERTIES AND SCOPE

Structure

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Information: Nature
 - 3.2.1 Disciplines Centered around Information
 - 3.2.2 Information Theory
- 3.3 Information: Definitions and Concepts
 - 3.3.1 Belkin
 - 3.3.2 Wersig and Neveling
 - 3.3.3 Brookes
 - 3.3.4 Bell's Approach
 - 3.3.5 Machlup's Approach
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- 3.4 Information: Types
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- 3.10 Keywords
- 3.11 References and Further Reading

3.0 OBJECTIVES

After reading this Unit, you will be able to:

- recognise the knowledge spectrum and its validity to library and information science;
- get a good overview of the nature, definition and concept of information;
- pick out the appropriate definition(s) of information that fulfills the requirements for library and information service;

- obtain a clear insight into the types and kinds of information;
- discern the qualities and properties of and barriers to information; and
- grasp the widening scope of library and information science.

3.1 INTRODUCTION

We have studied data, information and knowledge in the earlier two units with reference to their meanings, interrelationships and value in general and in particular, with reference to their relevance to library and information service. In this Unit, information is seen as an element of a knowledge spectrum. Information is also studied here as forming a link in a communication transfer chain, which integrates the source that generates it, the channel employed to transmit it through a medium to a receiver who finally receives it to fit it into his specific needs.

We shall also give a brief resume of literature on the nature, definitions and concept of information; and also disciplines wherein information is their core. This idea is illustrated with a schematic diagram to give an idea of the range and variety of subjects falling under this ambit. The purpose of this exposure to different ideas on information is to put our discussion in proper perspective vis-à-vis, their relevance to the expanding dimensions of library and information science.

As there is no single universally accepted definition of information, there can be no single set of characteristics or grouping of information into its types. The basis of grouping or classification of information has to be in relation to the information transfer process that links sources, media, channels, recipients and their needs, which are inseparable.

The qualities and properties of information while depending upon all different types have their own attributes, some of which are universally recognised and accepted. There are also quite a few barriers that obstruct the free flow of information.

The scope of information is studied with reference to its expanding dimensions and contexts of use. Ranganathan's Five Laws of Library Science restated with focus on information admirably fits in with the new dimensions of information service. Vickery in his book *Information Science: Theory and Practice* (1987) has given his views on the new dimensions of information science. The ideas of two eminent persons in this field are sketched briefly in this Unit.

3.2 INFORMATION: NATURE

The word 'information' is defined or interpreted very differently in the disciplines that have information as their core area of study and research. The nature of information is that, it is an element of a knowledge spectrum [Debons, 1980]. Here data, information, knowledge, and wisdom are viewed as part of a continuum, one leading to another, each the result of actions on the preceding, with no clear boundaries between them. This knowledge spectrum is presented in figure 3.1.

Knowledge Spectrum

Data, Information, Knowledge and Wisdom can be reviewed as part of a continuum, with no clear boundaries between them.

Knowledge

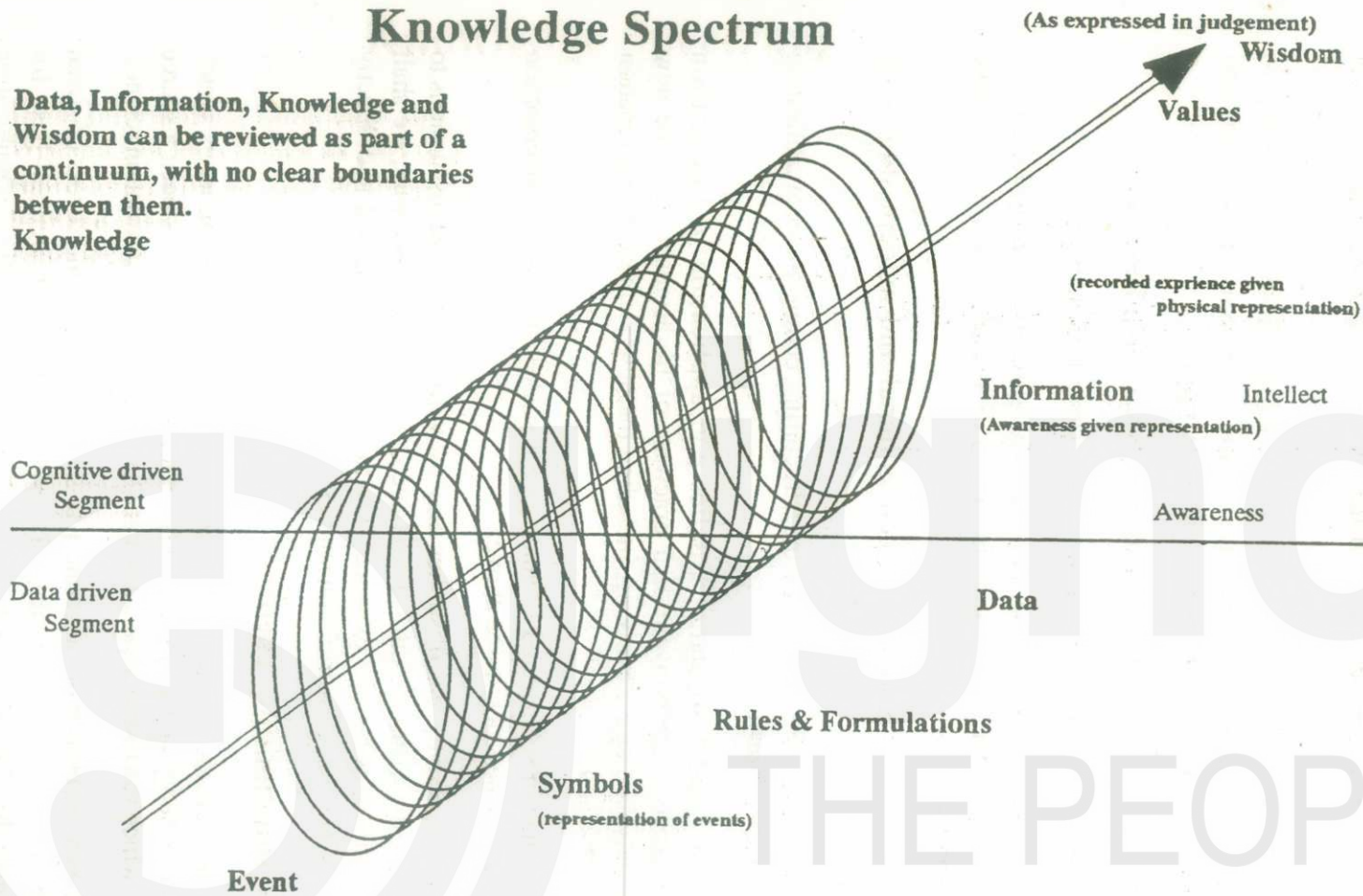


Fig. 3.1: Knowledge Spectrum

3.2.1 Disciplines Centered around Information

There are a number of disciplines that claim to be dealing with the phenomena of information as their central core. Some of these disciplines are:

- Electrical Engineering e.g. signal transmission over noisy channels as propounded in the Information Theory of Shannon;
- Computer Technology e.g. information processing, storage and retrieval as bits;
- Physical Sciences e.g. information considered as an abstraction similar to matter and energy; also analogous to the phenomena of movement and diffusion, structure, communication and entropy;
- Biological Sciences e.g. information processing in living beings;
- Behavioural Sciences e.g. cognitive process of information;
- Social Sciences e.g. sociology and economics of information and knowledge; here information is viewed as a resource and an economic commodity;
- Philosophical Studies e.g. conventional and modern studies on epistemology;
- Linguistic Studies e.g. expressing, structuring, coding and communicating ideas and information;
- Library and Information Studies e.g. application of Information Technology for conventional practices of librarianship and the new dimension that are evolving, including the newly emerging information systems and services;
- Information Science and Technology e.g. studies involving the intersection of disciplines mentioned above.

While all the above areas of studies may be worthy of detailed discussions to understand the nature of information and the knowledge spectrum, we shall confine ourselves here to examine only those that are relevant and directly useful to library and information studies.

3.2.2 Information Theory

Before we consider the definitions and concept of information, let us sketch briefly the theory of information of Shannon-Weaver, as it has been a source model, which has inspired quite a few studies in library and information science.

This theory pertains more accurately to the communication process of signal transmission and has an extremely sophisticated mathematical base for examining the effects of transmission of messages. When the communication engineers use the word 'information', they are not concerned with contents but the messages that the sender, by signals, conveys to the receiver to select a particular message from the ensemble of possible messages. Therefore, in this narrow technical sense of the term, information is the statistical probability of a sign or signal being selected from a given set of signs or signals.

The model has been simplified into a flow model viz.

Information, Definition, Types,
Nature, Properties and Scope

Source → Message → Channel → Receiver

This model recurs implicitly or explicitly in many of the information transfer systems that have been evolved dealing with contents of information as well. Information transfer process in scientific communication is explained usually as a flow model corresponding to the model of information theory stated above. It has been found useful to deal with information transfer in this way in different situations in library and information service.

Self Check Exercise

- 1) Enumerate the disciplines that have information as their core area of study, indicating the information aspect that is studied.
- 2) Explain the simplified model of information transfer derived from Shannon-Weaver Theory.

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of the Unit.

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3.3 INFORMATION: DEFINITIONS AND CONCEPTS

In this section, we are presenting a quick resume of the literature on the discussions on the definitions and concepts of information. There are too many formal definitions and none has universal acceptability, as the word information used is differently in the context in which the word figures. Therefore, it would be more useful and appropriate to give a brief review on the definition and concept of information rather than stating a few formal definitions of information.

Most writers take the position that the word 'information' is used with many different connotations and a single precise definition encompassing all the aspects cannot in principle be formulated. Whatever be the definitions of information, a science of information, could be useful for studying the structure of information science.

3.3.1 Belkin

In an elaborate study on the information concepts for Information Science, Belkin makes a distinction between definition and concept. The distinction is while a definition presumably defines the phenomenon, the concept is looking at or interpreting the phenomenon. By accepting the idea of a concept, it

becomes easier to look for a useful concept rather than attempting a universal definition of information.

Belkin postulates three approaches to the determination of the requirement of an information concept:

- Methodological ... having to do with utility of the concept;
- Behavioural ... having to do with the phenomena which the concept must account for; and
- Definitional ... having to do with the context of the concept.

With these postulates, the following eight requirements are enumerated which would be relevant and operational to develop a structure of information science:

- 1) It must refer to information within the context of purposeful, meaningful communication;
- 2) It should account for information as a process of social communication among human beings;
- 3) It should account for information being requested or desired;
- 4) It must account for the relationship between information and state of knowledge of generator and recipient;
- 5) It should account for the effect of information on the recipient;
- 6) It should account for the varying effects of messages presented in different ways;
- 7) It must generalise beyond the individual case; and
- 8) It should offer a means of prediction of the effect of information.

Requirements 1 to 6 pertain to relevance of information to user communities; the rest two are operational requirements to design and develop useful model of information systems.

3.3.2 Wersig and Neveling

Wersig and Neveling consider information much more comprehensively, adopting six different approaches:

- 1) **The Structural Approach** (matter oriented) in which information is seen as structures of the world or static relations between physical objects which may be perceived or not;
- 2) **The Knowledge Approach**, which records knowledge that is built up on the basis of perception of the structure of the world. This approach is not recommended because knowledge and information are used as synonyms;
- 3) **The Message Approach** in which information is recorded as symbols oriented in a physical career. This approach is used only by those concerned with the mathematical theory of communication;
- 4) **The Meaning Approach** where the semantic content of a message is accepted as information;

- 5) **The Effect Approach** or the **Recipient-Oriented Approach**, which states that information occurs only as a specific effect of a process;
- 6) **The Process Approach** where information is seen as a process, which, for example, occurs in the human mind when a problem and useful data are brought together.

The substance of these approaches is that information is a social process, and can be understood if it is in relation to needs either as reduction of uncertainty caused by a communication of data or as data used for reducing uncertainty.

3.3.3 Brookes

Brookes, the well known British Bibliometrician and Information Scientist, takes yet another stand. According to him knowledge is a summation of many bits of information, which have been organised into some sort of coherent entity. The relationship is expressed in a simple equation, which he calls the fundamental equation of information science.

$$K[S] + \Delta I = K[S + \Delta S],$$

which states in its very general way that the knowledge structure $K[S]$ is changed to the new modified structure $K[S + \Delta S]$ by the information I , the ΔS indicating the effect of the modification.

In other words, K is a knowledge structure and $[S + \Delta S]$ is modified knowledge structure caused by the absorption of the increment of information ΔI to $K[S]$

Brookes says that the equation is not strictly a mathematical expression but merely expressed in a pseudo-mathematical form because it is the most compact way in which the idea can be expressed. It merely says that a knowledge structure changes when bits of information are added to it and the new structure can be interpreted to have changed from its original structure and nothing more. It does not express any exact measure of change.

Brookes's 'fundamental equation of information science $K[S] + \Delta I = K[S + \Delta S]$ is a very profound expression of the human and natural way of thinking and suggests a basis for treating various aspects of information related phenomena. Having defined information as a 'small bit of knowledge' and as "an entity, which pervades all human activity", Brookes further, explains his view of knowledge as "a structure of concepts linked by their relationship and information as a small part of such structure". "Objective knowledge" is the main concept around which Brookes's fundamental equation operates.

But Brookes is inconclusive, as the equation defines the unknown in terms of unknown and is symbolised by a vicious circle of very small radius. But it is useful, he says, to express in this way because the same I may have a different affect on different knowledge structures. Brookes believes that the fundamental problem of information science is to interpret this equation and thereby explain information process.

Self Check Exercise

- 3) State the difference between concept and definition as exemplified by Belkin.

- 4) Give the salient points on the nature and definition of information propounded by a) Belkin, b) Wersig and c) Brookes.

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of the Unit.

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3.3.4 Bell's Approach

Daniel Bell, the eminent, Harvard Sociology Professor, in his famous book *The Coming of the Post-industrial Society, a venture in social forecasting*, and in his subsequent books places emphasis on the centrality of theoretical knowledge as the source of innovation and policy formation in an information society. The social transformation of a society from industrial to a post-industrial society (information society) is based on the creation of a new intellectual knowledge. He asserts that this is a key tool for system analysis and decision theory based on the new theoretical knowledge, computerisation, formal rules and procedures; it involves new methods which seek to substitute an algorithm i.e. decision rules for intuitive judgements. While there are other consequent factors arising out of the centrality of the new intellectual theoretical knowledge that transform a society, the knowledge factor is the primordial factor, ushering a society into 'new times'.

While some of the premises of Bell's theory are contested and questioned with reference to 'information society', the fact that information and knowledge are the real moving force of the social transformation is generally accepted. Dealing with his thesis, he defines data, information and knowledge in a pragmatic manner for a proper comprehension of his approach.

Bell suggests that information is data processing in the broadest sense; the storage and processing of data becomes the essential resource for all economic and social changes. These include:

- Data processing of record payrolls, government benefits (e.g. social security), bank clearances, credit clearances and the like.
- Data-bases: characteristics and features of populations shown by census data, market research, opinion surveys, election analysis and the like.
- Data processing for scheduling: airline and railway reservations, production scheduling, inventory analysis, document delivery priorities in libraries and information centres, and the like.

Knowledge is an organised set of statements of facts or ideas, presenting a reasoned judgement or an experimental result, which is transmitted to others through some communication medium in some systematic form. Knowledge consists of new judgements (Research and Scholarship) or presentation of older judgements as exemplified in textbooks, teaching and learning, and collected

as library and archival material.

Information, Definition, Types,
Nature, Properties and Scope

This approach of Bell appears to be in conformity with the objectives of library and information services, in providing support to any activity, irrespective of the type i.e. data, information or knowledge.

Self Check Exercise

- 5) What are the premises on which Bell bases his arguments on the transformation of the Industrial Society into Information Society?

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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3.3.5 Machlup's Approach

Fritz Machlup, an Austrian Economist, immigrated to the United States during the inter-war years, is said to be the pioneer of information economics. Machlup's studies on information and knowledge through his seminal book in 1962 viz. *The Production and Distribution of Knowledge in the United States* and his subsequent publications on knowledge and information, placed information and knowledge as the primary economic resource for growth and development of any economy.

Machlup's distinction between information and knowledge is succinctly described as shown in the tabular statement given below:

Information	Knowledge
is piecemeal, fragmented, particular	is structured, coherent and often of enduring significance;
is timely, transitory, perhaps even ephemeral	is a stock, largely resulting from the flow, inputs of information;
is a flow of messages	may affect the stock of knowledge by adding to it, restructuring it or changing it in any way

Later studies based on the Machlup's approach included a number of sectors, handling information in one way or the other. These encompass sectors of primary information, secondary, computer-based information providers, information retailers, seminar and conference services, information support services, etc.

The important aspects for us to note in these studies of Machlup and Bell, the former considering information as a vital economic resource and the latter dealing with information and knowledge as primary factor in the social

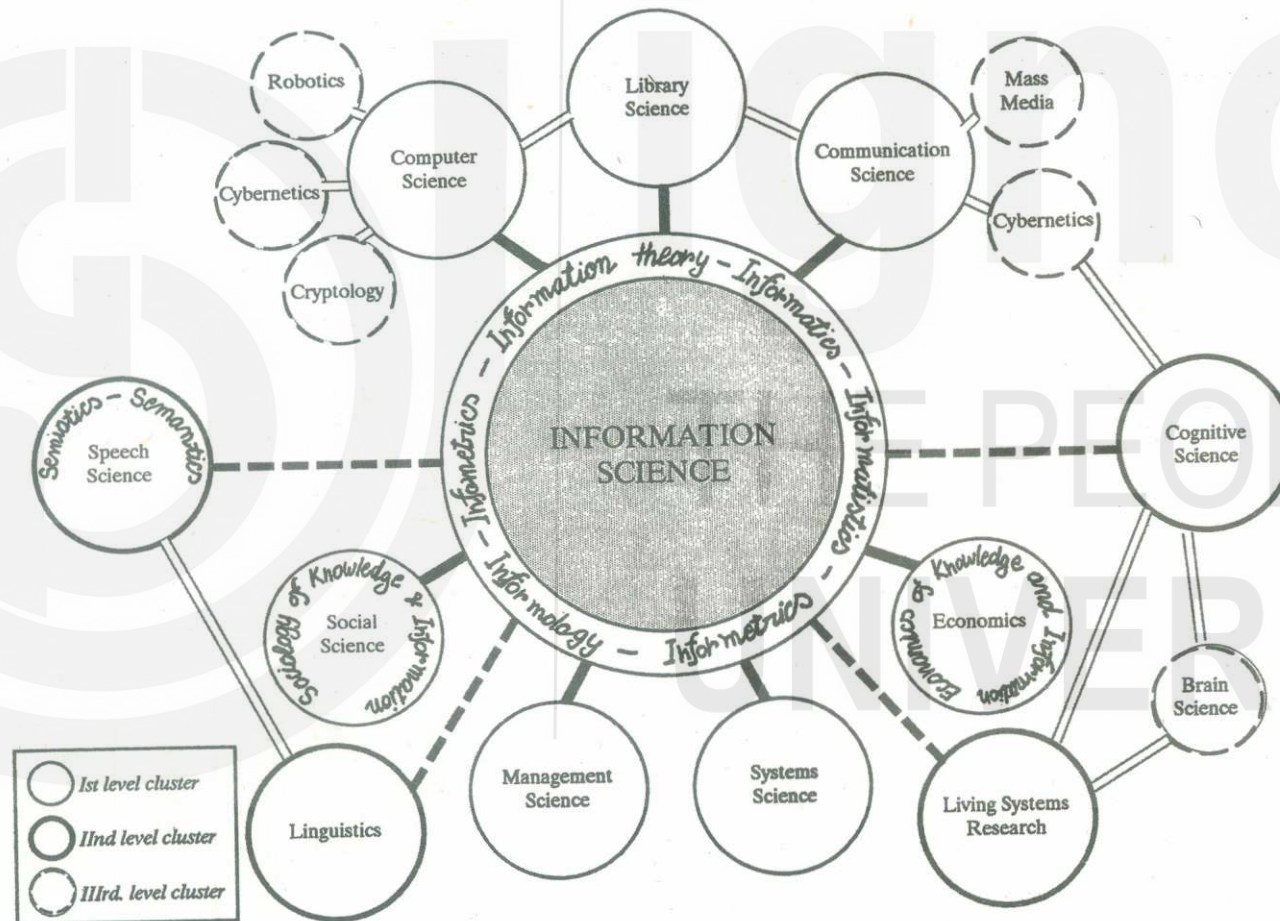


Fig. 3.2: A Panoramic view of Information Science: A Cluster of Disciplines and Specialities

transformation of a society, are that library and information services are very essential infra-structural support facilities for every human activity, just as the financial, transport, power sectors are.

Information, Definion, Types,
Nature, Properties and Scope

3.3.6 Information Science(s): The Power of Plural “S”

In another major work viz. *Study of information: interdisciplinary messages*’, Machlup provides an epitomised study on a number of disciplines, which have information as their core.

A schematic diagram of the various disciplines centering round information is given in figure 3.2.

The different chapters of this Work written by experts in their respective disciplines, present a neatly organised state-of-the-art report to prompt and initiate healthy debates and discussions of critical issues relating to information studies.

Machlup says, “the bond among the Information Sciences is their focus on information as the object of study, though it is important to bear in mind that the word information is interpreted very differently by various groups of researches. Like the Natural Sciences and the Social Sciences, Information Sciences need no single paradigm, no overarching scientific research programmes, no common fundamental postulates and axioms, no unified conceptual framework.”

The final statement that Machlup makes on the various aspects of his study is that the use of the word ‘information’ where only observation and analysis are involved is unwarranted. Those who believe that observations of physical reality or consultation of data tell us anything have misunderstood the basic lessons of methodology. He goes on to say that when information theorists explain their system, they make a sad misuse of language; they explicitly abstract them from a meaning-content of the signals, the transmission of which they describe. Their system does not care about telling anything, directing or advising anybody, arousing anybody’s interest or inducing any decision or emotions. Appropriate expression to use in the context would be signal transmission, or actuation or activating impulses. The use of the word ‘information’ in this sense has led to unending confusion.”

Self Check Exercise

- 6) Sum up Machlup’s approach to information science as a cluster of many disciplines wherein the central core is information.

Note: i) Write your answer in the space given below.
ii) Check your answer with the answers given at the end of the Unit.

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3.3.7 Relevance to Library and Information Studies

Libraries and Information Centres have always been concerned with information and knowledge, as these constitute their stock-in-trade.

The emphasis and accent are always on developing better tools and techniques for organising, managing and servicing recorded data, information and knowledge, irrespective of their physical media. They have not been so much concerned *per se* with universal definitions of data, information or knowledge as they were more concerned with supplying relevant information, data or knowledge to those who seek them without making any distinction between them.

Nevertheless the debates and discussions on the nature and definition of information do provide us a sharper focus on the contents and quality of information service to users either for reducing uncertainty to their prior information or perception of information/knowledge or help in taking right decisions in different contexts or aiding their studies or research or adding to or enriching their already existing knowledge. The main concern of library and information scientists involved in a communication transfer process is about the intellectual and semantic contents of information and the provision of high quality service.

Another point to be noted here is that the words nature, definition, type, property, scope of information are not mutually exclusive both in their meanings and usage. Their meanings overlap very considerably and hence their scope should be understood in their contexts.

Information and Communication Technology, Multimedia, Internet, Web and other related technologies have introduced a total metamorphosis in the methods and techniques of organisation and offering services in libraries and cognate institutions. But no technology by itself can ever change, modify, alter, or negate, information contents under any circumstances. Electronic Libraries, Virtual Libraries, Digital Libraries, and such other expressions are indicating only the physical store and the consequent changes in the organisation of such libraries; they have nothing to do with the contents of material these libraries have.

3.4 INFORMATION: TYPES

We have been discussing so far the nature, concept and definition of information in general and with reference to disciplines that have information as their central theme. But these discussions also have to be seen along with the different types of information to get an overall view of it in all its dimensions. We shall examine, in this section, the fuller dimensions of information with reference to its different manifestations.

Just as the word 'information' has no single universally accepted definition, there is no one single way we can group or classify information. In fact, the types of information could be grouped using different characteristics depending upon the purpose of such a classification. Keeping these in view, let us choose a set of characteristics on the basis of the modified Shannon-Weaver Model of information transfer with an added one viz. information needs. These are:

Source → Channel → Media → Information Needs → Recipients

Information, Definition, Types,
Nature, Properties and Scope

Source is the mode of communicating messages through signs, symbols, texts or graphics;

Channel refers to the established carriers that disseminate information knowledge or any type of their surrogates;

Media are the physical media that carry messages or contents of information;

Information Needs indicate the types of information that are normally communicated to those who seek the different types of information relevant to their needs. The scope to divide information in this way, however, is almost unlimited; and

Recipient is the ultimate receiver of information who may also generate or create information.

3.4.1 By Source

Using source as a characteristic, information can be grouped as follows:

Signals, Message in the form of Signs, Symbols, Words and Numbers e.g. Mathematical formulae, Statistical and Factual data, etc.;

Text matter, carrying larger amount of messages or information; and

Graphics of various kinds, e.g. Photographs, Pictures, Graphs, etc.

It may be worthwhile repeating here that in this context source connotes the way in which information is communicated, i.e. in the form of signals, textual matter or graphics, irrespective of the persons or groups who generate information.

Self Check Exercise

- 7) Explain briefly the relevance of the discussion of the different authors who have been examining the nature and definition to the study of Library and Information Science.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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3.4.2 By Channel

Using channel as a carrier that disseminates information for grouping information, we have the following terms e.g. Literature, Organisations and Institutions, and Agencies that distribute them.

Literature: Primary, Secondary and Tertiary channels. The different characteristics of these three with examples are given below:

Primary	
Characteristics	Examples
1) New, Original or new interpretations of known facts and ideas	Research papers Journal articles
2) Unorganised and unrelated, each unit being a separate	Conference Papers and Proceedings Official publications
3) Widely scattered	Theses and Dissertations Project Reports
4) Unassimilated into the general body of knowledge	Diaries, Memos, Correspondence, Personal files

Secondary	
Characteristics	Examples
1) Information derived from primary sources	Bibliographies, Current Awareness Bulletins
2) Organised and arranged according to a definite plan	Indexing and Abstracting journals Reviews, State-of-the-art Reports
3) Scattered information collected	Reports, Progress, Advances, etc.
4) Repositories of assimilated and digested knowledge	Reference books, Dictionaries, Encyclopedias
5) Bibliographical key to primary literature	Directories

Tertiary	
Characteristics	Examples
1) Compilations of primary and secondary sources	Bibliographies of Bibliographies, Year Books
2) Organised and arranged according to a definite plan	Directories, List of Research in Progress Guides to Literature
3) Aids to searching primary and secondary sources	Information Sources, Organisations, Human Resources

Information Institutions

Information, Definition, Types,
Nature, Properties and Scope

Libraries, Documentation and Information Centres, Information Analysis Centres, and such others. These institutions collect, process, analyse, disseminate all the three types of literature mentioned above

Distribution Agencies

Booksellers, Subscriptions Agents, Clearing Houses, Information Brokers and such others. While information institutions are essentially agencies involved in the provision of information services with reference to a specific clientele, distribution agencies are largely commercial agencies, selling information. However these distinctions are getting blurred with the advent of information technology.

3.4.3 By Media

Using physical media as a characteristic for grouping information, we have the following:

Oral: Person to person, one to one, one to many,

many to many;

Recorded: Paper-print

Microforms

Audio, visual and audio-visual

Electronic/ Digital

In the above categories, we distinguish Oral with other types of textual matter, irrespective of their physical media. Oral information refers to voice information with or without any corresponding textual information.

3.4.4 By Recipient

Using recipient as a characteristic for grouping information, we have the following that receive and use information and knowledge for various requirements:

Individuals, Groups, Organisations and Institutions.

3.4.5 By Information Needs

Using Information needs as a characteristic for grouping information, we have the following Information Needs:

By Standard

Popular

Scientific

Technical

By Type

Know-why

Know-how

Show-how

Know –why Information: more scientifically oriented information, readily accessible in the numerous secondary tools (data bases), available in libraries and information centers, Internet and also easily transferable.

Know-how Information: more technically oriented and noticed in the tools and more difficult to locate and obtain, less easy to transfer.

Show-how Information: operational skills, maintenance and control capabilities, seldom recorded in communicable form, and therefore, never gets recorded in any primary or secondary tools. Transferable only through personal contacts and interactions, depending very much upon the willingness of the person who has the skills to share them with others.

Recipients and information needs, as characteristics for grouping while producing different sets or classes of information, are in fact, closely intertwined. As B C Vickery puts it, the social position of recipients, their activities, knowledge generation and information input, knowledge structure, ability to assimilate, communication behaviour, etc. may still be a series of influences that will determine the information needs of individuals or groups. Information systems and services must respond to these kinds of requirements.

Self Check Exercise

8) Summarise the classification of information as discussed in Section 3.4, in a tabular form.

Note: i) Write your answer in the space given below.
ii) Check your answer with the answers given at the end of the Unit.

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3.5 INFORMATION: PROPERTIES

Information can be examined from the point of view of its inherent properties. We are studying them here with reference to those that apply to i) Information in general, ii) Scientific and Technical Information, iii) Information pertaining to technology and economics.

3.5.1 General

- Information is not consumed in its use.
- Information can be shared by many and can be used simultaneously without any loss to anyone.
- It is the most democratic resource in that it can be consumed by all, depending upon their intake capacity, particularly in the context of Internet facilities.
- Knowledge is dynamic, ever growing and continuing and no final word is said or will ever be said on any aspect of it.

(Note: Information is the building block of knowledge)

3.5.2 Scientific and Technical Information

- Universal, particularly in the physical, chemical and biological sciences.
- Open and available to all who seek them, through a well organised and operated communication system.
- A system of peer review and mode of communication operates in its dissemination.
- Peer group review ensures quality control of information.
- Healthy competition results on account of peer review and speedy communication.
- Becomes obsolete in fast developing disciplines and the obsolescence factor is quite high in some of them.
- Exponential growth in scientific publications has been causing concern in accessibility and availability.

3.5.3 Technological and Economic Information

- Highly competitive, particularly because of business interests, for reasons of security of nations.
- Secretive because of competition and security.

As described in Unit 1 of this course, knowledge and information have become a very powerful weapon for economic and political superiority among nations. The generation of new knowledge and its applications for various purposes has been given the highest priority in recent decades, particularly among western industrialised societies. The developing countries naturally suffer from a number of constraints in the acquisition, storage, processing, disseminating and making them available for use, despite Internet facilities. Some of the barriers to information also restrict the use of information and knowledge among the information-poorer nations. The following section projects some of these barriers to information.

Self Check Exercise

- 9) List three broad groups under which information properties are studied in this Unit.

Note: i) Write your answer in the space given below

ii) Check your answer with the answer given at the end of the Unit

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3.6 BARRIERS TO INFORMATION

A variety of obstacles are hindering the free flow and use of information and knowledge. Some of these barriers are deliberate and hence do not appear within easy means to overcome these barriers.

The barriers to communication of information flow are of the following kinds:

	Language	
Language	Jargon	Presentation
Man-man	Neologism	Level
Man-machine	Synonym Antonym	Style Form

While language is a powerful means of communication, the barriers caused by jargons and levels of presentation fail to convey the message intended to be communicated.

Problems of Cultural and Social Differentiation		
Communication	Media	Socio-Economic
Multiplicity of Sources	Comprehension	Culture
Seepage and scatter	Perception Alien of Reality Misunderstanding	Level of Development of countries

Cultural and Social differentiation may cause serious problems of communication. These problems may be overcome by appropriate presentation of information.

Problems of Volume, Mis-information and Delays		
Over Population	Pollution (Noise)	Delays in Handling
Primary papers	Propaganda	Publication
Rehash	Redundant Data	Postal Transit
Abstracts, Digests, etc.	Error	Translation Processing Searching Accessing Document Delivery Feedback

In this group, the problems posed by volume, mis-information and delays in publication due to various reasons

Economic, Political, Legal Barriers		
Economic	Political	Regulatory
Direct Cost	Instability	Foreign Exchange
Overheads	War	Customs

This group of barriers indicates the problem of costs, political situation of a country and other legal measures of a country.

Some of the barriers have been removed through ease of accessibility and availability of hard copies through Internet. But the crux is the capacity to use information and knowledge that makes a society to grow and develop.

Self Check Exercise

10) State the different kinds of barriers to information.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answer given at the end of the Unit

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3.7 INFORMATION STUDIES: SCOPE

The scope of information and the other associated concepts have been discussed at length in Units 1 and 2 of this Block with reference their relevance, value, role and importance in all human activities. We have also learnt that information and knowledge has value, utility only if it is communicated which makes information and communication inseparable, sometimes even indistinguishable.

It is necessary, therefore, to discuss the scope of information studies in a broader perspective in relation to communication process of information transfer which has been studied in some detail in earlier sections of this Unit. Source, Channel, Media, Recipient, and User constitute the elements that form an Information Transfer Chain.

Our primary focus being library and information studies, it is also appropriate to examine the scope of information in relation to the expanding dimensions of information services.

3.7.1 Ranganathan's Five Laws and Information Studies

Ranganathan's Five Laws of Library Science examined in the light of the canvas of Information Studies, give the widest implications as it is evolving today.

Restated with focus on information, the Five Laws are:

- Information is for Use
- Every User his/her Information
- Every Information its User

- Save the Time of the User; its corollary, Save the Time of the Information Services staff
- Information Institution is a Growing Organism.

The **First Law** stresses the value of information in its use. Information pervades every human activity, be it personal or corporate. In an information society, as has been evolving; information is viewed as a vital resource, as vital as finance. Information today is an economic resource and a very basic input in every human growth and development. It is important to reiterate that information has value only in its use. Mere possession of information in whatever form, if remains idle in a store, even if it is in a highly sophisticated digital form, will only remain ornamental.

The concept of information society is very much in conformity with Ranaganathan's perceptions. In fact, the well-known adage, 'Knowledge is Wealth'. 'Knowledge is Power' is captured in these ideas to reinforce the power of information and knowledge that transform non-resources into potential resources.

In essence, the First Law comprehends a whole range of aspects of information studies that includes:

- Development of document and non-document resources;
- Organisation and management of these information resources;
- Techniques and tools for processing the collections of information, irrespective of their physical form;
- Use of different kinds of literature in various contexts;
- Bibliometric studies measuring the value, growth, and development;
- National and international information policies.

The **Second Law** suggests that information services should be entirely oriented towards users' needs. User Studies, therefore, are crucial to objectivity and should show proper direction to services. This thinking is analogous to customer-oriented services in business. Such a service includes among others;

- Behaviour patterns of information gathering habits by different categories of Users in different contexts;
- Use and Users of different types of information;
- Study of interest profiles of users that includes individuals, groups, institutions and projects, programs and such others;

The emphasis in this Law is on the User of Information.

In the **Third Law** the focus is on information. The entire information transfer process should be in consonance with the ultimate use. The primary principle in information service is 'Right Information to the Right User in the Right Time' is communicated here. Primary, secondary, and tertiary communication channels should be focused on use. In other words, marketing of information, keeping users' information needs in view is stressed, providing scope for innovative products and services, irrespective of their physical form and media of communication.

The **Fourth Law** places the highest emphasis on the most precious resource 'Time'. Time loss is a loss forever. Timeliness in anything and speed with which it is accomplished with quality is the essence of service. The use of Information Technology enables a total metamorphosis in improving the means and mechanics to provide high quality information service. Information professionals should be geared to this transformation process that hinges on education and training and more importantly building up a proper perspective, developing high skilled capability in the use of IT for various Information Services. Use promotion, education in information use skills and user friendliness make the use and operation of a system not only simple but also saves great amount of valuable time. Continuous research on all aspects of information handling is an absolute necessity, keeping all these factors in view. But it must be borne in mind, the contents of information are the **meat** and IT is today an excellent enabling tool to get the meat palatable. The proof of the pudding is in the **eating** and not in the **making**.

The **Fifth Law** refers to the dynamics of change, which is seen in the evergrowing, sometimes, turbulent advancement of knowledge, which is a dynamic continuum and ever-growing phenomenon. The institutional mechanisms for handling and servicing information needs have to change in conformity with the corresponding changes in the information environment with a self-adapting capacity to these constant changes. The library and Information professionals must have a clear view of this need for affecting changes in the institutional mechanisms.

These Laws of Ranaganathan are not scientific generalisations but norms, percepts, guides to good practice in the wider field of information studies and their new expanding dimensions.

3.7.2 Observations of B.C. Vickery on Information Science

Vickery (1983) puts the changing dimensions of information studies as given below:

- The behaviour of people as generators, sources, recipients and users of information, all of whom are partners in the information transfer process;
- The qualitative study of messages: size, growth rate, distribution, pattern of production and use;
- The semantic organisation of messages and of channels that facilitate their identification by sources and recipients;
- Problems particularly associated with functions of information storage, analysis and retrieval;
- The overall organisation of information systems and their performances in transfer;
- The social context of information transfer, in particular its economics and politics.

Self Check Exercise

11) Give briefly the scope of information studies as viewed by Vickery and Ranganathan.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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3.8 SUMMARY

In this Unit, Information is studied from two perspectives.

In the first, information is seen as an element of a knowledge spectrum with all its implications for a multiplicity of studies with information as a central theme of study. This approach has given rise to the development of a number of disciplines, each of which has a specific focus on information. The definition of information, therefore, has a wide-ranging variety and no single definition has emerged as common to all the disciplines. Yet the model provided by Shannon-Weaver in their Mathematical Theory of Communication has helped specialists in Library and Information Science to view information as a communication flow model in the context Information Transfer Chain.

In the second perspective, the nature and definition of information as has been propounded by five different experts viz. Belkin, Wersig and Neveling, Brookes, Bell, and Machlup have been discussed. The relevance of all these discussions to Library and Information Science has been pointed out.

The Information Transfer Chain Model has been taken as a method of examining the different types of information. Source, Channel, Media, Recipient, and Information Needs are the characteristics that have been used for studying information types with suitable examples.

The properties of information are also examined in the light of their general, scientific and technical and economic and political points of view.

The barriers in communication are discussed with reference to a number of constraints in information communication and transfer.

In the light of these discussions, the scope of information studies is discussed. Vickery's approach and the Five Laws of Library Science are taken as illustrating examples to delineate the scope of Information Science.

- 3) A definition defines the phenomenon; but a concept interprets the phenomenon. Instead of trying to define the phenomenon for which there is no one single definition acceptable to all; it is more useful to interpret the concept of information in all its ramifications in different contexts. It leads to explain the transfer process of information.

Belkin postulates three approaches to the determination of the requirement of an information concept:

- Methodological ... having to do with utility of the concept;
- Behavioural ... having to do with the phenomena which the concept must account for;
- Definitional ... having to do with the context of the concept.

- 4) With these postulates, the eight requirements are enumerated of which the first six pertain to relevance of information to user communities; the rest two are operational requirements to design and develop useful models of information systems and to build a structure of information science.

Wersig and Neveling consider information in a much comprehensively adopting six different approaches:

- The structural approach
- The Knowledge approach
- The Message approach
- The Meaning approach
- The effect approach or the Recipient-oriented approach
- The Process approach

The substance of these approaches is that information is a social process and can be understood only if defined in relation to needs either to reduction of uncertainty caused by a communication of data or as data used for reducing uncertainty.

According to Brookes, knowledge is a summation of many bits of information, which have been organized into some sort of coherent entity. This relationship is expressed in a simple equation, which he calls the fundamental equation of Information Science.

$$K(S) + \Delta I = K(S + \Delta S)$$

Where K is knowledge structure and (S + Δ S) is the modified knowledge structure caused by the absorption of the increment of information Δ I to K(S). He believes that the fundamental problem of Information Science is to interpret this equation and thereby to explain the information process.

- 5) Daniel Bell places emphasis on the centrality of theoretical knowledge as the source of innovation and policy formation in a information Society. The social transformation of a society from industrial to a post-industrial Society (information society) is based on the creation of a new intellectual knowledge. He asserts that this is a key tool for system analysis and decision theory based on the new theoretical knowledge, computerization, formal rules and procedures; it involves new methods which seek to substitute an algorithm i.e. decision rules for intuitive judgments.

- 6) Machlup says that the bond among the Information Sciences is their focus on information as the object of study, though it is important to bear in mind that the word 'information' is interpreted very differently by various groups of researchers.

Like the Natural Sciences and Social Sciences, Information Sciences need no single paradigm, no overarching scientific research programs, no common fundamental postulates and axioms, no united conceptual framework.

It is, therefore, possible for several disciplines (wherein the central theme of study is information) to keep their own identity and yet be together as a cluster of independent disciplines. He, however, urges that the word 'information' should not be used where only observation and analysis are involved.

- 7) The discussions on the nature and definition of information provide us a sharper focus on the common and quality of information service to users either for reducing uncertainty to their prior information or perceptions or help in taking right decisions in different contexts or aiding their studies or research or adding to or enriching their already existing knowledge. The main concern of library and information scientists, being involved in a communication transfer process, is to the intellectual and semantic contents of information and the provision of offering high quality service. This approach coalesces well with the general philosophy of library and information science.
- 8) The three broad properties of information with examples are:

General: Information is not consumed in its use. It can be shared by many and can be used simultaneously without any loss to anyone.

Scientific Information: Universal, particularly in the physical, chemical and biological sciences. Open and available to all who seek them, through a well organized communication system.

Technological and Economic Information: Restricted because of time and geographical space bound. Competitive because of business interests, sometimes for reasons of security of nation.

- 9) Summary Table showing classification of Information by different characteristics, with definitions and examples

Characteristics	Definitions	Examples
Source	Mode of communicating messages through signals, symbols, texts or graphics	Mathematical, formulae, News, Research papers, photographs, pictures
Channel	A carrier of information for grouping information such as primary, secondary and tertiary documents	Books, Journals, etc. Bibliographical and reference materials, Yearbooks and directories
Modes	Physical Media for grouping information	Paper-print, microforms, audio-visual, electronic, digital
Recipient	Persons who receive and use information and knowledge for various requirements	Individuals, Groups, Organizations, Institutions
Information needs	Specific types of information; Needs by standards, by type	Popular, Scientific, Technical, Know-why, Know-how, Show-how

10) The four broad groups of barriers to communication of information with examples are:

Language	Jargon	Presentation
Man-man Man-machine	Neologism Synonyms and Antonyms	Level Style, Form
Communication Problem Multiplicity of sources Seepage and scatter	Media Problem Computerization Perception, Alien of Reality Misunderstanding	Socio-economic Problem Culture Level of development of countries
Over Population Primary papers Rehash Abstracts, Digests	Pollution (Noise) Propaganda Redundant data Error	Delays in Handling Publication Postal Transit Translation, Processing, Accessing Searching, Document Delivery Feedback
Economic Direct Cost Overheads	Political Instability War	Regulatory Foreign Exchange Customs

11) Information and knowledge are basic inputs for human growth and development. It is reflected in many ways in actual life of every human being or institutional organisation. Vickery and Ranganathan have examined information and knowledge in the context of Library and Information Science as the study of the behaviour of people as generators,

sources, etc. bibliometric measurements, semantic organization of information, storage, analysis and retrieval; sociology, politics and economics of information. Ranganathan incorporates most of these ideas in his Five Laws restated with information as focus instead of books.

Information, Definition, Types,
Nature, Properties and Scope

3.10 KEYWORDS

- Channel** : Established carriers that disseminate information of knowledge or any type of their surrogates.
- Information** : (No single definition is possible) Information is the building block of knowledge is generally relevant in library and information studies.
- Information Transfer Chain** : The movement of information from generation to use with a series of intermediate links that connect each other to form a chain.
- Knowledge** : Knowledge is an organised set of statements of ideas, presenting a reasoned judgment or an experimental result which is transmitted to others through some communication medium in a systematic form.
- Media** : The physical media that carry messages or contents of information.
- Recipient** : The ultimate receiver of information who may also generate or create information.
- Source** : The mode of communicating messages through signs, symbols, texts or graphics.
- Spectrum** : A broad range of varied but related ideas, the individual features of which tend to develop so as to form a continuous series of sequence.

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UNIT 4 KNOWLEDGE: DEFINITION, TYPES, NATURE, PROPERTIES AND SCOPE

Structure

- 4.0 Objectives
- 4.1 Introduction
- 4.2 Knowledge
- 4.3 Knowledge: Definition
- 4.4 Knowledge: Nature, Characteristics/Properties
- 4.5 Knowledge: Types and Scope
 - 4.5.1 Personal and Public Knowledge
 - 4.5.2 Tacit and Explicit Knowledge
 - 4.5.3 Three Worlds of Knowledge
- 4.6 Formation of Knowledge
 - 4.6.1 Ranganathan's Modes of Formation of Knowledge
 - 4.6.2 Neelameghnan's Extension
- 4.7 Origin and Growth Pattern of Disciplines
 - 4.7.1 Disciplines
 - 4.7.2 Attributes of Scholarly Disciplines
 - 4.7.3 Relevance to Library and Information Studies
- 4.8 Mapping of the Structure of Subjects
 - 4.8.1 Citation Analysis and Subject Structuring
 - 4.8.2 Graphic Display
- 4.9 Sociology of Knowledge
 - 4.9.1 Sociology of Science
 - 4.9.2 Sociology of Literature
 - 4.9.3 Sociology of Reading
- 4.10 Knowledge Utilisation
- 4.11 Summary
- 4.12 Answers to Self Check Exercises
- 4.13 Keywords
- 4.14 References and Further Reading

4.0 OBJECTIVES

After reading this Unit, you will be able to:

- get a fairly good idea of knowledge and its meaning in the context of our study;
- perceive the composition of knowledge into subjects;
- recognise the characteristics of knowledge;
- distinguish personal knowledge and public knowledge;

- understand Polanyi's tacit and explicit knowledge and the three worlds of knowledge as propounded by Popper;
- get an insight into the formation of knowledge, origin and growth pattern of disciplines; and
- get an exposure to sociology of knowledge, science and literature.

4.1 INTRODUCTION

In this Unit, we shall study knowledge in all its ramifications in the context of library and information science. Knowledge has always been a prime source through which human societies have advanced materially and elevated themselves spiritually. Knowledge comprises many hundreds of fields and sub-fields, known as subjects, which are interlocking and interlinking. This universe of knowledge is infinite, dynamic, and continuously expanding. The structure of a subject is never complete or closed; every aspect of it remains always open, offering new problems for further study and research. Knowledge is also seen as personal and public knowledge, as tacit/implicit and explicit knowledge. Popper sees knowledge as three worlds viz., physical, subjective and objective knowledge.

Knowledge structure growth and development has a pattern. This aspect of knowledge formation, its structural growth, and related aspects are studied by scholars. Dr. Ranganathan has examined the formation of knowledge in the context of classification design and development. Knowledge is also deemed to comprise different disciplines. Citation analysis and subject scattering form useful studies. Knowledge and its parts can also be mapped as in an atlas to have a graphic view of its ramifications.

Knowledge being a social product, its sociology is of interest to us as well as its sub-sets sociology of science, literature, and reading. Finally knowledge utilisation is the ultimate goal, which gets the human being, the value and utility.

The advent of Information and Communication Technology (ICT) has offered a tremendous opportunity to generate new knowledge, disseminate, distribute, and provide access and many other facilities cutting across space. All these aspects of knowledge are studied in this Unit.

4.2 KNOWLEDGE

From cave life to the sophisticated life of the information/knowledge society, knowledge has been the prime resource that has advanced human communities materially and spiritually. While we are not concerned with spiritual advancement in this Unit, knowledge in all its dimensions forms an important subject of study for library and information professionals. It will enable them to plan, organise and offer useful services to those who seek knowledge.

In this Unit, we attempt to study knowledge with reference to its definition, nature and characteristics/properties, its type(s), structure, formation and scope. We shall also study the way knowledge has grown and developed into subjects/disciplines, its sociology and other related aspects.

4.3 KNOWLEDGE: DEFINITION

A precise single definition of knowledge, universally acceptable to all and in all contexts, is well nigh impossible. Scholars who are interested in the study of knowledge, as a resource, as a philosophical concept, as social wealth, etc. have given their own definitions to suit their line of studies.

The meanings of “Knowledge” as given by the Random House Dictionary (RHD), and words synonymous with ‘knowledge’ are:

- Acquaintance with facts or principles, as from study or investigation; general erudition;
- Familiarity or Conversance, as with a particular subject or branch of learning;
- Acquaintance or familiarity gained by sight, experience, or report; as for example ‘knowledge of human nature’;
- The fact or state of knowing, clear and certain perception of fact or truth;
- Awareness, as of a fact or circumstance;
- That which is or may be known; information; and
- The body of truths or facts accumulated by mankind in the course of time, as for example ‘man’s knowledge of the moon’.

Words synonymous with ‘knowledge’ given in the RHD are Enlightenment, Information, Understanding, Discernment, Comprehension, Judgement, Wisdom, Lore, and Science.

Another approach to define knowledge is that the word ‘knowledge’ has its roots in the Greek word *gnosis*. A word that uses the same root is ‘recognise’. We know what we recognise. This means that we mentally process our experience, shaping it and giving it mental forms that we can identify. So we recognise experience and bring it into the realm of knowledge. This approach to the meaning of knowledge cuts across the meaning of knowledge given by RHD.

Daniel Bell, the Harvard University Professor of Sociology while discussing ‘knowledge’ as the moving force of the Post-industrial Society, gives a comprehensive definition of knowledge as follows:

“Knowledge is an organised set of statement of fact or ideas, presenting a reasoned judgment or an experimental result, which is transmitted to others through some communication medium in some systematic form. Knowledge consists of new judgments (Research and Scholarship) or presentation of older judgments as exemplified in text books, teaching and learning and collected as library and archival material.”

Alvin Toffler, the well known author of *Future Shock*, *Third Wave* and *Power Shift*, gives another meaning of knowledge, which includes data, information, images and imagery, as well as attitudes, values and other symbolic products of society whether true, approximate or even false.

In the fast emerging new discipline of ‘Knowledge Management’, Davenport defines knowledge as follows:

“Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms.”

Considering all these approaches to the definitions of knowledge, we can arrive at a working definition of knowledge for our discussion in this Unit.

Knowledge is a highly organised intellectual product of humans that includes personal experience, skills, understanding of the different contexts in which we operate our activities, assimilation of all these and recording all this in a form that could be communicated to others. This communication of recorded experience, data, information, etc. makes for further of growth.

(**Note:** This Unit should be studied along with the Unit 3, of this course on Information, Nature, Definition, Types, Properties and scope to get its full importance)

Self Check Exercise

- 1) Give the definition of knowledge as understood in the context of knowledge management.

Note: i) Write your answer in the space given below.
ii) Check your answer with the answers given at the end of the Unit.

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**4.4 KNOWLEDGE: NATURE,
CHARACTERISTICS/PROPERTIES**

We have also learnt in Unit 1 of this Course, that knowledge has been defined to constitute a stock of organised and structured ideas and concepts, validated by peer groups. When we talk of knowledge, we recognise that it comprises number of subjects, each having its own parameters and scope for independent study. However from the beginning of this century, the universe of knowledge comprises increasingly numerous subjects, which are increasingly multidisciplinary, interlocking and interlinking many disciplines, moving in multidimensional ways.

It is also said that our knowledge base today, includes much more than the traditional Natural Sciences, Social Sciences and Humanities. It covers a nation’s strategic conceptions, its foreign intelligence, its capabilities, and its cultural and ideological impact on the world. Thus, the control of knowledge

is the crux of a worldwide struggle for power as the most powerful weapon.

Knowledge utilisation is fundamental to its use. Knowledge, merely stocking it in whatever form, may be of little consequence, if it is not used properly. Again knowledge can be used for the good or ill of living beings. Destructive weapons (atomic weapons) are got out of intense research ostensibly for a nation's security. But, if it is used indiscriminately, it would bring about total annihilation of all living beings.

We shall present below some of the important characteristics of knowledge:

- Knowledge is infinite.
- Knowledge is dynamic, continuous, and ever expanding.
- No final word can ever be said of any discipline; they are at best provisional, subject to criticism, correction, contradiction, change or modification.
- A gifted man may acquire wide knowledge, deep wisdom and spiritual insights but all these are lost when he/she dies except those that he/she had recorded.
- Knowledge once parted to others, results in no loss to the person.
- Knowledge becomes obsolete.

Self Check Exercise

2) List the characteristics of knowledge.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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4.5 KNOWLEDGE: TYPES AND SCOPE

We have so far studied the nature of knowledge, what it comprises, and its characteristics. In this section, we shall discuss different views of knowledge.

4.5.1 Personal and Public Knowledge

Knowledge is broadly divided into two groups, personal knowledge (private knowledge) and social knowledge (public knowledge). Personal knowledge is the knowledge of the individual and as such is available to others only if communicated. Social knowledge is the knowledge possessed collectively by a society. It is supposed to be available to all the members of the society freely and equally. Libraries and information centres provide this kind of knowledge. It must be, however, stated here that these two kinds of knowledge are not mutually exclusive. Social knowledge is an essential source of personal

knowledge and it is from personal knowledge that most social knowledge is built up.

Ziman, the distinguished physicist, emphasises the importance of the organisation of public knowledge. There are three aspects to the organisation of public knowledge viz. a) organisation by creating, b) self-organisation and c) bibliographic organisation. Organisation by creation is the result of the efforts of those that generate knowledge by means of experiments and other methods of investigation and record them in a form to be communicated. Self-organisation refers to the references cited to any document to other documents, establishing a thought link between the citing and cited documents. When extended, it provides a very interesting intellectual organisation of knowledge that can cut across the conventional classificatory norms known to librarians. We shall study this aspect later in this Unit.

Bibliographic organisation refers to the organisation of primary documents in bibliographies, indexing and abstracting journals and other various types of information products and services. All these are handled by libraries and information centers.

4.5.2 Tacit and Explicit Knowledge

The above two groups of knowledge is expressed slightly differently by Michael Polanyi. Explicit knowledge is that expressed to others, orally or in a recorded form and tacit knowledge is personal knowledge that may or may not be expressed by an individual. Generally most people express their personal knowledge up to a point but not beyond for reasons of their own. Sometimes it may be deliberate or sometimes they may not be able to describe their special skill. For instance a particular skill in arts and crafts may only be demonstrated by an expert and not explained. In music, a curve of a musical phrase may be demonstrated by an expert but may not be conducive to be described or explained. This makes Polanyi to point out that we know more than we can tell or explain to others. "Another way of distinguishing between tacit and explicit knowledge is knowledge of the body, which is subjective, practical, analog while explicit knowledge is of the mind which is objective, theoretical and digital." Quite often we talk about the body language, facial expressions and other signals that communicate quite a lot of the intention of the person but never expressed in words. Therefore it is said that tacit knowledge is highly personal and hard to formalise, making it difficult to communicate or share with others.

However tacit knowledge is as important as explicit knowledge. In the new discipline of Knowledge Management, it is this tacit knowledge, which is valued very highly, constituting the real strength of a company. It is this knowledge of individuals that need to be extracted by various means and methods, to build up the organisational strength of a company to be competitive in a market.

4.5.3 Three Worlds of Knowledge

Another view of knowledge is the way Karl Popper has identified knowledge groups, more on a philosophical plane. Popper ontological scheme is to see three worlds of knowledge. viz., World 1, the physical world in which earth, vital though it is to us, but an insignificant speck in the immensity of the

universe of radiation and matter. World 2 is the world of subjective human knowledge, corresponding to individual knowledge. The World 3 is objective knowledge, which the product of human mind recorded in languages, in arts, the sciences, the technologies – in all the artifacts humans have stored or scattered the earth.

Although these three worlds are independent, they also interact. As humans living on earth, we are a part and parcel of the physical world, dependent for our continued existence on heat and light from the sun, oxygen from the air, carbon-dioxide being absorbed by plants, fresh water from springs, carbohydrates and proteins from our foods and so on. Through our mind and intellect and other sense faculties, humans observe everything in their environment and make our own subjective understandings. World 3 is one which all human thoughts, ideas and experiences are recorded in the form of print and non-print media which are the stock in trade for all libraries and information centers.

Personal knowledge is short lived. Human history has seen great persons, achieving extraordinary successes in ever so many walks of life. Such outstanding persons with great caliber have left their prints in history. But their personal knowledge is gone no sooner they die. Such persons are not born in every generation. Although knowledge includes personal and public knowledge, personal knowledge has a short life; invariably all tacit knowledge are not possible to be recorded.

Self Check Exercise

- 3) Distinguish between personal and public knowledge.
- 4) Why is personal knowledge short lived?

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of the Unit.

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4.6 FORMATION OF KNOWLEDGE

The organisation of public knowledge in their physical forms of print and non-print materials, in libraries and information centers, has to continuously grapple with the rapidly expanding dimensions of knowledge. Not only new disciplines are emerging, the multidimensional and interdisciplinary nature, and a host of other factors makes it essential to keep the tools of organising collections with the same pace of the growth of knowledge. Libraries and information centers disseminate information about their collection through their catalogues,

bibliographies, indexes, abstracts and other such products. Provision of subject approach to documents through these types of secondary tools, has been and is a major challenge to library and information professionals. Classification Systems, Subject Heading Lists, Information Retrieval Thesauri are some of the tools and techniques that have been employed in information storage and retrieval. These tools have to keep updated with the expanding horizons of knowledge. The designing of these tools and their developments need to be on a theoretical basis to respond to the unprecedented expansion of knowledge.

This need was seen by Ranganathan and he developed his general theory of classification with laws, normative principles, postulates, canons, etc. not only to take care of past and present knowledge but also for the future developments. He provided a general framework for organising isolates in any subject through his concepts of Basic Facet, Fundamental Categories of PMEST, which has become a model for other systems to adopt or adapt. In designing schemes for classification of subjects, he felt the need to study the ways subjects grow and get formulated. This resulted in his general enunciation of modes of formation of subjects. The following are the five preliminary modes of formation of subjects and isolates initially identified and expounded by Ranganathan.

4.6.1 Ranganathan's Modes of Formation of Knowledge

Dissection "is cutting a universe of entities into parts of coordinate status, even as we cut a slice of bread into strips." When the parts are ranked, they form an array. Each part is termed as a "Lamina".

Example: Botany, Agriculture, Zoology constitute the dissected members of the Universe of Basic Subjects.

Lamination "is a construction by overlaying facet on facet, even as we make a sandwich by laying a vegetable layer over a layer of bread. When the basic layer is a Basic Subject and the other layers are isolates, a compound subject is formed."

Example: In the subject "Agriculture of Corns", the two layers, Agriculture and Corn lie on both the ends of the Basic Subject Agriculture and isolate idea Corns. There can be more layers of this type.

Denudation "is the progressive decrease of the extension and increase of the intension (or the depth) of a Basic Subject or an isolate idea, even as we scoop the flesh of a soft fruit from deeper and deeper layers or as we excavate a well". In the words of Shera denudation is "the exposure of a new area of knowledge by erosion or divestment through research or enquiry."

Example: Philosophy, Logic, and Symbolic logic.

Loose Assemblage "is the assembling together of two or more subjects."

Example: General relation between Political Science and Economics.

Superimposition "is connecting together two or more isolate ideas belonging to the same universe of isolate ideas. The need for this usually arises when an entity is eligible to as isolate idea on the basis of two or more quasi isolate ideas."

Example: Sociology of Rural Poor.

4.6.2 Neelameghan's Extension

Based on Ranganathan methodology, Neelameghan worked further on these ideas of the modes of formation of subjects and enumerated a few micro modes. These are:

Fission is the process of division or splitting or breaking up into parts. The process has, until recently, been denoted by the term "Dissection". However, "Dissection" usually implies the splitting, breaking up, etc. of an entity into parts by an outside agency. On the other hand, Fission is an internal process of division without the involvement of an outside agency.

Distillation of Kind 1 A distilled subject is one which gets formed on the basis of some or similar or common observation, experiments and experiences in several subjects.

Example: Management Science, which is distilled out of studies in the management of science laboratories, universities or industries and such others. Other examples of such subjects are Systemology, Metrology, Research Methodology, and Conference Techniques.

Distillation of Kind 2 From time to time, for various academic and sociological reasons, scholars may study extensively and in depth some particular idea or even several ideas. This may lead to a considerable literary warrant for the ideas generated. The publication of a new periodical, the organisation of a faculty in a teaching institution, the formation of a research group, the formation to have an independent status as a subject in its own right.

Example: Statistical Calculus developing from Mathematics, Microbiology developing from Biology and Botany. International Relations developing from Political Science; Demography developing from Sociology.

Fusion is a result of interdisciplinary research with characteristic trends in present day research programs. These efforts lead to the emergence of a new set of ideas or theories of an interdisciplinary character. These ideas attract a group of specialists and a new field of specialisation emerges with its own normative principles, postulates and theories.

Example: Astrophysics, Biomechanics, Psycholinguistics, Socio-cybernetics

Clusters are formed of subject fields wherein there is a core entity of study with inputs or viewpoints or works on it coming from specialists from diverse subjects.

Example: Studies in Sinology, Tibetology, Studies centered around famous personalities – Gandhiana; Studies grouped together as in Defense Sciences.

Others: Environmental Sciences, Ocean Sciences, etc.

Agglomeration of Kind 1 consists of subjects treated integrally or distinctively in one and the same document.

Example: Natural Sciences, and Humanities.

Agglomeration of Kind 2 constitutes subjects comprehending other subjects with respect to the schedules of a particular scheme of classification.

Example: Psychology and Sociology as in UDC.

(**Note:** These are illustrations, not exhaustive listings of the different kinds of modes of formation.)

These studies of Ranganathan and Neelameghan have been developed in the context of designing classification schemes such as Colon Classification. They may be useful in contexts other than this also. For instance the intellectual organisation of information knowledge and information for various other purposes, collection development, information storage and retrieval and others. Research studies on the formation of formation of subjects are a continuous effort as new subjects/disciplines keep on emerging. As we know no final word can ever be said on any research effort. They are at best provisional.

Self Check Exercise

- 5) Enumerate the modes of formation of subjects as propounded by Ranganathan and extended by Neelameghan.

Note i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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4.7 ORIGIN AND GROWTH PATTERN OF DISCIPLINES

Formation and structure of subjects of Ranganathan and Neelameghan are one method of studying the growth of subjects. There are also other observations made by scholars as to how disciplines get formed and what are their attributes. In this section, we give a brief resume of this approach to knowledge.

4.7.1 Disciplines

Giving an overview of the social organisation of knowledge and information, McGarry observes that a discipline is a branch of instructions, of mental and moral training. Etymologically it is derived from the word 'disciple' which means one who learns. A scholarly discipline is an organised field of enquiry pursued by a community of knowledgeable persons. In contrast to vocational and skilled crafts, persons involved in their scholarly disciplines are acutely conscious of the historical and social environment of their intellectual commitment. They act as authorities in their particular fields. The results of their activities in the form of theories and formulations are included in the curricula in all formal schools of learning.

4.7.1 Attributes of Scholarly Disciplines

Some of the attributes of scholarly disciplines are:

- It enables distinguishing between knowledge and opinion. Opinions do not have anything to do with scholarship; they are subjective and conditioned by one's own perception of things. Knowledge is the outcome of disciplined enquiry and is developed by criteria of justification and validity.
- Disciplines of knowledge are composed of people. Communities of scholars share a domain of certain intellectual enquiry or discourse. Their deliberations result in a body of knowledge which eventually gets formed into a discipline.
- A discipline may contain knowledge and information of all degrees from the simple introductory textbooks to the complex elaboration of specialists symposium. Authenticity which is the outcome of learning, scholarship applying critical scrutiny and rigorous methods of evaluation, judgment, etc., lend quality to the discipline.
- A discipline is not a collection of a summary of ideas and a rule of thumb technique ; it has form, pattern and structure.
- Each discipline has a distinct domain of enquiry and specialised methods by knowledge is created and validated.
- Every discipline classifies its domain in a particular way, according to its ramification. This gets reflected in all writings in the discipline.
- Each discipline has a documentary communication structure through which ideas are conserved, transmitted, assessed and validated.
- A discipline has its own specialised vocabulary which serves the scholarly community both as a medium of communication and as a thesaurus for mapping out the domain of study.

Disciplines differ in their purpose, methods and domains of enquiry and they differ from each other in varying degrees. Meanings in Biology are often the same logical type as meanings in the Physical Science in that they are empirical descriptions of matters of fact ideally formulated in terms of exact laws and explanatory theories of great generality. In the Humanities and the Fine Arts, the *Form* becomes the subject matter and the other concepts are the singularity of the work. Accordingly, there are strong and influential bonds between the social and intellectual organisation of subjects disciplines and its modes of communication and information transfer.

4.7.3 Relevance to Library and Information Studies

An important part of work of the library and information professionals lies at the intersection of disciplines in organising literature search services and other related information storage and retrieval efforts. Studies on *Knowledge about knowledge* give the professional an insight into the disciplines to intuitively work out the strategy for content analysis and synthesis.

In the final analysis, one can study the academic contents of disciplines to see how they are related to use and for the provision of library and information services.

Self Check Exercise

- 6) State the purpose of the study of ‘Knowledge about knowledge’ in the light of interdisciplinary nature of modern subjects.

Note: i) Write your answer in the space given below.
ii) Check your answer with the answers given at the end of the Unit.

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4.8 MAPPING OF THE STRUCTURE OF SUBJECTS

The previous two sections dealt with the modes of formation of subjects and the origin and patterns of growth of disciplines respectively and their relevance to library and information studies.

In this section we shall study another model of structuring subjects and mapping them to get a view of concept relationships in subjects.

4.8.1 Citation Analysis and Subject Structuring

An interesting method of structuring of concepts has been conceived by Eugene Garfield, the innovator of Citation Index and Citation Studies. Citing a reference in books, research papers, journal articles, conference papers and similar other documents, is an age long practice. The citing and the cited articles have a relationship between them by virtue of the authors having some connections to the ideas propounded in both the cited and citing articles. The relationship established between the two articles, transcends the formal reference value and establishes the conceptual relationship between them. At a deeper level, it can be discerned that there is a relationship between the two articles. This method of citations when analysed with reference to many other citations brings to the surface, a cluster of concepts, which have some intrinsic relationship between them, which is much beyond the conventional hierarchical and associative relationships between concepts. This has been very effectively captured by Garfield in his mapping of the structure of some subjects.

This method of identification of clusters of concepts related to a subject bears evidence to the interdisciplinary nature of newly emerging subjects. The problem of seepage and scattering of articles in core, peripheral and alien periodicals has been a serious constraint in meeting the information needs of researchers and other types of users in library and information centres. This approach in clusters using citations is a useful method. This is particularly

helpful in computer searching wherein the relationships between concepts are captured in a matrix.

**Knowledge: Definition,
Types, Nature, Properties
and Scope**

4.8.2 Graphic Display

Most of the classification schemes display the concept relationship in subjects in linear fashion, indicating them by various types of indentation and other methods of display techniques. In this method, there is a restriction imposed by the linear display of concepts whereas these concepts are truly multidimensional in their relationships. This problem of display is generally overcome by graphic display methods, which may map the hierarchical and associative relationship.

This method of graphic presentation of concepts of multidimensional relationships brings out the ramification of subject concepts effectively. This makes it easier for an indexer or a searcher in storing and retrieving work. An atlas of the different broad concepts may be required to show the relationships between major groups and narrow concepts in specific subjects, as in geographical atlas of world, continental, country, and smaller geographic divisions.

4.9 SOCIOLOGY OF KNOWLEDGE

We have so far studied knowledge, its varied definitions, distinguishing personal knowledge from public knowledge, Polayani's tacit and explicit knowledge, Popper's three worlds of knowledge, Ziman's perception of public knowledge, formation of knowledge and its extension by Ranganathan and Neelamegham respectively, ramifications of disciplines, citation and subject structuring, and mapping of subjects.

All these give us an idea of how knowledge has been studied from different angles. In this section, we shall learn about another dimension of knowledge study viz. Sociology of Knowledge.

Knowledge, it is said, is a product of humans and gets aggregated over a period of time and also keeps on expanding. It is also said that it is a social product. Hence it has been studied by sociologists, as a artifacts of human beings. Sociology is defined as the science or study of the origin, development, and organisation and functioning of human society. One of the major contributions of human society is knowledge, which has been the basic strength for the human society to grow, develop and advance. As a theory, Sociology of knowledge, seeks to analyse the relationship between knowledge and existence, as historical social research, it seeks to trace the forms that this relationship has taken in the intellectual development of mankind.

The International Encyclopaedia of Social Science (1968) defines Sociology of knowledge as follows:

“The sociology of knowledge may be broadly defined as that branch of sociology which studies the relation between thought and society. It is concerned with the social or existential conditions of knowledge.”

Two world hypothesis, which has been heuristically very useful in positioning relation between groups and cultures represent fundamentally different

orientations. These two worlds are science and the humanities.

To sum up, sociology of knowledge charts out the scope of the subject by developing a relationship between knowledge and existence, thought and society, groups and culture, and science and humanities.

In the next sections we shall discuss sociology of science, literature, and reading in all of which, library and information professionals are vitally interested.

Self Check Exercise

7). What are the roles of sociology of knowledge?

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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4.9.1 Sociology of Science

Sociology of science is the nature of scientific ideas, and their development, structural organisation, individuals and the groups involved in scientific activities. In other words, Sociology of science is primarily concerned with a construction of a set of highly generated systematic and relatively exhaustive concepts and propositions of relationships. It is interested not only in fundamental scientific ideas themselves, but also in their applications to technology. In this process, it uses both historical and contemporary data, drawn from a variety of cultures, to serve its primary goal of constructing a system of analytical concepts and propositions.

The Social Structure and Development of Science

Sociology of science sees man's scientific behaviour as his/her response to the functional problem created by the need to have an adequate knowledge of the physical, biological and social aspects of the empirical world. In order to explain the degree of development of science, four general components of science as a whole are given, each of which has a measure of autonomy. These are: a) Substantive scientific ideas; b) Scientific methodology, including both ideas and instruments; c) Scientific roles; and d) Motivational and award for scientific roles.

Substantive scientific ideas very true dimensions of: i) generality or abstractness; ii) exhaustive for the relevant aspects of the phenomena. It is said that the more abstract, systematic and exhaustive, a set of substantive scientific ideas is the greater of its scientific development.

Among the interesting problems that sociology of science tries to explain is the question of why the physical sciences have developed more rapidly in all

these three respects than have the biological sciences and why these in turn, have developed more rapidly than the social sciences. Among the social sciences, there have been more recent developments in economics than in political science or sociology. This can be explained at least in part by the greater accessibility of data on a variety of economic phenomena than of data on people's political and social norms and actual behaviour.

Knowledge about ideas and instruments that make up scientific methodology varies in its degree of development. Modern science has made great advance over earlier Science in its development, largely due to the knowledge of essential methodologies such as the character of concepts and clarification, the logic of comparison and inference, and the function of contrived and natural experimentation. An important sociological fact about the development of social science is their ability to borrow a great deal of the methodological sophistication from other disciplines of science.

Another factor for the development of science is the motivational and the award/reward system for the roles of scientists.

Self Check Exercise

- 8) State the general components of science in explaining its degree of development.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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Sociological Characteristics of Science

i) Structural Differentiation

The degree of structural differentiation in a society and specialisation of roles between major scientific institutions, provide a set of more favourable conditions for the development of science. Certain values are much more favourable to the development of science than others. One such value is "Libertarianism" i.e., academic freedom. This is one kind of important foundation for scientific progress.

ii) Environment

Scientific knowledge is power i.e., power to adjust more or less satisfactorily to the non-social environment and in the internal and external social environment. Social and environmental pressures quite often trigger major scientific discoveries and technological innovations. This is true of all stages of history. These can be illustrated by examples from national defence for security, industrial and agricultural growth to withstand competition, health care, etc.

Factors Influencing Scientific Development

A variety of economic needs and resources often combined with one or more other social factors, have had very large direct and indirect influences on the development of science. In the modern world, both organisation and governments have provided many kinds of support for science in order to pursue economic interests and needs. Direct support exists in the form of governmental and industrial research laboratories; indirect support is given through tax concessions and incentives, financial and other forms of subsidies to both universities and industry.

The desirability of using science to meet economic needs and increase economic resources is no longer in question anywhere among the societies of the modern world. Political factors, closely combined with economics, influence scientific research and developments. Research on the nature of metals, on the causes of chemical reactions and explosives, and on the mathematics of the curves of ballistic missiles, has been spurred by military needs to maintain a balance of power.

The maintenance of science is very much facilitated by an educational system that is sufficiently specialised, geared to growth and development.

Motivation and Award/Reward System for Scientists

Institutionalisation has been a special feature of modern civilisation. Universities, various government organisations and many industrial firms, having recognised the value and consequent need for Science, have established regular and permanent roles and careers for scientists. In addition, a variety of special research institutes with endowments from foundations, commercial associations and other special interest groups, are sometimes operated by private individuals, and they further provide specialised jobs for scientists.

The mere existence of social roles for scientists is not enough for their full contributions. Adequate and legitimate awards for those who perform very distinctive roles should be made available to motivate them to give out their best. Titles, prizes, medals, higher offices and other eponymous (in the name of a person of outstanding) distinctions, symbolise the existing hierarchy of differential prestige. Both at the international and national such award/reward systems exist to give incentive to highest performance in science.

The Nobel Prize in any of the four scientific disciplines viz. Physics, Chemistry, Medicine and Physiology, Economics in which it is granted is the best-known hall mark of scientific achievements.

Therefore, the role of the scientist is subject to structured set of motivations and rewards. Interestingly, it is said that the scientist is no more a “selfless” creature above and beyond the influence of his social role.

Communications among Scientists

One of the essential ingredients of the development of society is a peer review group, which validates scientific findings. This is achieved in many ways. All these involve an effective communication system in the diffusion and dissemination of scientific research. One of the important objective inventions towards this, is the creation of learned societies whose essential objective is to provide a forum for scientists to meet at regular intervals and to promote

scientific activities. The Science Journal is an outcome of such efforts. Through participation in national and international conferences, informal visits to institutions, letters, circulation of reprints, mimeographed materials scientists strive to maintain effective communication without which their activities would slow down considerably. The computer and communication technologies, the Internet, e-mails and such other facilities have accelerated the speed of communication.

Self Check Exercise

9) Enumerate a few of the factors influencing scientific development.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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Science Posing Problems

There are two aspects of science that are perceived as social problems. One pertinent to scientists' sense of interference in their field of activities by extraneous factors. For example, scientists resent what they define as unnecessary controls on their work. They complain about insufficient financial support for their preferred types of research. They wish to throw nationalistic and other parochial limitations on their research communication activities. A variety of organised and unorganised means of protest now exists among scientists to cope up with these problems.

The second aspect of the problem is with reference to the evil effects that science may bring to society. Some harmful consequences of science are given as examples for restricting the influence of science or even eliminating it. It is, therefore, defended that responsibility for harmful social consequences of science rests not directly with scientists but with the several established social and political processes for handling social problems. It has also come to be recognised that scientists can play a variety of social roles in these social and political processes to ensure that it is not a science problem that harms the interest of the society. A number of social and political arrangements are now being worked out, to permit scientists to act as expert advisers on the technical aspects of the social problems to mitigate the unsocial and harmful results of science.

4.9.2 Sociology of Literature

Another subset of sociology of knowledge is sociology of literature, which gives expression to human imaginative and artistic outputs, in relation to the social environment in which such works are created.

Unlike contributions in the physical, natural and social sciences, a literary work is imaginative, and in its entirety a product of the human mind. A literary work may take different forms of presentation (poetry, drama, novel, short stories, etc.) and may reflect social life and environment in all dimensions. It may have artistic and aesthetic quality, couched in an attractive but simple language with clarity of thought and ideas. A literary work establishes a relation between the writer and the readers to whom the work has an appeal. It is a meeting or sometimes the clashing of two free acts, one of production and the other of consumption with all their effects and side effects on moral and social relations. "There is always another man in literature, a writer for a reader and reader." So sociology of literature relates to the study of the writer as a professional person, the literary work that the person produces, the reader of the work as a consumer and the publisher and bookseller who promote its use.

Literary Milieu

A work of literature is a product of a literary milieu in which thoughts and ideas are exchanged, judgment on them passed, and values stated in them are discussed. The existence of such a milieu is and always has been inseparable from the very fact of literature. Literary work, is, in fact, conceived as a two-way communication; messages are broadcast by the writer to a community of readers whose response may bring writers reputation and status in the community of writers or may do the opposite by bringing him/her disrepute.

Literary milieu, being part of a broader societal milieu, the whole network of literary intercourse is subject to all conditions imposed by social life. In fact, the amplitude, the significance, the richness, in short the quality of literature depends to a large extent on the place a particular literary work occupies in the literary milieu and consequently by the writer's place in the society concerned, on the awareness of the situation in which the work is produced and other related factors.

Literary Recognition

A writer invariably seeks recognition for the literary work he/she produces. In general all writers do not get the recognition they seek. It has been studied that the number of writers who get recognition and establish, represent only one percent of the total number who actually write and publish literary works. Of the several factors that contribute to the selection process of recognition, the following are some:

- A certain amount of contemporary literary recognition that a writer already has;
- The place of the literary work in the educational curriculum at all levels i.e. from the elementary to the advanced levels, reference in other works, and in encyclopaedias such others; and
- The existence of a class and political structure to which the writer belongs.

In sum, the small group responsible for the literary recognition of writers and for the literary opinion that builds up for a writer, usually rests with university intellectuals, those belonging to the influential circles, moneyed class and the upper crust of high political or technical strata of society.

Literature and Mass Communication

Knowledge: Definition,
Types, Nature, Properties
and Scope

The printing and publishing of books on a mass scale is an important landmark in literature dissemination and distribution. Then introduction of paperbacks, which is comparatively a recent development, afforded a technical means for a fresh image of the book as a means of mass cultural communication. Paperbacks as is well known, have become very popular. A sale of a million copies of booksellers is a normal feature today particularly in the western countries.

Apart from their role of dissemination and distribution, publishers play a very decisive and significant role in selecting literary works of quality and also take the risk in investing on their publication. In this process, the publisher is conditioned by the substantial capital investments. He/She is naturally anxious to avoid commercial loss, and he does this by limiting the experimental titles of works to elites or by abandoning the idea of 'creative' publishing and strictly program his/her production to the functional needs of a pre-selected mass market.

Self Check Exercise

10) What constitutes of sociology of literature?

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

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4.9.3 Sociology of Reading

No sociology of literature is meaningful without a sociology of reading and the cultural impact that reading habits have on the society. While it is rather difficult to define a reading public precisely, a few attributes of such a group can be identified. These for a literary work are the actual mass of readers, their core composition in terms of their educational, economic, cultural and other related status. However, the case of books reaching unexpected and even unsuspected public beyond social, national, linguistic, temporal barriers, are becoming numerous.

This is an area of considerable interest and importance to the library and information community. Very little work has been done in India to study the reading public in general or with reference to any particular tiles in English or in any Indian language. Planned research, is however, essential to get right results. Some of the organisations like the Sahitya Akadami, the National Book Trust, the National Library of India, The Raja Ram Mohun Roy Library Foundation and some leading publishers may also be interested in such studies to fund research projects. It is for the professional associations to pursue such efforts.

Sociology of literature in the contemporary situation with particular reference to India may be two fold:

- Helping persons or agencies responsible for book production in the various languages and regions to take stock of the new problems created by mass literary targets set for the country; and
- Helping the hitherto ignored masses of readers to gain aesthetic and artistic consciousness and claim their parts of cultural heritage to mankind.

4.10 KNOWLEDGE UTILISATION

We have known that global, regional and national studies, experiments and experience in socio-economic development indicate, that as a society moves from a pre-industrial state (agricultural stage) to industrialisation and on to the post-industrial state, it tends to utilise science, technology and societal knowledge in an increasing measure, in all developmental activities. Hence, it progressively becomes an information/knowledge society. This society is characterised by the increasing use and utilisation of knowledge in all its process of growth and development. In the knowledge society, knowledge is the key-determining factor for innovation, policy formulation and material progress. As a consequence of this recognition, there have been increasing efforts in creating new knowledge through institutions exclusively dedicated to research.

Impact of Information and Communication

Any discussion of knowledge use and utilisation would be incomplete if we do not take account of the unprecedented impact of information and communication technology (ICT). Today recorded knowledge in whatever physical form it exists is available throughout the globe cutting across space. The Internet with its multifunctional facility, incorporating the world wide web and e-mail and all the other components of electronic information and knowledge, has made it possible for interactive studies and exchange of ideas among peers. This extraordinary facility empowers, information-rich countries to have access to global knowledge. Knowledge being power, the accessibility and availability has already created the digital divide among the information rich and information poor countries. Yet the use of the Internet, however, has very considerably increased among the Asian and African countries. This is another dimension that needs to be kept in mind while discussing knowledge, its generation, storing, dissemination and distribution, accessibility and availability. ICT is not only a facilitator and enabler, but also could be highly productive.

The Indian Scene

While many of the attributes of an information/knowledge society may not be present in India, a few features, which are characteristic of the knowledge society, have surely emerged. The value of scientific and technological knowledge in the Indian context was eloquently articulated by Pandit Jawaharlal Nehru in the Scientific Policy Resolution (SPR) of the Government of India as far back as in 1958.

This policy has planted the seedlings in India and a very fine infrastructure has been built in India for knowledge generation.

The setting up of a number of R&D institutions in Science, Technology, Social Sciences; Humanities, the establishments of educational and training institutions of higher learning, centres for advanced studies in many disciplines, acquisition and cultivation of technological and managerial skills and expertise through institutes of technology and management, creation of learned societies and professional associations, consultancy organisations to bridge research and industry, multimedia centers and many others are undoubtedly meant to create the necessary conducive environment for knowledge creation, use and utilisation. India is also to become soon a super power in software technology, which is the soul of information technology.

Self Check Exercise

11) What is the infrastructure created in India to generate new knowledge?

Note: i) Write your answer in the space given below

ii) Check your answer in the answers at the end of the Unit.

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4.11 SUMMARY

In the Unit, we began with the definitions of knowledge, indicating the shades of differences in their meaning. The nature of knowledge along with its characteristics is briefly explained. In discussing the types of knowledge, we distinguish between personal and public knowledge, tacit and explicit knowledge and Popper's three worlds of knowledge. Knowledge is ever expanding, sometimes turbulently. This characteristic takes us to the study of the modes of formation of knowledge. The ideas of knowledge formation as propounded by Ranagathan and extended by Neelemeghan are described with examples. Another view of knowledge is looking at knowledge as a set of disciplines; its origin, growth and nature are all explained. Another dimension of its study is its sociology. Sociology of science, literature, and reading which form the subsets of sociology of knowledge are discussed. Knowledge use and utilisation are the final goals of generating knowledge for the human advancement in all directions. The way knowledge use and utilisation are greatly enhanced by the unprecedented advances in information and communication technologies are briefly mentioned. The infrastructure built in India for knowledge generation and use are briefly stated.

4.12 ANSWERS TO SELF CHECK EXERCISES

- 1) Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of

knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms.

- 2) The characteristics of knowledge are:
 - Knowledge is infinite intangible and difficult to measure.
 - Knowledge is dynamic, continuous, and ever expanding.
 - No final word can ever said of any discipline; they are at best provisional, subject to criticism; correction, contradiction, change or modification.
 - A gifted man may acquire wide knowledge, deep wisdom and spiritual insights but all these are lost when he dies except those that he had recorded.
 - Knowledge once parted to others, there is no loss to the person who parts with it. It sometimes increases with use.
 - Knowledge becomes obsolete.
- 3) Personal knowledge is the knowledge of the mind of an individual, although and as such is available only to him/her or through to others if communicated. Public knowledge is the knowledge possessed collectively by a society or a social system. It is supposed to be freely and equally available to all the members of the society. Libraries and information centers provide this kind of knowledge.
- 4) Personal knowledge is short lived because the person who has the tacit knowledge when passes away, the personal knowledge of that individual is lost, unless that knowledge is recorded.
- 5) Dissection, Lamination, Denudation, Loose Assemblage, Superimposition; Fission, Distillation of Kind 1, Distillation of Kind 2, Fusion, Agglomeration of Kind 1 and Agglomeration of Kind 2.
- 6) Studies of knowledge about knowledge gets the library and information professional an insight into the disciplines, to work out intuitively the strategy for information storage and retrieval, intellectual organisation of knowledge, collection development and many other users related information services.
- 7) As a theory sociology of knowledge, seeks to analyse the relationship between knowledge and existence. As historical research, it seeks to trace the forms that this relationship has taken in the intellectual development of mankind.

The dual roles of sociology of knowledge are:

To aim at discovering workable criteria for determining the interrelations between thought and action; and to develop a theory, appropriate to the contemporary situation concerning the significance of non-theoretical conditioning factors in knowledge.

- 8) Academic freedom, environment pressure, direct and indirect support to scientific research, motivations of scientists for research and creation of new knowledge, communication of scientific research and evil effects of scientific research.
- 9) Industrial and government support in relation to economic and social need

based research; political factors such as military needs, balance of power, etc. and increasing specialization in the educational system are some of the important factors associated with scientific developments.

- 10) Sociology of literature relates to the study of the writer as a professional, the literary work that the person produces reflecting the social values prevailing at a particular point of time in the society, the reader of the work as a consumer, and the publisher and bookseller as distributors of knowledge who promotes its use.
- 11) The setting up of a number of R & D institutions in Science, Technology, Social Sciences, Humanities, the establishment of educational and training institutions of higher learning, centers for advanced studies in many disciplines, acquisition and cultivation of technological and managerial skills and expertise through institutes of technology and management, creation of learned societies and professional associations, consultancy organisations to bridge research and industry, multimedia centers and many others are undoubtedly meant to create the necessary conducive environment for knowledge creation, use and utilisation.

4.13 KEYWORDS

Aesthetics	: The theory of the fine arts and the philosophy of the mind and emotions in relation to it; that branch of philosophy which deals with the beautiful, the doctrine of taste.
Citation	: When a reference "A" is cited in the citing article 'B', then the article 'B' is referred as 'Citation' of reference 'A'.
Discipline	: A branch of knowledge, subject of instruction.
Libertarianism	: Principles or doctrines of the freedom of will.
Milieu, Social	: Refers to the man's social environment or surroundings.
Ontology	: The branch of metaphysics that studies the nature of existence.
Private Knowledge	: The knowledge of the mind of an individual and as such is available to him/her or through him/her to others, if communicated.
Social Knowledge	: The knowledge possessed collectively by a society or a social system and supposed to be available freely and equally to all the members of the society.
Sociology of Knowledge	: The science or study of the origin, development, organisation and functioning of human society.
Subject	: An organised form of knowledge.

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