
UNIT 5 INFORMATION, COMMUNICATION PROCESS, MEDIA AND DIFFUSION

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5.0 OBJECTIVES

After reading this Unit, you will be able to:

- understand the meaning of the term information and its different conceptualisations;
- explain the concept of ‘communication’ and identify different types of ‘communication’;
- describe communication process and analyse the different elements of “communication process”;
- distinguish the different communication media;
- define what “information diffusion” is;
- discuss the patterns of diffusion process;
- explain the various factors affecting information diffusion process;
- elucidate different “models” of diffusion; and
- discuss the role of information systems in information diffusion.

5.1 INTRODUCTION

There is a growing recognition that information and communication are interrelated in very fundamental ways. The disciplines of Communication and Information/ Library Studies have a long tradition of *common interests and concepts*. This tradition has provided increasing interdisciplinary linkages between the two fields. But, “the intersection of Communication and Information Studies cannot be explained only, or even largely, in terms of what might be termed a “Scholarly push”. Far more crucial to growing interest in the communication-information relationship, is the momentum and rhetoric of the market place. These forces give urgency to the need for frameworks that clarify the theoretical relationship between communication and information by identifying similarities and differences, exploring ways in which the differences may be complementary and/or supplementary, and facilitating theoretical integration in general”. In this Unit, an attempt is made to explain to you the relationship between the concepts “information and communication”. In the process, focussed perceptions of ‘information’ have been discussed. When considering the nature and role of information, from whatever perspective, meaning becomes central. Information is something that one person communicates to another. There is widespread confusion associated with defining of ‘communication’. “Not so, however, the attempt to investigate the relationships between information as a phenomenon and communication as process”. So far as definitions of the concept communication is concerned, the one employed by Ruben has been commended (*i.e.*)...The process through which individuals in relationships, groups, organisations and societies *create, transmit* and *use* information to organise with the environment and one another. This Unit discusses the aspects of definition of communication, types of communication, communication process and communication media. Also the Unit describes information diffusion, patterns of diffusion and its implications

to information systems, services and information professionals. It is hoped all these aspects will be useful in providing adequate knowledge to the participants of MLIS programme.

5.2 INFORMATION

The question “What is information”? has eluded answer for a long time. Of course, definitions proliferate and interpretations multiply even though nobody has said the last word. The best minds in information science give considerable importance to the concept and continue to discuss it. As T.D.Wilson observed “it was not so much the definition itself that mattered as the uses to which it was put” [T.D.Wilson, 1981].

The uses to which information is put are countless and therefore, the power of those *metaphors* which link the human and the social organisms in describing information as the *life blood of society* appear to be justified. Without a regular and uninterrupted flow of meaningful information, society would quickly run into difficulties, with business and industry, education, leisure, travel and communications, national and international affairs, etc. In fact, the advanced societies increasingly depend on the enabling powers of information and communication technologies (ICT). It might be stated that information has been a *significant element* in the life of all societies. Therefore, it is common for each society to have its own characteristic information and, knowledge base. However it may be noted that in the case of developing countries it might well be that *indigenous knowledge* rather than that contained in the *World's stores of information* is likely to be more relevant [Menou, Michel, 1994].

5.2.1 Conceptualisations of Information

Information is a concept that is applied in multiple ways in everyday usage as well as in the research literature [Mc Credie, *etal.* 1999]. Here, we identify and illustrate the range of what is meant by information, hoping to shed light on assumptions about information.

5.2.2 Information as Commodity/ Resource

Some researchers emphasise information as a thing or resource [Arrow, 1979, Bates, 1988, Buckland, 1991], a commodity that can be produced, purchased, replicated, distributed, manipulated, passed along, controlled, traded and sold. By focusing upon information-as-thing Michael Buckland [1991] brings into consideration such phenomena as objects and events, seeking in the process to widen our perception of what constitutes data and documents. Buckland's approach is useful both for its breadth of vision and of the way it manages to weave together such concepts as information, knowledge and communication. Also, by demonstrating information as a thing that is embodied in objects or information systems information can be tangible, as opposed to knowledge, which is inherently intangible. By this approach, Buckland sheds more light on the traditional approach of Machlup who saw information as intangible, involving either the telling of something or that which was being told. Buckland points out, in order to communicate knowledge it must be expressed or represented in some physical way as a *signal, text* or communication. This

conceptualisation is consistent with a model of sending information as a message from sender to receiver. It may include an assumption that the receiver will interpret and understand the message as intended by the sender.

There are, however, difficulties with the treatment of information as a *resource*. One such difficulty is associated with its intangible nature and also the fact that unlike physical matter, information *per se* is not subject to the kind of laws that would enable it to be treated in economic terms. Some writers have also warned against the dangers of a pre-mature acceptance of the arguments in favour of *the resource characteristics of information*. For instance, Michael Menou is rather sceptical of those claims, which would portray information as a *critical resource in all circumstances- individual, organisational and societal*. [Menou, 1994]. He opines that such claims need to be supported by more than anecdotal evidence and a limited body of empirical research. He emphasises that information is seldom identified to the *level of specificity* required to demonstrate its impact on any given situation or problem. Though, such criticisms are not taken lightly, they have to be balanced against the fact that the notion of *information-as-resource* is by now *well-established* in fact, most evidently in recognition of the related concept of a '*marketplace of ideas*', as reflected in profusion of national and international laws and policies relating to trade in information and its associated goods and services. This aspect serves to highlight another practice of viewing information as a *commodity*.

The notion of *information-as-commodity* has gained considerable currency in recent years, commodity comprising all types of information services, as also transborder data flows. It is stated that the concept of *information-as-commodity* is wider than that of *information-as-resource*, as it incorporates the exchange of information among people and related activities, as well as its use. The concept of information as a commodity is connected closely to the concept of *value chains* with commoditised information gaining in value as it progresses through different steps of creation, processing, storage, distribution and use. It might be stated here that the problems include those of measurement and appropriability, and with treating information *as a public good* as just one more free market commodity.

5.2.3 Information as Data in the Environment

Some writers tend to view information more broadly to include data in the environment available for interaction with human information processing capabilities. This data category includes *objects, artifacts, sounds, smells visual and tactile phenomena, activities, events or the phenomena of nature*. According to Buckland, it is easy to assume that all communication is *intentional*. In practice, however, one is informed also by perception of things that are communicated *unintentionally*. In other words, *neither the individual nor the data* unintentionally engage in communication. "The discoveries one makes in the process of casual (non-goal-directed) browsing [Chang Di Rice, 1993] or the references another makes about an individual's character or performance based on observation of the individual's behaviour when exposed to view, particularly when the individual is unaware of being observed, serve as additional examples of unintentional communication available when one attends to information as data in the environment".

“Taylor (1996) specifically uses the environmental approach in his concept of information use environments, which are intersections of:

- a) sets of people (professors, entrepreneurs, special interest groups, socio-economic groups);
- b) classes of problems (well- versus ill-structured, complex versus simple, assumptions agreed upon versus not agreed upon and familiar versus new);
- c) work settings (involving attitudes towards information, task domain, information access and history/experience, constraints and opportunities) and
- d) what constitutes problem resolution. These environments are contexts for various kinds of information needs.

5.2.4 Information as a Representation of Knowledge

Some of the researchers in information science view information as a representation of, or pointer to, knowledge. The tradition of scientific method and Scholarly publication is a clear example of this conceptualisation [Lievrouw, 1988]. Card catalogues or databases of citations to scientific documents illustrate an abstraction of representation of information, such as in documents, books and periodicals. Traditionally, this view of information has been based on the assumption that printed document is a primary representation of knowledge. Recent years have seen a proliferation of alternatives to print, such as representation of knowledge available on video or audiotape, videodisc, CD-ROM, Internet or other electronic or computer media.

5.2.5 Information as Part of the Communication Process

Some researchers consider information as part of communication process, as part of human behaviour in the process of moving through space and time to make sense of one’s world. [Atwood and Dervin, 1982]. From this conceptualisation, meanings are in people rather than words or data and *knowledge is what users do with data rather than what data do to users*. An assumption relating to this conceptualisation is that understanding must be based on observation of human behaviour in information seeking and sense making processes and on the meanings intended and interpreted by participants.

In the foregoing paragraphs, different conceptualisations of the concept information have been discussed and explained to you so that you may be in a position to understand focussed perceptions of the concept ‘information’. Let us now attempt to know what communication is, and the different aspects associated with the concept.

Self Check Exercise

- 1) Briefly explain the different conceptualisations 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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5.3 COMMUNICATION: CONCEPT AND GENESIS

The word ‘Communication’ is derived from the Latin word ‘Communis’, which means ‘sharing’. Communication encompasses all methods used by living beings to express or to convey a kind of thought or feeling. When we communicate with someone, we try to establish a certain degree of commonness with the person we communicate with.

If we look into the evolution of communication, we notice that communication has taken place in many ways and has taken many forms throughout the history of mankind. In the beginning sign languages or expressive body languages were forms of human communication. With the evolution of language, spoken word became the common form of communication. The invention of scripts and writing paved the way for the written form of communication. Written form of communication enabled recording and storing of information for the future generations. Invention of printing provided major technological breakthrough for recording knowledge and information in the form of documents. Other inventions like telegraphy and telephone systems provided mechanisms for people to communicate over long distances. Over the last four decades or so *electronic* and *mass media* became commonplace methods of communication.

5.3.1 Definition of Communication

Communication has been defined in many ways. For example, the Oxford Dictionary defines it as “The imparting conveying or exchanging of *ideas* and *knowledge* whether by *speech*, *writing* or *signs*”. On the other hand, Columbia Encyclopaedia defines communication as “The transfer of *thoughts* and *messages* as contrasted with transportation of *goods* and persons. The basic forms of communication are by *signs* (signals) and *sounds* (hearing)”.

Also, we come across the following explanations for the concept in literature:

- act or instance of transmitting;
- imparting or interchange of thoughts, opinions or information by speech, writing, etc;
- something imparted, interchanged or transmitted;
- document or message imparting information, opinions, etc;
- process by which information is exchanged between individuals or groups through a common system of symbols, signs or behaviour.

If we analyse the above-mentioned definitions and explanations provided for

the concept, we note that they imply that communication refers to transmission or exchanging of information and that for information to be transmitted, it has to be first mentally conceived, generated or formed by an individual. Only then, can information be communicated to another. The transmission process, could, however, be oral, through visual images or icons, or through written text in any language, or a combination of all these different modes of communication. From what has been stated above, it might be inferred that the media and the method used to communicate ideas through is important. Therefore, let us try to understand the forms and channels of communication.

5.3.2 Channels of Communication

Basically, there are two ways of communication:

- 1) Oral communication,
- 2) Written or Documentary communication.

Oral Communication

Oral communication is a method of communication through speech. It is characteristic of its immediacy and personal touch, which might be difficult to capture in other forms of communication. In this form, there is often an informal or flexible setting (atmosphere), which allows the sender and receiver, interact with questions and answers, comments and response. All this takes place in a given time and results in immediate feedback and permits an instant reaction.

Written Communication

Some basic characteristics of written communication are that it:

- has a more formal perspective, suggesting greater authority and trust worthiness;
- can be a potential record, capable of extended life and of being used again and again;
- can be extracted in parts or portions and can be quoted;
- it is suitable for reading at an individual's convenience, speed and place; and
- is accessible to a large readership which can lead to the benefit of expert criticism and review by peers.

5.4 TYPES OF COMMUNICATION

Communication systems may be classified or grouped into vocal or non-vocal or verbal or non-verbal as per the characteristic of physical phenomenon. They can also be categorised into intrapersonal, interpersonal, group or mass communication. Let us try to understand each one of these categories.

5.4.1 Non-vocal and Vocal Communication

Non-vocal communication refers to the use of *signs, signals and symbols*, gestures, etc in communication process. Signals, signs and symbols are the *three related components* of non-vocal communication process. This type of communication can be found in pre-historic period in all cultures.

There is basic difference between signs and signals. A sign contains meaning of an intrinsic nature while a signal is merely a device by which one is able to formulate extrinsic meanings. In other words, the meaning of a *signal is explicit* while that of a *sign is implicit*. Signals play a prominent role in communication systems. In certain situations signals allow the flow of information and in certain others they prevent. e.g.: use of signals in rail transport system.

Signs usually carry meaning by themselves. The meaning can be understood only by trained staff. Traffic signs are common example of *signs*.

Symbols are generally complex and are not easy to understand. They usually carry seminal meaning. Individual's perception plays a very important role. Example: Symbols used in classification schemes, such as Colon classification. Symbol has been defined as a device with which an abstraction can be made.

These *three* components: signals, signs and symbols have been used in non-vocal communication.

Vocal communication refers to any form of communication that uses the *human vocal chords*. It can range from shouting to spoken languages. Man's vocal apparatus as a device of communication represents an apex of physical and intellectual evolution. It has the potential to express the most basic instructional demands as well as a range of highly intellectual processes including the possible mastery of numerous complex languages, each with a large quantum of vocabulary. The vocal organs permit the production of *sound effects, animal noises, birdcalls* and other *amusing high manipulations of speech*.

5.4.2 Non-verbal and Verbal Communication

Non-verbal communication includes actions such as gestures, vocalisations, facial expressions and other behaviour. Whereas, verbal communication refers to the *use of words*. The era of verbal communication began with the development of language. Communication is generally equated with speaking and writing words (vocabulary) are viewed as the primary means by which information is conveyed from one person to another. Communication by facial expression, by tone of voice, by touch etc. falls under the category of non-verbal communication. Non-verbal communication is of seven types. These are:

- *Para linguistics* is a kind of complementary language which includes meaningful variations in speech corresponding to patterns of loudness, pitch, hesitation;
- *Kinesics* which includes facial expressions, eye movements, gestures, etc;
- *Haptics* which refers to the use of touch to communicate, for example, shaking hands, holding hands, patting, etc;
- *Proxemics* refers to the use of interpersonal space, that is to say how far a person is standing from the other, can communicate different meanings;
- *Dress and appearance*: dress, hair styles, make-up, jewellery, etc, can also constitute non-verbal code of communication;
- *Chronemics* that is to say how time is considered is sometimes a message in itself, a form of non-verbal communication and is called Chronemics; and

- *Iconics, which means interpretation of symbolism*, found in objects or designs can be considered a type of communication. The best example of this type of communication is *international traffic signs*.

5.4.3 Intra-personal, Interpersonal, Group and Mass Communication

Communication can also be classified in terms of its levels. The different levels of communication are as follows:

- *Intrapersonal communication* means communication within one person, i.e., talking to oneself, reading something, etc. In this type of communication, the source and recipient of information becomes one person. Intrapersonal communication includes a person's thoughts, experiences and perceptions during a communication event. Intrapersonal communication is of different types which include: i) postures, ii) muscle tension, iii) sleep, iv) use of tranquilisers, and v) emotions.
- *Interpersonal communication* means communication between two or more persons. It could be face-to-face, or it could be at a distance with the help of telephone or letters, etc. For effective inter-personal communication we must develop certain skills and tactics, which will help us to establish rapport quickly with new persons. One such skill is to be able to control the communication situation. This does not mean that we must act in a dominant way.
- *Group communication*: In this form of communication many people are involved and the speaker and the listener are shifted among the participants. This type of communication may take place between small groups usually not exceeding 25. It may also take place in large groups where there is communication by one or more persons to an audience of more persons.
- *Public or mass communication*: This generally refers to communication, which takes place between one person or a group of persons through a special media to a large audience. Mostly large-scale communication is disseminated by the media of print, broadcasting, film or the electronic media to large audiences. This type of communication is referred to public or mass communication.

In mass communication the relationship between sources and dissemination is different from that in case of individual or interpersonal communications. Interpersonal communication is one-to-one exchange, whereas mass communication is one-to-many exchange in which a few sources transmit to a great number of destinations.

Self Check Exercise

2) Identify different types of communication with the help of suitable examples.

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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5.5 COMMUNICATION PROCESS

Communication is not something that happens in a disjointed fashion. It is a transfer of a cluster of transactional functions of body and mind of one individual to another. Communication is said to possess the following characteristics: intention of the communicator, nature of communication, emphasis on action, measurability of action, comparability of intention and measured action.

Communication process always requires at least three basic elements: the source, the message and the destination. In fact, source is the point at which messages originate. It is also referred to as *sender* or initiator of information. A source may be an individual (speaking, writing, gesturing, etc.) or a communication organisation like newspaper, publishing house, television station, etc. Message may be in the form of written or printed text, sound or light waves in the air, impulses in the electric current, or in the form of any other signal which is capable of being interpreted meaningfully. Destination is the intended target of the message. Again, destination could be an individual or a group or a mob. Destination is the final link in the communication chain.

It may be stated here that in communication process, we try to establish commonness between the *sender* and the *recipient* of message. For this to happen, two more steps need to be added in practice. The steps are: the encoding of the message to be transmitted and a *mechanism to decode it* at the *receivers' end*.

The establishment of commonness between the sender and the receiver depends a lot on the field experience of the two. If the field of experience between the two is different, it is difficult to establish commonness between the two. In other words, the source can encode and the destination can decode the message in terms of experience each has had. It might therefore, be said that communication process is one of transmission and reception, the passing of ideas, information and attitudes from person to person. All the steps in communication process must be accomplished with high degree of efficiency if communication is to take place.

5.5.1 Communication Cycle

Hitherto we have been discussing the linear model of communication process in which the source transmits message and the destination receives it. In regular practice, however, the communication process does not end with the receiving of the message by the destination. It must be stated that communication is a continuous process in which each individual or institution functions as the transmitter as well as receiver of messages. In other words, communication process works in a cycle, in which each individual functions as the encoder, interpreter and the decoder of information alternatively. In fact, communication is interactive multidimensional process.

5.5.2 Elements of Communication Process

Most of the communication systems, whether sophisticated or not, are perceived to possess the following basic elements:

- Information source
- Encoder
- Message
- Communication Channel
- Noise
- Decoder and
- Receiver/Destination.

In other words, the act of communication has to originate from a source. The idea/ message of communication has to be encoded using symbols. The process of translating ideas, feelings and information into a code is known as encoding. The device/ mechanism used to carry out the message is called a channel. The success or failures of communication mainly depends on the channel used.

Self Check Exercise

3) Explain the basic elements of a communication process.

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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5.5.3 Communication Media

Media is obviously the plural form of ‘medium’– which is the conductor, the channel, and the means by and through which something is transmitted. In other words, medium is the channel through which messages or information are transferred to the receiver. A medium could be a spoken word or printed word or it could be an electronic message. The term communication media is often used to refer to both the channel and the source.

Communication media can broadly be classified into conventional and non-conventional media. Conventional media mainly comprises print media, including graphic media while non-conventional media comprises mainly electronic media including optical and hyper media.

Let us discuss, the most important of the media namely print media and electronic media.

Print Media

Print media include: books, learned periodicals, conference proceedings, magazines, newspapers etc. The main function of these media is to provide

information, and in certain cases provide entertainment also. The audience for the print media could both be specialised, diverse and large. As a means of communication the book has monopolised for centuries, followed by the periodical and other forms of communication media, which make available more information for use. Other types of print media like indexing and abstracting periodicals, directories, conference proceedings, etc. provide information about where to find information from primary sources like books, periodicals etc. Print media still remains a powerful communication media.

Electronic Media

Electronic media refers to such media where messages are sent by such mechanisms as telephone, telegraph, facsimile, etc. For example, broadcasting which is carried out by radio and television provides with news and entertainment to general public. These different media are briefly discussed in this section.

- **Telegraph:** This is one of earliest methods of modern telecommunication. It was invented by Samuel Morse in 1830. The invention of telegraph has increased the speed of human communication. It involved the manual keying of messages using a code known as *Morse code*. The code is built up of short and long pulses of current in the telegraph wire, with the transmitter's Morse key. One of the major developments in telegraphy is the invention of Baudot code system. In this system the sender could use a sort of typewriter keyboard; each key press would automatically generate a 5-bit combination (word of current pulses or pulse absence). At the receiving end with a special output unit could reproduce the message, either by punching holes in code patterns in a paper tape or by putting readable characters directly on to a paper tape.
- **Telephone:** The development of the telephone represented a solution to the technological problem of conversion of the sound patterns of human voice into electrical patterns. Telephone happens to be one of the largest established methods of electronic information transfer. It differs from the telegraph in that the electric current carries the more complex patterns of human voice over the wire. Originally telephonic communication between two persons could take place only through a special cable link. The concept of multiplexing is a major development in the direction. This allows a number of different signals to pass through the same links at the same time.
- **Broadcasting Media:** This makes long distance message transmission possible between sources and receivers without the need of transportation or a direct physical (wire) link. In case of broadcasting message is transmitted in the form of energy waves in the electromagnetic spectrum. Broadcasting includes mass communication devices like radio and television, through which messages are sent out regularly by professional communicators through electronic media to large and diverse groups of audience. Broadcasting as a technology implies transmitting electronically generated radio waves to receiving devices. Radio and telecasting stations are the centres for transmission. Recent development in this field includes the use of satellite communication systems. Space satellites now provide

a worldwide television and telephone network that links every country on the globe.

- **Electronic Mail:** It is conceived primarily as an alternative to the conventional postal mail service. It is used for the transmission of messages or documents in an electronic form. In most of e-mail systems, transmission is accomplished via telecommunications network designed for data transmission. The greatest advantage associated with e-mail is that it overcomes the delay connected with traditional postal service. Also, e-mail is economical compared to conventional mail system. The input to and output from an e-mail system can be via a video terminal, or a word processor with a printer, facsimile machine or any data terminal including computer vision and voice communication systems.
- **Videotext and Teletext:** Both these are interactive information services and that these allow individuals to request frames of information. But, they are somewhat different technologies. In other words, Teletext is delivered over the air while videotext is delivered by wire. In videotext, a person can request for information from a central computer for delivery over telephone or cable television lines. Teletext in contrast is a system that enables the users to view on request frames of information already being transmitted but invisible on their television screens.
- Videotext is a generic term that refers to both Videotext and Teletext. Teletext and Videotext are the most radical of the new communication technologies which have brought the powers of computer to the home TV Set and have transformed the entertainment medium into an information appliance.
- It may be mentioned here that electronically the society has progressed from the wired era of telephone and telegraph to wireless era of broadcasting and now stands on the threshold of era of integrated grid. Integrated grid refers to the communication infrastructure that is now taking shape world over, with internet revolutionising the communications network. The developments in ICT are changing the entire nature of telecommunications.

In the foregoing sessions we have learnt about communication media: conventional as well as non-conventional. Since the conventional media are inadequate to cope with the contemporary information environment, the non-conventional media have been developed. These media have not only enhanced the speed of communication, but also increased the chances of information access. Computer mediated communication systems have brought in these advances.

5.5.4 Models of Communication

Models simplify reality, select important elements and indicate the relationships that exist among key elements. Similar is the case with models associated with human communication. Many models of communication include certain basic concepts such as a sender, a process of encoding into signals or symbols, a message, a channel, a receiver, a relationship, a process of decoding, a range of things to which message refers (referents) and an actual or probable effect,

intended or not. Some models also include feedback mechanism between sender and receiver.

Communication models help us to understand how communication systems work. The best-known communication model is that of *Shannon and Weaver*.

Shannon and Weaver’s Model

In this model, a message emanates from an information source. It is converted into a signal or series of signals by a transmitter. Enroute, this signal is mixed with or contaminated by ‘noise’, that is to say, various kinds of unwanted interference coming from ‘noise’ sources. The received signal is decoded by a receiver, being converted back into the original message, more or less, which is what the receiver (or destination) receives.

Shannon and Weaver’s model seems straightforward. It recognises that encoding and decoding occur. It takes into account the problem of interference: ‘noise’ is a term from electrical engineering denoting electro-magnetic interference. Noise arriving with the signal makes it more difficult to decode accurately, as we all know from everyday experience.

This model has been criticised, however, because it is linear. That is to say, it accounts only for the act of sending and receiving. It is a one way model, based on engineering. In fact, this was the dominant model for a quarter century. The thinking behind it was probably reflected in the thinking of many top broadcasters, for example, thought of themselves as primarily responsible for sending out messages, and perhaps for reducing ‘noise’ to a minimum, but not for receiving them back. Broadcasting organisations put most of their resources into production and transmission of programmes, and much less into listening to audience opinion.

To convert Shannon-Weaver model into a two-way model of communication, we must add a feedback channel, complete with transmitter, encoder, noise, decoder and receiver, all to deal with messages running from the receiver to the sender. It could be said that we are simplifying working Shannon and Weaver’s model in reverse, but in fact we are working it almost simultaneously in both directions. In this two-way model, the feedback channel can be vitally important to the original receiver as a means of seeking clarification of the original message. Feedback channels, verbal and non-verbal, continually serve this purpose in human communication.

It may be stated that Shannon-Weaver’s model has been criticised because it did not provide for the complex nature of relationships among humans, some of the scholars like Schramm and Kincaid have advanced models intended to fill this need. Let us briefly learn about some of these communication models.

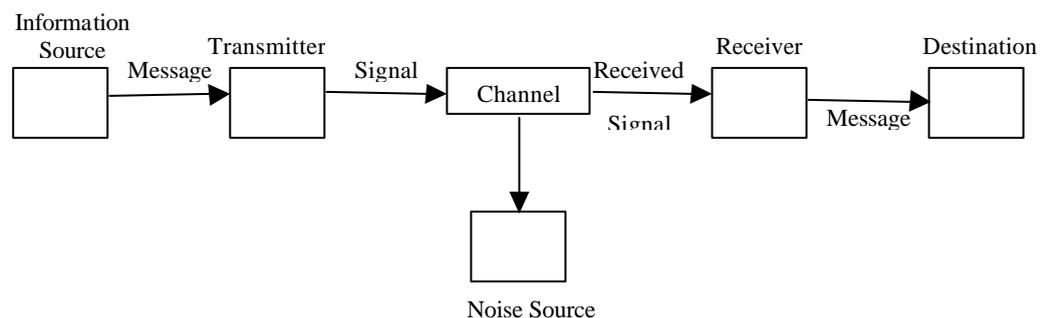


Fig. 5.1: Shannon Weaver Model of Communication Process

The models that need to be considered are:

- Lasswell’s model
- George Gerbner’s model
- The Schramm model

Lasswell’s Model

Lasswell, a U.S. Political Scientist developed this model in 1948. This model is very useful to split the communication process into different components. The value of this model lies in its use as a structuring device and in situations in which the sender has a clear interest to influence the receiver. The model is summarised as “Who says what in which channel to whom with what effect”?

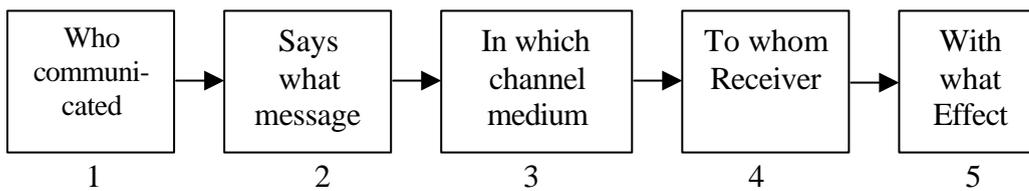


Fig. 5.2: Lasswell’s Model of Communication Process

Lasswell’s model can be interpreted in the context of Libraries in the following manner:

- Who? Authors, publishers, research bodies, translators, professional bodies, etc.
- What? Symbolic contents of knowledge, use of language notations, symbols etc.
- Which channel? Books, journals, mss, reports, conference proceedings, a.v. materials, computer media etc.
- Whom? Library users or members of society
- What effect? Knowledge addition to individuals of society or users of library.

George Gerbner’s Model

This model is conceptually different from the earlier two models. Gerbner developed this model in 1956. the essence of this model is to “connect the communication situation and the participant’s perception of and response to the situation and the communication process. This model can incorporate machine as well as human process in different combinations and at various stages.

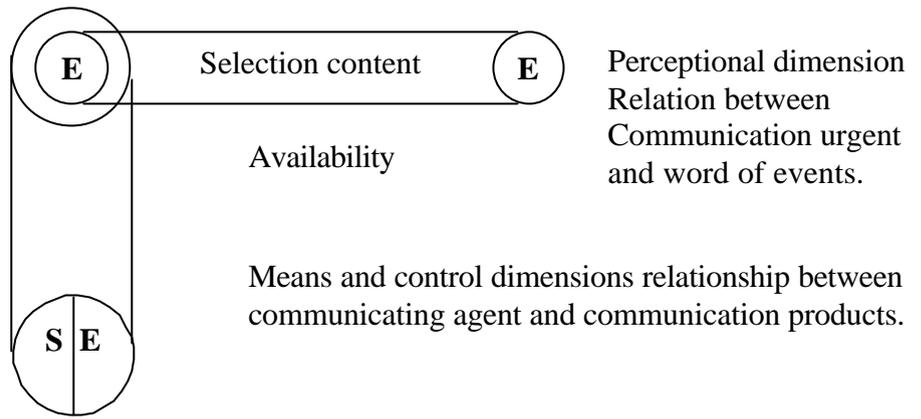


Fig. 5.3: George Gerbner's General Model of Communication

The Schramm Models

Schramm tried to develop a human communication model giving emphasis on experiences of two individuals and the interaction between those two were later designed as models. He developed three models to explain the proposed concept or theory. The three models are diagrammatically represented.

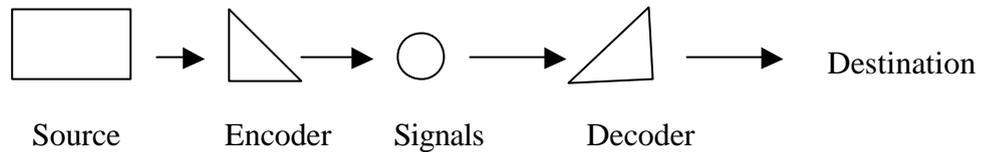


Fig. 5.4: Schramm's Model I

According to this model, communication starts from source (i.e. 1st individual) and it is encoded transmitted through signals. These signals are decoded either manually or mechanically and reach destination (i.e. 2nd individual). This model is more or less similar to Shannon-Weaver Model.

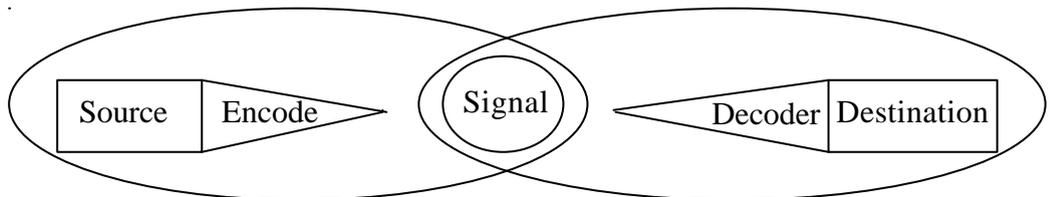


Fig. 5.5: Schramm's Model II

In this model, he introduces the idea that only that which is shared in the fields of experience of both the sources and destination is actually communication because only that portion of the signal is held in common by source and destination.

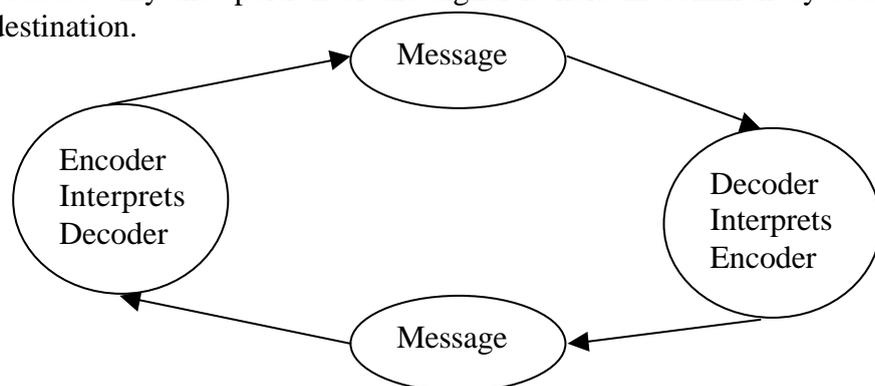


Fig. 5.6: Schramm's Model III

This model deals with communication as an interaction with both the parties encoding, interpreting, decoding, transmitting and receiving signals. In this model feedback and the continuous loop of shared information can be noticed.

Each model is intended to explain certain points, which its creator feels are relevant in communication process or structure. No model can accomplish everything that is desired. In other words, it cannot be “do it all” model. Therefore, it is essential that we select models that would best suit our purpose to solve the problem at hand.

In the above paragraphs, an attempt has been made to explain to you what a communication model is all about and discuss some of the important models available at present. In what follows let us try to learn about Information Diffusion.

Self Check Exercise

- 4) Discuss briefly the Shannon and Weaver Model of communication. List other prominent models of 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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5.6 INFORMATION DIFFUSION

5.6.1 Meaning

We generally observe that information spreads from person to person in the society. The phenomenon of spread or dispersion through time and space is known as diffusion. Ideas and innovations are dispersed from producer to the user. Innovations are translation of ideas into new practices, processes or products. The diffusion of ideas and innovations is an essential component of social and economic change for better or worse. In other words, the diffusion of ideas and innovations is a source of advancement for the society as a whole. Because of its wide spread influence, the diffusion process has been extensively researched and documented. In this entire process, communication has been found to be a key element.

Research on the diffusion of new ideas has its origins primarily in the field of *rural sociology* with studies focussing on the adoption of new agricultural techniques by farmers in the United States. Subsequently, attention was drawn to other types of innovations, such as new medical products and new industrial processes, as a result, a more international scope emerged. Though, earlier studies were mostly based on desirable changes in society, contemporary studies on diffusion deal with both harmful and beneficial effects of innovations.

Development communication has emerged as a specialised field dealing with factors affecting the diffusion of innovations and attitudes of populations, especially in developing countries. Research on diffusion research also focuses on role of social networks, information flow, demographics and psychological variables “innovativeness” and “resistance to adoption”.

5.6.2 Diffusion of New Ideas or Innovations

The traditional approach to diffusion research was concerned more with social processes and other *demand-related factors* affecting the diffusion of innovations, and not with commercial or supply view point. To fill this gap Lawrence Brown developed a “*market and infrastructure*” model of information diffusion that focussed on *supply-oriented* rather than “*demand-oriented*” factors affecting diffusion. There are three stages in this proposition:

- First Stage: establishment of public or private agency through which an innovation is distributed or made available to the population at large (this provides a special pattern of diffusion)
- Second Stage: conceive and implement strategies to promote adoption among the populations in their service or market areas. This leads to establishing infrastructures such as service and delivery systems and also designs of information dissemination programmes.
- Third Stage: create different levels of access to an innovation, depending on individuals’ economic, locational social characteristics. This ultimately influences the decision of adoption or rejection.

Thousands of new products are introduced each year.. However, a large majority of them fail: Failure to gain acceptance may frustrate both private and public sectors. As public sectors use *public funds* on R and D, they are more prone to criticism. The ‘limited effectiveness’ of technological and social change programmes is attributed to the failure of public agencies to employ sophisticated marketing techniques and strategies.

5.6.3 Patterns of Diffusion Process

A variety of temporal patterns have been associated with diffusion processes. Let us try to understand basic patterns namely: i) temporal pattern of diffusion, and ii) spatial pattern.

Temporal Pattern of Diffusion

While studying the temporal pattern of diffusion, we come across certain questions like:

- When does an idea or innovation first begin to spread within a country, region or organisation?
- How quickly does it spread once introduced?
- What types of people, organisations or firms tend to be early adopters?
- What types of ideas and innovations spread most quickly?

The spread of ideas and innovations generally begins slowly, accelerates as

the diffusion process begins to unfold more fully, slows after some turning point is reached, and levels off as saturation is approached. A graph of the cumulative level of adoption over time follows an *S-shaped (sigmoid)* curve. Figure 5.7, taken from E. M. Rogers (1983) shows the basic sigmoid curve and its relationship to the rate of spread of information.

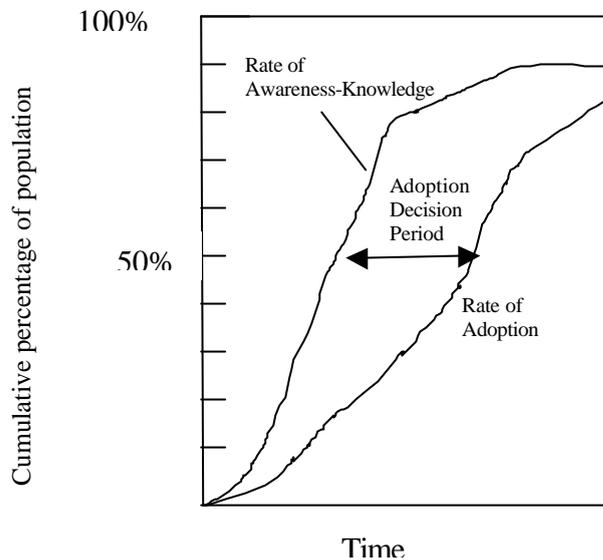


Fig. 5.7: Diffusion over Space and Time

The sigmoid (S-shaped) curve that describes most diffusion processes: rate of awareness-knowledge (uppermost curve), rate of adoption (lower curve), and the adoption decision period (gap between awareness-knowledge and adoption curves). Adapted from Everett M. Rogers, *Diffusion of Innovations* (1962), 3d ed., New York: Free Press, 1983.

The graph indicates the fact that an innovation can be accepted by a person only if the person is aware of the existence of the innovation. In other words, the behaviour of the population toward an innovation is closely related to the distribution of information regarding new phenomenon, even though the availability of information may not, by itself, ensure the acceptance. The graph also depicts the *variable adoption period*, which is stated to be the *shortest* in case of *early adopters*. Another concept (i.e. *the diffusion effect*) is also built into the curve. It may be observed that when 5% of the individuals in a social system are aware of innovation, there is little normative pressure to adopt it. On the other hand, as the rate of awareness of an innovation increases among the population to 20 to 30 per cent, peer pressure begins to develop, and the rate of adoption increases. Once this threshold is passed, a diffusion effect begins to trigger substantial influence from peer networks to accept the innovation. This diffusion or *snowball effect* is partially important in social systems that are highly connected.

Spatial Pattern of Diffusion

In spatial pattern of diffusion, two distinct types been identified. They are: the neighbourhood effect, and hierarchical effect. Let us try to learn about them.

- Neighbourhood effect: It has been observed distance affects the rate of distribution. In other words, the neighbourhood effect refers to the time elapsed between the introduction and adoption of an idea or innovation tends to increase with distance from nearest source of information or

access. The source may be a near by adopter, the distributor of an innovation, or some other propagator of information or resource. Distance to a source affects rates of diffusion. It may be stated that personal communications occur more frequently across shorter distances when compared with longer distances. Also, costs of adoption increase with the distance from the source of an innovation, owing to the expenses incurred due to transport, delivery, service and repair. In this case, diffusion occurs in a *wavelike fashion* as depicted in the figure 5.7. In the first instance, adoption is restricted to a compact area. As the diffusion process continues, the circle of acceptance and use expands and distance increases between the points of origin and the area of most rapid adoption. As distance and time lapse increase the innovation waves weaken gradually (see the figure 5.7 Diffusion over Space and Time).

- **Hierarchy or Cascade Effect:** This effect refers to the tendency of large urban places adopting an innovation before small urban places do so. The *per capita rate* of adoption is also greater as the larger cities have the capital to introduce innovations. It may also be mentioned that as the density of population increases, the amount of information also increases. This phenomenon is known as '*Hierarchy*' or '*Cascade*' effect. It has been observed that the *Neighbourhood* and *Hierarchical* Effects often occur in concert. This process is depicted by a *schema* developed by Torsten Hagerstrand in 1967 [Figure 5.7]. This schema portrays diffusion as occurring through a hierarchy of social communication networks. The national, regional, and local levels of spatial aggregation each contain a network within which neighbourhood effect principles of contact operate. Further, a node on one level will have contact with nodes on another level, providing mechanisms for the filtering of contacts down the urban hierarchy. It may be mentioned here that if only the national scale is considered, a *neighbourhood effect* would be observed, but if nodes on all three levels were considered together, the pattern could be seen *hierarchical*.

5.6.4 Factors Affecting Diffusion of Information

Different ideas and innovations diffuse at different speeds. According to Marilyn Brown the following factors affect the rate of diffusion:

- **Relative Advantage:** If the new innovation is perceived to be the superior to the product or practice already in existence, it will replace the existing one. Relative advantage may be considered in terms of cost-effectiveness, a lessening of social conflict, greater comfort or security.
- **Compatibility:** If a new idea or technology *requires less change* in the prevalent sociocultural values, behavioural patterns, facilities, existing equipment, and procedures, it has *greater chances of its rapid diffusion*.
- **Impact on social relations:** Many ideas and innovations may lead to alterations in social relationships. The new ideas may inhibit or promote adoption and thus help further diffusion process. For instance, the new agricultural technologies have accelerated urbanisation in some developing countries, and this in turn affected family and community relationships.

- **Complexity:** The use and understanding of an idea or innovation depends on how complex the idea or innovation is. In other words, complexity associated with new ideas or innovations inhibits its adoption and use.
- **Communicability:** If an idea or information about an innovation can be obtained or communicated to the potential adopter easily, it will be quickly disseminated.
- **Observability:** If use of an innovation is observable, knowledge of its existence is facilitated. For example, the diffusion of many agricultural innovations such new equipment and crops is facilitated by the fact that they are visible and therefore, easily made known to the uninformed.

Divisibility and Reversibility: If an innovation is divisible into smaller parts, then trials are possible and diffusion is promoted. Also, diffusion is more rapid, if it is possible to return to the original condition or situation after its initial trials, in case of failures.

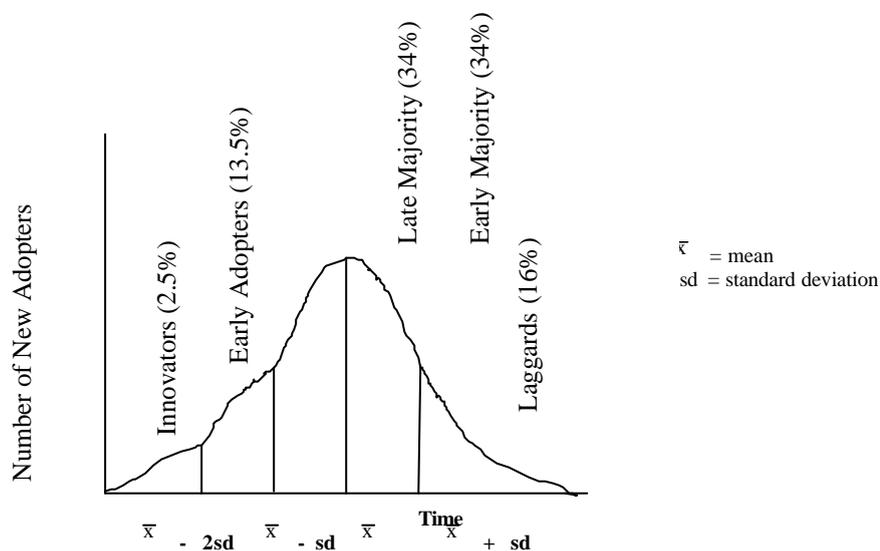


Fig. 5.8(a): Adopter Categories

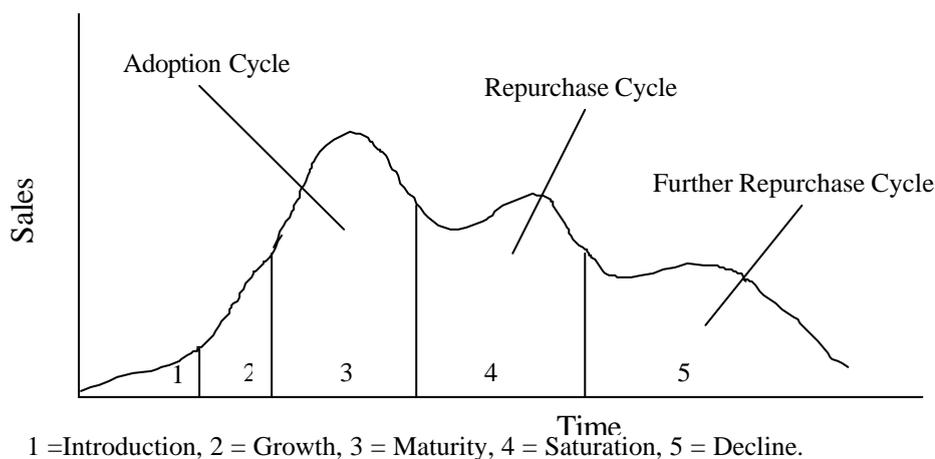


Fig. 5.8(b): Innovation Life-cycle stages

Fig. 5.8: (Diffusion) Adoption and Innovation life-cycle curves. a) Adopter Categories. Adapted from Everett M. Rogers, *Diffusion of Innovations*, New York: Free Press, 1962. b) Innovation life-cycle stages. Adapted from David F. Midgley, *Innovation and New Product Marketing*, London: Croom Helm, 1977.

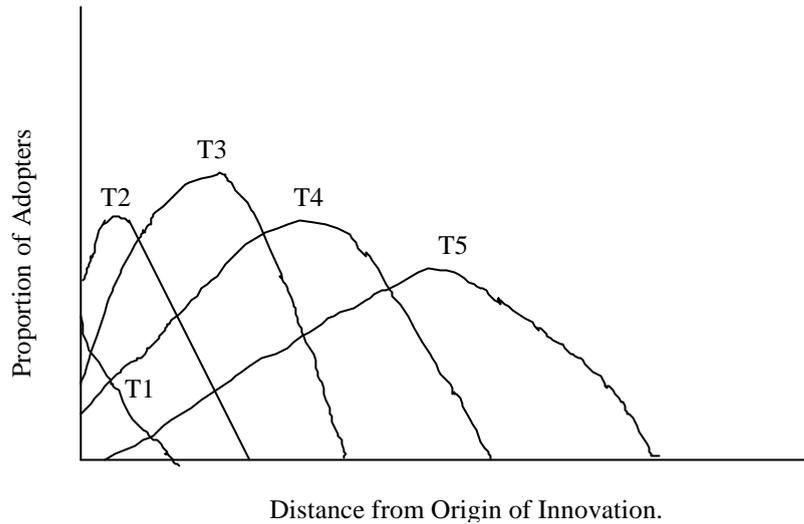


Fig. 5.9: (Diffusion). The shape of diffusion in space and time: proportion of adopters at successive time periods as a function of distance from origin of the innovation. Adopted from Richard L. Morrill, “The Shape of Diffusion in Space and Time,” *Economic Geography* 46 (1970):259-268.

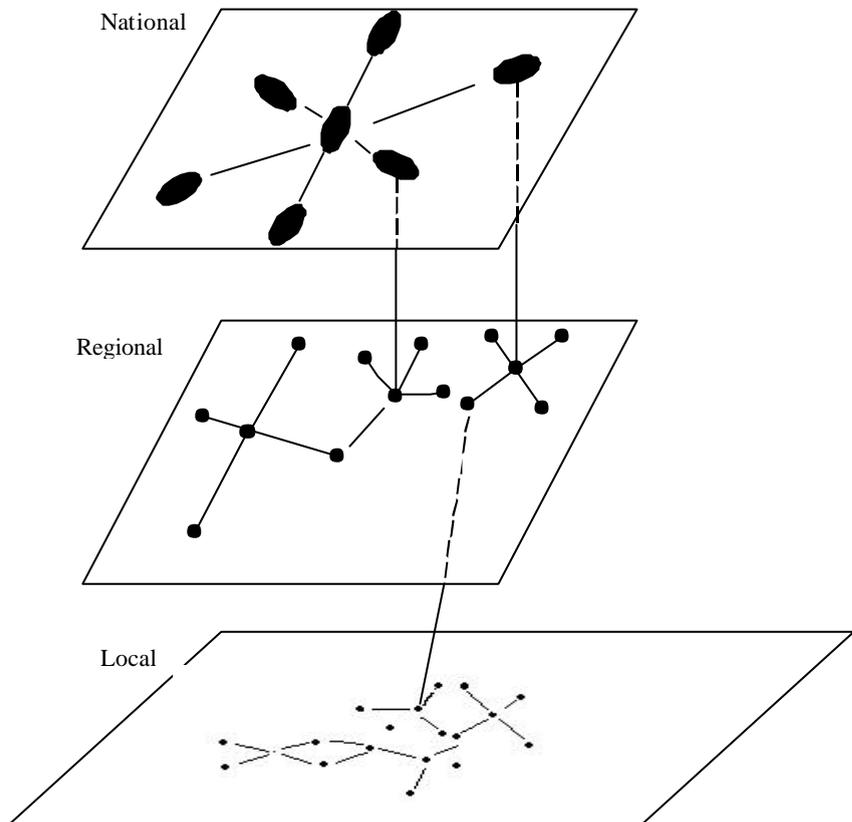


Fig. 5.10: (Diffusion) Schematic portrayal of diffusion networks viewed at three different spatial scales. Adapted from Torsten Hagerstrand, *Innovation Diffusion as a Spatial Process*, Chicago: University of Chicago Press, 1967.

Categorisation of Adopters of New Ideas and Innovations

It may be noted when the absolute number of adopters are plotted into a graph for a distinct time period, a *bell shaped* approximately normal frequency curve is obtained. Using this bell or normal curve, it is possible to talk about the type of people who tend to adopt an idea or innovation during different stages of the diffusion process (Figure 5.8a, 5.8b). It may be stated that people who

adopt an idea or innovation at similar times tend to have similar characteristics. Particularly, innovators and early adopters generally are better educated, have higher social status, are more risk-taking and cosmopolitan, and have greater social participation and opinion leadership than later adopters. They also tend to gain more information from impersonal sources and are less reliant on Interpersonal Communication as an influential source of information. Laggards the last to adopt tend to have traditional values and low social status, education, and income. Their adoption occurs only after information has “tickled down”, when pressures to adopt are strong, and when the prices for the new product have dropped.

Adoption of New Ideas

It may be mentioned here that the adoption of new ideas by organisations and individuals reveals certain characteristics.

Organisations which adopt innovations more readily reflect certain traits such as: openness to communication with their surrounding environment, functionally different subunits, expertise of members, decentralised power, flexible rules and regularisations, and availability of resources, etc.

Apart from organisational aspects, individuals also play important role in the adoption of new ideas. The individual’s decision making process can be divided into time periods. E. M. Rogers and F. F. Shoemaker developed a model describing the stages through which an individual passes from first knowledge of an innovation to a decision to adopt or to reject it. This model is known as A-I-E-T-A model of decision-making. As per this model, the decision-making process comprises the following time periods:

- Awareness: The individual learns about the existence of a new idea or innovation,
- Interest: The individual recognises that he/she may have a need for this new idea or innovation.
- Evaluation: The individual assesses the idea or innovation in terms of its benefits and costs and decides whether or not to try it.
- Trial: It is an evaluation of an idea or innovation through a small scale or a limited use. The trial reduces the uncertainties associated with the innovation.
- Adoption: It refers to the adoption or use of new idea or innovation on a continuous, full-scale basis. Problems associated with the use of the innovation may emerge at this stage, particularly when the individuals involved in the *adoption decision* are different from those involved in or affected by the actual implementation.

The A-I-E-T-A model of decision-making can be used to describe the role of different sources and channels of information. In general, mass media and other impersonal sources of information create awareness or interest, but later stages in the process require more personal, specific, and local sources of information.

5.7 DIFFUSION OF TECHNOLOGICAL INFORMATION

In the literature, we come across several studies on the diffusion of technological information in the society (Chatman). Models of information diffusion are constructed. These models help us to estimate the number of people with the information in question at any given point of time. There are different parameters, which may be estimated if the exact values are known. Such parameters include the maximum number of information recipients (N_m) and the number of recipients to whom a transmitter sends information during a time interval (n_i). The diffusion process-taking place is represented in the diagram (see the Figure 5.11).

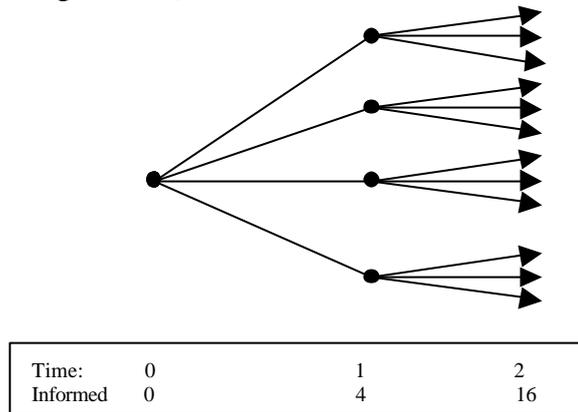


Fig. 5.11: Person-to-Person Diffusion Process (Source: Losee, R. M.)

When information diffuses, it may be seen as having an origin where only one person has information as indicated on the left side of the diagram. It may be noted that in this example population, each information recipient transmits to three additional people.

At the time $t = 2$, the person who originally had the information transmits it to three new people, as indicated by the arrows on the right half of the diagram. At the end of the transmission cycle the total number of people who have received the information will be the number of people who had received the information at the end of the previous transmission cycle plus three times this number. The total number of recipients, who have received information at time 't' is $N(t) = 4N(t - 1)$. The total number of recipients, $N(t)$, grows at an exponential rate. If the population were infinite in size and infinitely dense, so that one can never transmitted to some one who already had the information, $N(t)$ could be graphed as a curve 'A' shown in the following Figure 5.12.

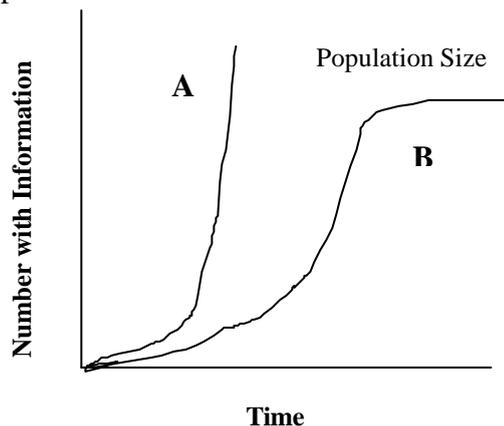


Fig. 5.12: Diffusion Curve (Source: Losee, R. M.)

Neither of these assumptions is ever fully met. As time progresses, more and more people will already have received the information and fewer additional people will be added to the list of informed. The graph of the number of informed people now looks more like curve 'B'. The rate of difference 'r' for curve 'B' is of the form $r = (t) (N_m - N(t))$. The component $(N_m - N(t))$ will be larger at $t = 0$ and will approach 0 when the number of people with information approaches N_m . If $f(t)$, is $C_i N(t)$, it may be understood as a coefficient of internal influence on diffusion process. Diffusion is seen as occurring only through interpersonal contacts, and the $N(t) [N_m - N(t)]$ may be interpreted as the product of number of people with the information and the number of people without information.

If $f(t)$ is a constant C_e , the number of people already having information not being a factor, the diffusion is controlled by factors external to diffusion environment. When control of diffusion process is mixed between external and internal factors, the rate of diffusion may be modelled as:

$$r = [C_e + C_i N(t)] [N_m - N(t)]$$

Where C_e and C_i are factors representing external and internal coefficients of diffusion, as above.

This entire explanation of Information Diffusion provided above has been taken from Robert M. Losee. 'The Science of Information', 1990, pp.250-253.

So far, we have used the term 'diffusion' rather loosely without precise definition. Mansfield conceives of a three-way definition for diffusion:

- 1) Imitation or Interinstitutional diffusion refers to spread of new process from firm to firm with in an industry.
- 2) Intrainstitutional diffusion refers to spread of the process within individual firms.
- 3) Overall diffusion refers to the spread throughout the society as a whole.

Thus, interorganisational diffusion might be measured by the proportion of institutions that have adopted a new process, interorganisational diffusion by the proportion of any one firm's output produced using the new process, and overall diffusion by proportion of the total industry output that is produced using new process. In general, diffusion means *Interinstitutional diffusion*, because it is interesting to study adoption and usage process between institutions.

5.8 MODELS OF INFORMATION DIFFUSION PROCESS

Interorganisational diffusion surveys, study the adoption and adaptation process of an innovation, particularly the analysis of variance between firms. It concentrates on individual innovations diffusing through single type of industries and attempts to explain differences between institutions *in the time taken* to adopt an innovation. This is known as the *institutional characteristic of diffusion*. In the international approach, an explanation of international differences in the speed of diffusion of innovation in terms of the characteristic of the countries and industries is presented.

Rogers argued that the adoption of an innovation mainly depends on communication and often follows an S shaped curve when plotted over time. *Rogers' model* is the most well-known and wide spread diffusion model, but far from the only one. Mahajan, *et al* (1990) presented an overview of diffusion models, arguing that the Bass model (1968) had given the most important impulses to the research on diffusion innovations. Bass identified two forces behind the diffusion process, *mass media communication* and *word of mouth communication*. Mahajan, *et al* mentioned nine assumptions that warrant attention. Four of those considered are of special importance when estimating the diffusion of computers and Internet to households.

These are:

- i) Diffusion of an innovation is independent of all other innovations;
- ii) Nature of an innovation does not change over time;
- iii) Diffusion of an innovation is not influenced by marketing strategies;
- iv) There is only one single adoption by each adoption unit.

Mahajan, *et al* presented several other diffusion models, where attempts have been made to maintain better predictions by handling facts, not fitting the mentioned basic assumptions. Let us try to understand the significance of some diffusion models we come across in the research literature.

5.8.1 Epidemic Model

The epidemic model, also known as the learning model, is more popular in sociological and marketing literatures, but has also been used by economists. A common feature of this model is the analogy drawn from the spread of diseases. Consequently, a theoretical tool often used is one of the mathematical theories of epidemics. As reference to these theories is also often made by economists working in this area, an exposition of simplest model of epidemics will provide a useful introduction to the study of this model. The basic hypothesis of a simple epidemic model is represented by the following equation:

$$m_{t+1} - m_t = \beta (n - m_t) m_t / n$$

Where m is the number individuals in a fixed population of n having contacted the disease, between *elapse time epochs* t and $t + 1$. This is proportionate to the product of the number of uninfected, both at time t . The value of β (epidemic indicator) will depend on a number of factors such as the *infectiousness of the disease*, and the *frequency of social interaction*.

5.8.2 Economic Theory Model

As a result of the nascent nature of process innovations and of the imperfect information, there may be major differences between firms in the expectations of how profitable the adoption of any innovation will be. This, coupled with the likelihood that firms differ in their attitude to risk general and new innovations in particular, leads to the conclusion that different firms react differently to the same innovation. Specially, the time lag before adopting the innovations will probably differ significantly between firms within the same industry. For economic reasons, it was suggested that an important contributor

to interfirm differences would be the difference in their size (i.e., the size of the firm). This logic has been formalised into a model called “Industrial Engel Curve” which relates probability of a firm having adopted the new innovation to the firm’s size. When the Industrial Engel Curve was fitted with data collection, results were encouraging. The sample innovations, on which the data was based, indicated positive relationships between the speed of adoption of innovation and the firm’s size. Many other correlations could be brought in, such as nature of innovation *vis-à-vis* industrial growth, cyclical factors and growth factors, the role of the firm’s size and industry concentration, etc.

5.8.3 Stock Adjustment Model

This model is used in the study and analysis of investment behaviour. In fact, the Stock Adjustment Model was used to study the stock levels of computers in U.S. and U. K. in the 1960s and 1970s. It helps to indicate the stock level, in particular, equilibrium stocks in any time period. Although the Stock Adjustment Model has limited applications, it is of great help to study interorganisational diffusion process of innovations.

5.8.4 Vintage Model

The vintage model was postulated by Salter and others in 1960 (Productivity and Technical change, 1960) brings in an economic theory of diffusion. The basic structure of a ‘Vintage Model’ may be summarised as follows: “New knowledge assumed to be embodied in new product and so, gross investment in the vehicle of diffusion. Old product is only replaced or scrapped when its operating costs exceed the returns it earns. Similarly new equipment is only installed if its total costs are covered by the revenue it earns. It is usually assumed, for analytical convenience, that plant is invisible and that new knowledge cognate be introduced on old equipment. Thus, each vintage of product embodies the best practice *know-how of its date* of production and is then committed to this nascent knowledge until its expiry. The appearance of a cost saving process innovation within their frame work will have the following consequences:

It will become profitable to replace immediately some proportion of existing product because the total costs of the new products are lower than the operating costs of some old product. The existing capital stock comprises a number of vintages embodying the old know-how the newer vintages being slightly more efficient than the old, due to minor improvements in specification over the years.

However, the simplicity of the model depends heavily on the assumptions of cost minimisation, on the one hand, and the invisibility of plant and the embodiment hypothesis on the other. In, principle, each of these assumptions can be relaxed without destroying the essence of the model. In practice, however it is doubtful whether the model would retain its productive power if all the four assumptions were relaxed simultaneously.

5.8.5 Information Diffusion Theory

Elfreda A. Chatman identifies three diffusion models, namely:

- Elements of Diffusion Model

- Attributes of Innovation Model
- Stages of Adoption Model

She applies these models to study the awareness, use, and diffusion of an innovation in a job environment among working poor.

The diffusion of information is studied with four elements (1) the innovation, (2) communication, (3) social structure, (4) time. Attributes of innovation explain the characteristics that may improve acceptance of innovation or rejection. Finally, stages of adoption are used to explain the decision making process of adoption or rejection of an innovation.

Elfreda A. Chatman presents her analysis of the information diffusion from person, to person, the social structure that helps movement of various models of communication, the impact of variance of these modes. The study also analyses the attributes, such as (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability of innovations. The stages of adoption model, designed for the diffusion of technological innovation appears to have limited applicability to the diffusion of job information. According to the study of information about a job has a finite usefulness when disseminated. Although, the “job adopter” experiences awareness, trial and acceptability of information about a job, the diffusion of the information as useful is limited to the number persons who can be hired for a position. Information diffusion models are some times found overlapping in actual practice and they can be theoretically separated to draw influences.

5.9 INFORMATION SYSTEM FOR DIFFUSION

A nation’s competitiveness depends on the capacity of industry to innovate and upgrade. Innovation is based on new ideas, including new combinations of old ideas, the utility of which is tested with applications of many kinds of information. Empirical studies have repeatedly found that in more prosperous enterprises there is greater awareness of information and greater ability to manage it. Sweeny (1989) reports “empirical evidence strongly indicates that *it is the quality of information activities and of the information process by a firm* which makes its innovation commercially successful and gives the competitive edge”. “Information plays a large role in the process of innovation — information that is not sought or available to competitors, or information available to others that is interpreted in new ways. Sometimes it results from sheer investment in market research or R & D. It is striking, though, how often innovators of those firms that are simply looking in the right place, unencumbered by or unconcerned with conventional wisdom” [Michael E Porter, 1990]. It has been observed that innovative ideas are initiated either by the perception of a need or recognition of technical feasibility. Several studies suggest that most major technological breakthroughs are initiated by the discovery of a technological possibility.

Diffusion of innovation happens through the appropriate flow of information. It begins from the R&D stage itself.

5.9.1 R&D Information Flow

Maddock observes that the main function of an R&D establishment as being a

link in the innovation chain to enable the innovation-flow to occur more efficiently. He defines the role of an R&D in the following terms. Firstly, it should be in close contact with relevant advances in science and technology. Secondly, it should provide an opportunity to bring relevant but difficult disciplines together. Thirdly, it should apply science and technology at the lowest cost in terms of time and effort. Fourthly, and most importantly, it should be active in technology transfer and should, therefore, preferably be located close to the users of R&D work. Fifthly, it should be able to assess objectively the feasibility of an innovation project. From what has been stated above it is clear that an R&D establishment has to rely on a large input of information from external sources as shown in the Table 5.1.

Table 5.1: Information in Diffusion of Innovation

<p>INFORMATION IN DIFFUSION OF INNOVATION</p> <p>The Listening Post</p> <p>The Interdisciplinary Role</p> <p>Science / Technology Application at Lowest Cost</p> <p>In Time and Effort</p> <p>Technology Transfer</p> <p>The Feasibility Appraisal Role</p>
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In this connection it is important to note difference the between company and corporate research and development establishments, on the one hand, cooperative or national research institutes on the other hand. Whereas the former have a major commitment to industrial innovation in general, and new product development in particular, the later tends to pay more attention to process improvement and to research aimed at improving the technological infrastructure. The national research institutes, therefore, often act as important sources of scientific and technical information to research establishments in industry, although they must themselves rely on other sources of information (Table 5.2).

Table 5.2: Diffusion and Information Orientation

<p>DIFFUSION AND INFORMATION ORIENTATION</p> <p>CORPORATE RESEARCH AND DEVELOPMENT ESTABLISHMENTS</p> <ul style="list-style-type: none"> ● Innovation Oriented ● Cost Conscious ● User of Information ● Information of Proprietary Nature: Know-how "Commodity" <p>NATIONAL RESEARCH INSTITUTES</p> <ul style="list-style-type: none"> ● Infrastructure Oriented ● Providers of Advice and Information ● Information More of an Open Nature: "Resource"

5.9.2 Information Services, Information Institutions and Diffusion

It may be mentioned here that concepts such as library, information service,

extension services, etc. are manifestations within a continuous spectrum with a shift in the major activity and in the need to adapt to changing requirements. The physical form of the services is determined by the measure of specialisation, which is necessary to satisfy the need for which the service is created or designed (Table 5.3).

Table 5.3: Spectrum of Services

SPECTRUM OF SERVICES		
TYPES OF SERVICES	ACTIVITY	RATE OF CHANGE
Archive Library Special Library Documentation Service	Storing	Low
Information Service Information Analysis Information Synthesis	Interpretation	
Extension Service Advisory Service	Advising	High

Broadly speaking, an information service, as activity, comprises the interpretation of information in terms of user needs. In other words, it is a “repackaging” function. In accomplishing this function of information service, as an organisation can make use of all possible resources or concentrate more on documentary information (such as journals, indexing and abstracting services, monographs, etc.). A typical R&D information service would provide conventional or computerised current awareness and retrospective search services to supply the user with necessary documents. (Table 5.4).

Table 5.4: Information Services in Diffusion

INFORMATION SERVICES IN DIFFUSION
Alerting
<ul style="list-style-type: none"> ● Broad Current Awareness (To Group of Firms) ● Highly Specific SDI (To Individual Scientists, Engineers) ● Retrospective Searching (In-Depth Searches. Quick Reference Enquiries)
Document Delivery
<ul style="list-style-type: none"> ● Acquisition ● Cataloguing. Classification ● Lending. Copies
Interpretation of Information
(Analysis of Information in Documents)
<ul style="list-style-type: none"> ● Specialised (In-House) Databases ● Extension (Field Liaison)

Depending on the organisation and the size of R&D establishments, as also the mandate of an information service within such establishment, more sophisticated information services like information analysis and advisory services as well as specialised databases would be provided.

Where R&D information services also provide information services directly to industry, it is not uncommon to find field liaison services, especially in the

case of information services forming part of national R&D establishments. Information services in industrial R&D establishments will probably pay more attention to patent literature and trade intelligence when compared to information services forming part of those national R&D establishments, which are more infrastructure-oriented.

5.9.3 Gatekeeping of Technical Information

Many papers, articles and handbooks have been published on this topic. As such, only some broad guidelines on what industrial firms can do to use external information sources to their best advantage are indicated here. These guidelines concern the establishment of in-house libraries, correspondence information, monitoring and business intelligence systems, as well as the use of external information systems (Table 5.5).

Table 5.5: Information Sources and Diffusion

INFORMATION SOURCES AND DIFFUSION
<ul style="list-style-type: none"> ● Library: Books, Journals, Reports Trade Literature, Newspapers, Cuttings, Patents, Standards, Manuals ● In and Outgoing Correspondence Information System: Technical Subjects ● The Use of External Systems for Literature Current Awareness or Selective Dissemination of Information ● Sharing Facilities for Scientific, Technical and Business Databases: Bibliography and Numerical ● Information Search Unit: Study of Literature to Trigger New Ideas ● Monitoring or Early Alert System: Identification of Threats and Opportunities ● Business Intelligence System: Alliances of Information for Decision Support

In this context a distinction can be made between the information needs of entrepreneurs establishing new industries and those of existing industries. It may be mentioned here that the small firms may need advice on how to set up in-house libraries and / or information services mentioned earlier. Many international organisations as well as national documentation centres are able to provide such advice.

No mention has been made, till now, of management information systems, although many firms (especially smaller ones) are in need of unbiased advice on the creation of such systems. There are clear indications, however, that the fields of documentary information, management information, records management, and office automation are converging in a manner similar to the converging of computation and telecommunication.

It must be stressed at this stage that no amount of information can encourage innovation if the management of the organisation is not receptive to risk taking for the sake of innovation, especially in these days of “professional management”.

5.9.4 Information Policy in Support of Information Diffusion

Information flow is a necessary condition for diffusion of information related to innovations. In many countries evidence is available in favour of governmental obligation to provide innovation support to industry. It has been

mentioned that government policies are rather biased to support large industrial firms. But, recent studies indicate that small firms can also contribute extensively to innovations. Chico writing on Technonet Project in South East Asia, lists technical information services, industrial extension services and entrepreneurial development programs as important ingredients for promoting innovation, especially in small firms. However, most of the small industrial firms of developing countries lack these facilities. The developed countries have well designed policies in this regard. In the USA, the policy is to stimulate innovation through removal of impediments, while in other countries direct governmental involvement in the form of subsidies for industrial R&D, based upon selective industrial strategies, as well as the introduction of other innovation support programmes is advocated. Several Western Countries, as well as Japan, have established, or are in the process of establishing formalised information policies for this purpose.

Self Check Exercise

- 5) What is meant by diffusion? Explain the varieties of diffusion.
- 6) Discuss the economic theory of diffusion.
- 7) Briefly discuss some of the important models of diffusion.

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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5.10 SUMMARY

In this Unit, we have attempted to explain to you different conceptualisations of the term ‘information’. The main aspects discussed are: 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 this Unit relates to the concept of ‘communication’. In this regard, the idea and meaning of communication, the definition of communication is explained to you. The form and channels of communication are described and are represented diagrammatically to have a clear understanding. The essentials or ingredients of communication are dealt with briefly. The different functions of communication along with its types are discussed in detail. Attempt has been made to highlight the significance of personal communication bringing out clearly the importance of models and media of communication.

The third aspect discussed in this Unit happens to be “Information Diffusion”. In this regard, the main aspects discussed are: the meaning of diffusion, which is a process of transfer of knowledge, or the movement of technical know-how within a group of users such as farmers, doctors, engineers, etc.; the pattern of

diffusion process occurs in two ways namely temporal and spatial; diffusion could be interfirm, intrafirm, or spread through out the industry; several factors such as relative advantage, compatibility, complexity, communicability, observability, and diversability; affect the information diffusion of innovations; the process of information diffusion has been studied through four models: Epidemic Model, Economic Theory Model, Stock Adjustment Model and Vintage Model, each having its own characteristics. Also, the information system for diffusion is affected through information units operated close to R&D establishments. A spectrum of services is offered by information institutions for the support of innovation, for example Gatekeeping or Technical Information is a unique service adopted to provide information support to innovation. Mention has also been made in the Unit about national efforts providing information support services through a variety of institutions that activate spreading of information.

5.11 ANSWERS TO SELF CHECK EXERCISES

1) Different Conceptualisations of Information:

Information is not just one thing. It means different things to those who expound its characteristics, properties, elements, techniques, functions, dimensions and connections.

In every day life, the word ‘information’ is closely related to the concept of communication, more specially with the aspect of communication of ideas, thoughts, and knowledge bringing forth an understand of information that it has properties to convey ideas, thoughts, concepts and knowledge.

The table below furnishes different conceptualisations of information.

Conceptualisation	Description	Assumptions
Resource / Commodity	A message, commodity, something that can be produced, purchased, distributed, sold, traded, manipulated, passed along, controlled.	Assumes sender → receiver, assumes receiver makes of message what sender intends.
Data in environment	Objects, artefacts, sounds, smells, events, visual and tactile phenomena, activities, phenomena of nature.	Accounts for unintentional communication
Representation of Knowledge	Documents, books, periodicals, some visual and auditory representations, abstractions of information (e.g. citations)	Assumes printed documents are primary representation of knowledge; assumes primacy of scientific technical knowledge.
Part of process of communication	Part of human behaviour in process of moving through time / space to make sense of world	Assumes meanings are in people, not in words; assumes human behaviour is basis of the process.

Buckland identifies three principal uses of the word information:

i) information as process (i.e. the ability to inform),

- ii) information - as knowledge (i.e. the knowledge that is imparted in the process of being informed, and
- iii) information - as thing, concentrating on the various properties of information and its different manifestations and understandings.

By focussing upon information - as - thing, Buckland brings into consideration such phenomena as objects and events, seeking in the process to widen our perception of what constitutes data and documents. Buckland's approach is useful both for its breadth of vision and for the way it manages to weave together such key concepts as information, knowledge and communication. Moreover, by demonstrating that as thing, which is embodied in objects or information systems, information can be tangible, as opposed to knowledge which is inherently intangible, he sheds light on the traditional perceptions of information, most notably that of Fritz Machlup who considered information as an intangible.

2) Communication systems can be distinguished in the following manner:

- i) **Vocal and Non- vocal Communication:** Vocal communication refers to any type of communication where human voice is used; it could be spoken language, shouting or laughing. Non-vocal communication, on the other hand, refers to use of signs, symbols, signals, gestures etc. to communicate something.
- ii) **Verbal and Non-verbal Communication:** Verbal communication refers to the use of words to communicate something; different languages come under the category of verbal communication. Non-verbal communication, on the other hand, refers to those different modes of vocal and non-vocal communication where words are not used. The examples of non-verbal communication are gestures, facial expression, vocalisation etc.
- iii) **Intrapersonal Communication:** Communication within one person such as reading a book.
- iv) **Interpersonal Communication:** Communication between two persons such as writing letters, face-to-face conversation.
- v) **Group Communication:** It could be either a small group ranging from three to about 25 persons or large group where one or several persons communicate to an audience of 25 or more persons. Social gatherings and conferences are examples of group communication.
- vi) **Public or Mass Communication:** Any large scale communication that disseminates through media such as print, broad casting etc. comes under this category. Broadcasting of news through radio and television are examples of public mass communication.

3) The basic elements of communication process are:

- i) **Source:** Which generates information.
- ii) **Encoder:** Translates the information or message into words, signals, signs, etc.

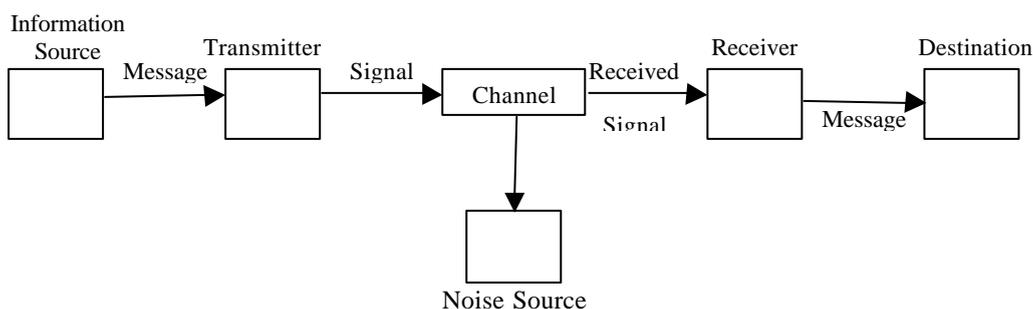
- iii) Message: It is the meaningful representation of the thought or ideas of the information source.
- iv) Channel: The medium through which the message is transmitted.
- v) Noise: Disturbance that interferes with the message in the transmission process and degrades or distorts the information or message.
- vi) Decoder: Translates back the message from words, symbols, etc. into thoughts and ideas of the information source.
- vii) Receiver / Destination: The person or equipment, which receives the information. In oral communication the listener is the receiver as destination of information. In the case of electromagnetic communication the equipment e.g., telephone, televisions are the receivers and the person or group of persons for whom the information is meant is the receiver.

4) Shannon and Weaver Model of Communication

Shannon and Weaver Model of Communication is one of the best-known models of communication. In this model (depicted in the figure), a message emanates from an information source. It is converted into signal or series of signals by a transmitter. Enroute, this signal is mixed with or contaminated by 'noise', that is to say, various kinds of unwanted interference coming from noise sources. The received signal is decoded by a receiver, being converted back into the original message, more or less, which is what the receiver (or destination) receives.

This model has been criticised, however, because it is linear. That is to say, it accounts only for the act of sending and receiving. It is a one-way model, based on engineering. In fact, this was the dominant model for a quarter of a century.

To convert Shannon and Weaver's Model of Communication into a two-way model of communication, we must add feedback channel, complete with transmitter, encoding, noise, decoding and receiver, all to deal with messages returning from the receiver to the sender. It could be said that we are simply working Shannon Weaver model in reverse, but in fact we are working it almost simultaneously in both directions. In this two-way model, the feedback channel can be vitally important to the original receiver as a means of seeking clarification of the original message. Feedback channels, verbal and non-verbal, continually serve this purpose in human communication. New information technology enables us to engage in far more two-way communication than was possible earlier.



Shannon Weaver Model of Communication Process

Some of the other prominent models of communication are:

- i) Lasswell's Model
 - ii) Gerbner's Model
 - iii) Schramm Model.
- 5) Diffusion is an information transfer process of knowledge. It is the spread or activation of the usage of technology within a population of users, usually within a group characterised by some common element of productive activity viz. farming, mining, etc. Thus diffusion is the movement of technical know-how within the group of users such as farmers, doctors, engineers, etc. This is clearly distinguished from the lateral shift i.e. from one group of users to another e.g. from farming to mining.

Mansfield has conceived three varieties of diffusion. They are:

- a) Interfirm diffusion: It refers to spread of new process from firm to firm within an industry. It is also known as imitation diffusion.
- b) Intrafirm diffusion: It refers to the spread of the process within individual firms.
- c) Overall diffusion: it refers to the spread of transfer through out the industry as a whole.

However, in general diffusion means interfirm diffusion which reflects the adoption and usage process between firms within an industry.

- 6) According to Economic Theory of diffusion there can be major differences between firms within the same industry of how profitable the adoption of any innovation will be. This will depend on the nature of innovations, information about it, and attitude of the firms taking risk. Apart from the size of the firms may also contribute to the interfirm differences. This argument has been formalised into a model called 'Industrial Engel Curve' which relates probability of a firm having adapted to the new innovations to the firm's size. Data collected to Industrial Engel Curve indicate positive relationship between the speeds of adoption of innovations to the firm's size. Many other correlations could be brought in such as nature of innovation vis-à-vis industrial growth, cyclical factors and growth factors, the role of firm size, industry concentration, etc.
- 7) There are considerable number of intra and interorganisational diffusion surveys focussing on the adoption and usage process of innovations. The time taken for the spread of diffusion of innovation is influenced by the institutional level characteristics. At the international level the characteristics of countries and organisations therein affect the adoption of innovation. The researchers of innovation diffusion have compared the diffusion process with epidemics, economic theory, stock adjustment and vintage and devised four models of analogy. Of these, the Epidemic Model and the Economic Theory Model are considered somewhat important. Let us try to know what these models are.

Epidemic Model: This model is known as the ‘learning model’. It is more popular in the sociological and marketing literatures, but has also been used by economists.

A common feature of this model is the analogy drawn from the spread of diseases. Consequently, a theoretical tool often used is one of the mathematical theories of epidemics. As reference to these theories is also often made by economists working in this area, an exposition of the simplest model of epidemics will provide useful introduction to the study of this model. The basic hypothesis of a simple epidemic model is represented by the following equation:

$$m_{t+1} - m_t = \beta (n - m_t) m_t / n$$

Where m is the number individuals in a fixed population of n having contacted the disease, between elapse time epoch's t and $t + 1$. This is proportionate to the product of the number of uninfected, both at time t . The value of β (epidemic indicator) will depend on a number of factors such as the infectiousness of the disease, and the frequency of social interaction.

The second important model is that of

Economic Theory Model: As a result of the nascent nature of process innovations and of the imperfect information, there may be major differences between firms in the expectations of how profitable the adoption of any innovation will be. This, coupled with the likelihood that firms differ in their attitude to risk general and new innovations in particular, leads to the conclusion that different firms react differently to the same innovation. Specially, the time lag before adopting the innovations will probably differ significantly between firms within the same industry. For economic reasons, it was suggested that an important contributor to interfirm differences would be the difference in their size (i.e. the size of the firm). This logic has been formalised into a model called “Industrial Engel Curve” which relates probability of a firm having adopted the new innovation to the firm's size. When the Industrial Engel Curve was fitted with data collection, results were encouraging. The sample innovations, on which the data was based, indicated positive relationships between the speed of adoption of innovation and the firm's size. Many other correlations could be brought in, such as nature of innovation vis-à-vis industrial growth, cyclical factors and growth factors, the role of the firm's size and industry concentration, etc.

5.12 KEYWORDS

- Compunication** : Convergence of communication and computer technology.
- Diffusion** : It is a transfer process in which there is movement of technical know-how within a group of users.
- Epidemic Model of Diffusion** : Diffusion process examined on the analogy drawn from the spread of diseases.

- Facsimile Transmission** : Transmission of an image over communication line in the form of electric signals in such a way that the image is reproduced at the destination using special equipment and paper.
- Industrial Engel Curve** : Relates to probability of a firm having adopted the new innovation to the firms' size.
- Interfirm Diffusion** : Spread of new process from firm to firm within an industry.
- Intrafirm Diffusion** : Spread of new process within a firm.
- Multiplexing** : It is a system of device which takes a number of data communication channels and combines the signals into one common channel transmission.
- Optical Fibres** : A thin glass or plastic fibre used to carry data in the form of light waves.
- Teletext** : A generic term for information services provided by television companies in which data is super imposed on the television signal in such a way that a suitably adapted television can display the data as full screens of alphanumeric and block graphic characters.
- Videotext** : A generic term for system whereby computer based information is made available on an adapted television monitor.

5.13 REFERENCES AND FURTHER READING

- Arrow, K.J. (1979). The Economics of Information. *In: Dertouzos, M.L. and Moses, J (eds.) The computer Age: A Twenty-Year View.* Cambridge: M I T Press. Pp. 306-317.
- Atwood and Dervin (1982). *Challenges to Sociocultural Predictors of Information Seeking.* New Brunswick, NJ: Transaction.
- Baptista, R. (1989). The Diffusion Process Innovations: A Selective Review. *International Journal of Economics of Business.* 61, 107.
- Bates, B.J. (1988). Information as an Economic Good: Sources of Individual and Social Value. *In: Mosco, V. and Wasco, J (eds.). The Political Economy of Information.* Madison, WI: University of Wisconsin Press.
- Brown, L. A. (1981). *Innovation Diffusion: A New Perspective.* New York: Methuen & Co.
- Brown, Marilyn A. (1989). Diffusion. *In: Encyclopaedia of Communication.* New York: Oxford University Press. Vol. 1. Pp. 31 - 36.

Buckland, Michael (1991). Information as Thing. *Journal of the American Society for Information Science*. 42(5), 351-60.

Charpie, R. A. (1970). *Technological Innovation and the International Economy*. Fifth Annual Lecture of the Science Foundation. London: Wiley Interscience.

Chatman, Elfredn A. (1986). Diffusion Theory: A Review and Text of Conceptual Model in Information Diffusion. *JASIS*, 36, 377 - 386.

Davies, S. (1979). *The Diffusion Process Innovation*. Cambridge: Cambridge University Press.

Dholakia, N., and Bakke, J. W. (1996). Institutional Patterns of Information Technology Diffusion. In Belk, R [et al.] (eds.). *Consumption and Marketing Macro Dimensions*. London: International Thomson Printing. Pp. 324 - 356.

Dutton, William, (ed.) (1996). *Information and Communication Technologies: Visions and Realities*. Oxford: Oxford University Press.

Geroski, P. A. (2000). Models of Technology Diffusion. *Research Policy*, 29 (4/5), 603 - 625.

Hall, B. H. (2003). *Innovation and Diffusion*. Preprint. 46p.

Lennstrand, Bo (1998). Diffusion of Information and Communication Technology to Households. Paper presented at the *Twelfth Biennial ITS Conference at Stockholm*.

Lievrouw, L. A. (1988). Four Programs of Research in Scientific Communication. *Knowledge in Society*. 1(2), 6-22.

Losse, Robert M. Jr. (1990). *The Science of Information*. San Diego: Academic Press. Pp. 250 - 253.

Mc Creadie, Maureen and Rice, Ronald E. (1999). Trends in Analyzing Access to Information pt. 1: Cross-disciplinary Conceptualisations of Access. *Information Processing and Management*. 35 (19), 45 - 76.

Maddock, Sir Ieuam (1981). Research Organisations and Their Contributions. *In Conference on Innovation in Industry*. Pretoria: S233, CSIR.

Mahajan, V., [et al.]. (1990). New Product Diffusion Models in Marketing: a Review and Direction for Research. *Journal of Marketing*. 54, 1-26.

Menou, Michael (1994). *The Impact of Information: Definitions and Measurements*. (Preprint, 1994).

Rogers, E. M. (1995). *Diffusion of Innovation*. 4th ed. New York: Free Press.

Shannon, C.E. and Weaver, W. (1949). *The Mathematical Theory of Communication*. Urbana, IL: University of Illinois Press.

Stoneman, P. (2001). *The Economics of Technological Diffusion*. Oxford: Blackwell's.

Taylor, R. (1996). Information Use Environments. *In*. Auter, E. and Choo, C., (eds.) *Managing Information for the Competitive Edge*. New York: Neal-Schuman.

Torsten, Hagerstrand (1967). *Innovation Diffusion as a Spatial Process*, Translated by Allen Pred. Chicago: University of Chicago Press.

Valente, Tom (1995). *Network Models of the Diffusion of innovations*. New Jersey: Hampton Press.

Witson, T. D. (1981). On User Studies and Information Needs. *J. Doc.* 37 (1), 3-15.

Zettlemeyer, F. and Stoneman, P. L. (1993). Testing Alternative Models of New Product Diffusion. *Economics of Innovation and New Technology*, 2, 283 - 308.