CHAPTER 1

INTRODUCTION

India has seen a major economic and social transformation in the last two decades. The nation is moving out of ‘less developed countries’ group and its dreams of development are now being realized to some extent. It is been recognized that information contributes to development and development in turn results in a better information infrastructure. Information is, and has always been, a vital component of every activity. It is the uninterrupted flow of this vital resource, which keeps alive business and industry, education, leisure, travel and communications, national and international affairs and the entire society as we know today. Hence it has been described as the “life blood of society” by Martin (1995, p. 18). Bates (2005) notes that information is all around us, all the time; the only thing in the universe that does not contain information is total entropy.

Although it is omnipresent, the fact that it is unseen and intangible makes it difficult to recognize or define. Various attempts have been made to define information. However some of them are context dependent while many others are too general. Since the term information is used both as an object and a process, and can exist in different forms defining it is a challenging task.

1.1 INFORMATION: ITS MEANING

The English word ‘information’ was apparently derived from the Latin accusative form *informationem* of the nominative *informatio* meaning concept or idea: this noun is in its turn derived from the verb "informare" (to inform) in the sense of "to give form to the mind", "to discipline", "instruct", and "teach". (http://en.wikipedia.org/wiki/Information)
Thus a literal, etymological definition of information is *to give form* to something. In the modern usage of the word this means to give form to a message by moulding it into a shape or pattern that can be communicated. There are many interpretations about what information is, and there is little consistency in the way in which the term ‘information’ is used and defined. Information does not yet have a commonly accepted, generic, context independent definition. There is a long standing debate among philosophers whether information can exist in the abstract or is created only through the process of communication. Some experts emphasize that information can exist irrespective of whether any human or other form of intelligence perceives it or utilizes it. However all general dictionaries emphasize the communication aspect of the term. The Oxford English Dictionary defines it as “that of which one is apprised or told; intelligence, news.” The New Webster’s Dictionary of English Language gives the meaning “intelligence, notice, news, or advice communicated by word of writing; knowledge derived from reading or instruction, and knowledge derived from the senses or the operations of the intellectual faculties.” The Random House Dictionary of English Language states that it is “Knowledge communicated or received concerning a particular fact or circumstances; any knowledge gained though communication, research, instruction, is information.” According to Webster’s Third New International Dictionary “Information is the process by which the form of an object of knowledge is impressed upon the apprehending mind, so as to bring about the state of knowledge.” According to the Merriam-Webster Online Dictionary ‘information’ is “the communication or reception of knowledge or intelligence, or knowledge obtained from investigation, study, or instruction. It is intelligence, news, facts, and or data. ([http://www.merriam-webster.com/dictionary/information](http://www.merriam-webster.com/dictionary/information))

Information is something that one person communicates to another; hence the meaning can only be understood in a socio-cultural context. As Stonier (1991) has observed, a word in a foreign language possesses information, but may have no meaning for the listener if the listener has no prior knowledge of that language. Therefore, to be operative information has to make sense and in order to do this, it has either to fit with pre-existing meanings or be capable of integrating with them and possibly transforming them.
Library science experts have emphasized the aspect of comprehension in their definitions. As per Harrod’s Glossary it is “An assemblage of data in a comprehensible form capable of communication” According to the Online Dictionary for Library and Information Science (ODLIS), Information is data presented in readily comprehensible form to which meaning has been attributed within the context of its use. In a more dynamic sense, information is the message conveyed by the use of a medium of communication or expression. Whether a specific message is informative or not depends in part on the subjective perception of the person receiving it. (www.lu.com/odlis/i/)

Shera emphasised that “information, both in the sense in which it is used by biologists and in the sense in which we as librarians use it, is ‘fact’. It is the stimulus which we perceive through our senses. This information may be a single isolated fact or it may be a whole cluster of facts, but it is still a unit; it is a unit of thought. It can have any dimension. It is that intellectual entity which we receive, the building block of knowledge. (1965, p. 15) He also stated that in the generic sense, it is that which is transmitted by the act or process of communication, it may be a message, a signal, a stimulus. It assumes a response in the receiving organism and therefore, possesses response potential. (1972, p.164) According to Porat (1977) Information is “organised data which can be communicated.”

Meadow (1967) stated that information includes (a) ‘data’, that is symbols in response to a query; (b) ‘facts’, that is highly subjective form; (c) ‘documents’, that is datum or ‘fact’ in the ‘information’ which is generic term. (p. 107). He thus emphasizes both the content of the message and its container. Hoffman (1980) provides a succinct definition of information as “an aggregate of statements, facts and or figures which are conceptually, by way of reasoning, logic, ideas, or any other mental mode of operation interrelated, or in shorthand, as A formula: Information = facts, figures + their meaningful connection.

The definition given by UNESCO (UNISIST, 1979) emphasizes the content and different formats of information. “Information is made up of symbolic elements, communicating scientific and technical knowledge, irrespective of their nature (numerical, textual, graphic, etc.) material carriers, (paper-print, microform or
machine readable form) form of presentation, etc. It refers both to the substance or contents of documents and to the physical existence; the term is also used to designate both message (substance and form) and its communication (act)”.

Some authors have tried to classify information instead of defining it. Koblitz (1963) distinguished between three kinds of information, i.e. Semantic information as a message, Semantic information as a process, and Documental information, which is information containing new facts or statements. Hertz and Rubenstein (1953) classified information as Conceptual, Empirical, Procedural, Stimulatory, Policy, and Directive information. (p. 5-10)

Since information is such a universal concept there are many other valid definitions for information originating from a variety of disciplines that make heavy use of the concept e.g. physics, genetics, neurology, cybernetics, computer science, economics, communications, knowledge management, media studies, library science, information science, archival science, etc. The mathematical theory of communication devised by Claude Shannon in 1948, has been even more influential, and this despite the fact that the information to which it applied was a technical concept, totally devoid of any semantic connotations. (as cited in Martin, 1995) In this narrow technical sense, information was the statistical probability of a sign or signal being selected from a given set of signs or signals. Shannon applied the concept of entropy to the measurement of choice and uncertainty, where uncertainty was the measure of the statistical independence or degree of freedom of choice present in the selection of a message. The greater the freedom, the greater the uncertainty; the greater the degree of uncertainty, the smaller the amount of information in a message. There have been attempts were the link between information and uncertainty is questioned. For example Machlup and Mansfield (1983) observed that countless numbers of messages are received by people without any effect on their uncertainty, and that some kinds of information will generate even more uncertainty than existed before.

Shannon’s definition of information and his ideas about information flow and transfer are more quantitative than qualitative. Several quantitative definitions have also been built upon in the realm of physics. These definitions are focused on measuring the quantity of information units or the strength of its transmission. This approach
reduces information to a binary set of symbols or signals which are not necessarily electronic. The quantity or frequency of the total number of possible messages that these symbols can make are calculated against the backdrop of random or intentional noise in the transmission channel i.e. the signal to noise ratio. This theory continues to be used in the communications industry to invent and improve the transmission of information over copper wires, through the air, through fiber-optic cable, etc. Since 1999 the concept of qubits, essentially quantum bits of information, as being the fundamental building block of the knowable world instead of matter, atoms or the quantum field has been introduced in quantum physics (Garderen, 2007)

The quantitative information theory is interested specifically in the symbols and signals of these messages and not their intended or interpreted meaning. This is in contrast to the other definitions of information given earlier which are more concerned with the meaning and understanding of the message that the information communicates. Experts from the field of Library and Information science and other social sciences are more interested in the qualitative aspects of information.

1.2 CHARACTERISTICS OF INFORMATION:

As the earlier definitions of information point out information is made up of four Cs. –content, (facts or opinions), communication, comprehension and container. It has distinct characteristics which make it valuable. The inherent characteristics (Satyanarayana, 1996) of information are:

- **Other resources depend on information and knowledge.** It is the perception and evaluation of resources which make their use possible. One cannot use that, of which one knows nothing. Thus the availability of information determines the use of other resources.

- **It is a resource itself:** Information is not reduced or diminished by wider use and sharing. On the contrary, its value tends to gain in the process. It is called “a synergetic resource”, i.e. the more we have the more we use and the more useful it becomes. Information expands as it is used.
- **It is alive:** Information exists in the human mind: what it observes, remembers and retrieves, and what it then analyzes, intuits and integrates. Information is the input and output of human perception.

- **It is compressible:** It can be concentrated, integrated, summarised, and miniaturised for easier handling. Thus many complex cases are stored in theorems, masses of data into a single formula, and lessons learned from much practical experience in a manual of procedure.

- **It is substitutable:** It can replace capital, labour or physical materials. Automation and robotics in factories and offices are displacing, transforming and upgrading the labour force.

- **It is diffusive:** It tends to leak and the more it leaks the more we have. Examples are the strait-jackets of public secrecy, intellectual property rights, etc.

- **It is shareable:** When information is shared it results into a shared transaction not an exchange transaction, as the one who gives away some information or passes on an idea or fact, retains it while sharing the same.

Thus we can conclude that information as a resource is pervasive and different from other resources in fundamental ways, in kind and not merely in degree.

Attempts have also been made to assess the benefits resulting from the use of information. Two main categories of benefits that relate to the nature or area of application of the changes resulting from the use of information have been studied (Menou, 1993) - direct benefits and indirect benefits. Direct benefits are those which are an immediate consequence of using information for the purpose for which it was sought, to solve the particular problem for which it was sought. Indirect benefits may only occur in the medium or long term and are not specifically related to the problem at hand when the information was used, for example, structuring the knowledge base, enlightenment, and attitudinal changes. In each of these categories, two subcategories have been further distinguished based on the conditions of occurrence of the benefits: immediate benefits and potential benefits.
The value of information lies in its use for understanding the situation, in decision making and planning, predicting, monitoring and reviewing activities. It is important that in order to be of use information is accurate, and relevant. The value of the information is not an inherent or constant quality. It depends on the needs of the recipient and on the use to which it is put. Information is not only valuable for the individual but also for an organization or at the national level. Pauline Atherton in “Handbook for Information Systems and Services” (UNESCO 1977) explains the value of information for a nation. It can be used to

- Improved capability of a country to take advantage of existing knowledge and ‘know-how’ achieved elsewhere.
- Rationalization and systematization of a country’s research and development efforts in light of knowledge already available.
- Creates a wider knowledge base for the solution of problems.
- Provides new alternatives and approaches to the solution of technical problems, and options for minimizing future ones.
- Improves effectiveness and efficiency of technical activities in the production and service sectors and
- Results in better decision making in all sectors and at all levels of responsibility.

The value of information to a nation suggests its relationship to development.

1.3 THE CONCEPT OF DEVELOPMENT

Consensus regarding the concept of “development” is hard to achieve. For several years the concept of development was interpreted to be economic development and GNP and Per Capita GNP and distribution of wealth were used to measure development. However they project different dimensions. For a country with a high GNP per capita, development may relate to quantitative and possibly qualitative growth, but does not imply much structural change; in a country with a low GNP per capita, structural changes are almost inevitably a requisite.

The meaning of development as restricted to economic development was found faulty and limiting. Many of the so-called development indicators and the value judgements
based upon them seem to equate development with the replication of socioeconomic structures found in the Northern Hemisphere. Efforts to devise more appropriate indicators, such as the quality of life indicator developed by Morris (1979), and the socioeconomic indicators compiled by the United Nations Research Institute for Social Development aimed at providing a more accurate picture.

It was realized that development is something more than mere production of commodities and services hence the concept of development was widened to include human development. A number of indicators contributed to development which was understood as significant changes in the evolution of modern societies; these included urbanization, literacy, vocational training, newspaper circulation, political democracy, independent judiciary, free enterprise, rational behaviour, social mobility, occupational diversity, associations, fewer factions (ethnic or other), and nuclear families. The United Nations Development Programme (UNDP 1990), aimed at providing a more accurate picture by defining human development as enlarging people’s choices and freedoms to live a long and healthy life, have access to knowledge and a decent standard of living, and participate in communities with dignity and self-respect. It included indicators of health, education and standard of living.

The capacity for development is enhanced through the simultaneous cultivation of material and nonmaterial resources. Development requires strengthening the infrastructure for cultivating physical resources (land, material, plants, and energy) and intellectual or creative resources (those that build human capital). By raising the value of human capital, a dynamic society is capable of sustainable economic development.

Vitro agrees (as cited in Menou, 1993) that development may be viewed as “The ability of a society to add value to material and non material resources [which is] the key for generating local wealth and an important factor in contributing to a more equitable distribution of new wealth. To add value is to add to the information content of resources.” He referred to this as “information sector hypothesis”. Menou noted that although the contribution of information to development at various levels is often referred to it is not sufficiently elucidated. However, he also felt that reliable
assessments at this level are almost beyond reach. (Menou, 1993) Because of its characteristics, information may not be managed like other production factors. This may partly explain why the focus is currently on information technology rather than on information itself.

1.4 RELATION OF INFORMATION AND DEVELOPMENT

Availability and use of information plays an important role in the development process. One can safely agree with Boulding (1966) that “Development, even economic development, is a knowledge based process”.

According to Neelameghan human survival and development and hence the world’s economy and development, over the centuries, in a broad sense, have evolved around two principal axes, namely the energy axis and the information communication axis. To elaborate his view he explained the energy axis as the investments and efforts for the identification of energy sources, energy generation, storage, processing, transfer, use, and conservation and the related economic and geopolitics; and the information communication axis as the investments and efforts for the generation, recording, storage, processing, accessing, communication and use of information and the related economics and geopolitics. (1999, p108)

The connection between the developments along the two axes has become obvious in the recent past. The discoveries, inventions and innovations in one domain have accelerated the discoveries, inventions, and progress in the other domain, like a synergistic effect. Therefore, economists, sociologists, and futurologist have been studying the impact of information technology (IT) on society, and trends in national economies centred around access to and use of organised information. These two factors – energy availability and use and information availability and use – are now included among the indicators of socio-economic development of nations. (p.110)

More recently Pitroda (2010, p. 7) explains the connection between information and development. Traditionally infrastructure meant power, road, transportation, irrigation and even education and was considered essential for development. However we cannot capitalize on this infrastructure without information and its proper
communication and dissemination. He refers to this as information infrastructure which to him is ‘infrastructure of the infrastructure’

However it is pointless to ask whether information “causes” development or, conversely, development “causes” information. This might even be a false problem. One may find evidence that better performance occurs when information is effectively used and, conversely, performance is poorer when it is not. This relation may be enough to support the idea that information is a necessary condition for development and causal links may not be required at this stage. A number of studies (Strassmann 1985, 1990; Koenig 1990) suggest that such a relation exists. No specific factor, much less information, can be singled out as a main cause of development. A wide range of external influences are involved at each level in the interplay between information and development because of the very nature of the socioeconomic and cultural environment in which information is produced, distributed, and used.

Information does create an impact on development. Three broad classes of impact have been distinguished: those that are both measurable and quantifiable, such as cost and time savings; those that are measurable but not quantifiable, such as increased quality; and those that are neither measurable nor quantifiable, such as new insights, learning, and performance of higher-order tasks viz. up-scaling.

Information also plays an important role in development planning. It is apparent that development planning and monitoring requires the optimal allocation and utilization of the national resources based on reliable forecasts and meaningful decisions. These exercises require timely, reliable, precise and comprehensive data and information about these resources and other priority requirements. Therefore, information is not merely an input resource for effective development planning but is also essential to ensure the optimal allocation and utilization of all other resources. Mangla emphasizes that the national development plans should give due recognition to the ‘information sector’ as they do to other sectors of economy such as agriculture, industry, education and research, science and technology, trade and culture. Such a recognition would undoubtedly provide a better perspective to the premise that ‘the level of information handling capability is the socio-economic development indicator’ in a country. (2003 p. 94)
Information can be of real use in the development process when it is appropriate and is used effectively. Martin (1995) argued that given the widely acknowledged relationship between information and the decision making process, countries especially the developing countries should concentrate on the training and creation of skillful producers of information and the creation and consolidation of cost-effective information services appropriate to the local milieu. He further argued that there are a few obstacles to the implementation of policies which would help a nation develop fast. According to Martin (1995) these are,

“lack of appreciation of the potential role of information in the development process; inadequate nature of existing information services; shortage of funds, foreign exchange, technology and trained staff; absence of an appropriate information culture; serious problems of access to information; and lack of a coherent national information policy”

1.5 THE INFORMATION SOCIETY

Information and knowledge have conventionally supported and underpinned all developments be they social, economic, scientific or technical. They were, in a sense, part of the “intellectual infrastructure” of society. (Parekh, 2003) Technological changes particularly developments in Information and Communication Technology (ICT) together with structural changes in the economy resulted in what was termed as the ‘Information Society’. (Moore, 1997).

In the earlier stages of societal development, the economy relied greatly on the primary sector namely agriculture, forestry, and mining. Gradually, the secondary sector, i.e. manufacturing and industry became more important, contributing a larger proportion of GDP. The rise of the secondary sector was then followed by an expansion of the tertiary sector. The commercial and service sector, of which a major portion deals with information, its creation, transfer and processing, grew and made a greater contribution to the national income. (Clark, 1957)

The term “information society” as it is now used first emerged in Japanese social sciences in the early 1960s. The Japanese version of this expression is joho shakai or johoka shakai. As stated by Karvalics (2007, p.5) the term was first used during a
conversation in 1961 between Kurokawa, the famous architect, and Tudao Umesao, the renowned historian and anthropologist. Later during 1964 to 1971 the term was used in many works from Japan by authors like Masuda, Igarashi, and Hayashi. A dictionary on the information society was also published in Japan, as early as 1971. The first English language reference dates from 1970 and can also be linked to Masuda.

Before this several terms were used to convey a similar concept, each emphasizing a different aspect. The expression “post-industrial society” was coined in 1914 in Great Britain by Coomaraswamy and Penty, and later revived from 1958 in USA by Daniel Bell. The Australian economist Colin Clark introduced the concept of “the third (tertiary) sector” in 1940. The term “brain work” replaced “manual work” which was used by Marshall, as early as 1890, and opened the way towards the concept of information society. Similarly the term “intelligentsia” was used in German and Russian-speaking areas; “white-collar work” was used by Sinclair and Drucker used the term “knowledge worker” in 1967. (Karvalics, 2007, p.5)

All these terms were used to express the growing importance of those social groups in the labour market that emerged and were using their intellectual performance and knowledge to make a living. However due to the increasingly complicated patterns of information, knowledge processes and institutes, partly due to technological change, other terms became successively unsuitable and in the end the term “information society” gained acceptance as the umbrella term used to describe the elemental social changes that took place in the second half of the 20th century. The term included and encapsulated all the previous partial concepts and even preserved the expressive power, approach and attitude they represented. (Karvalics, 2007, p.6)

The term was used in multiple ways to emphasize different issues. According to Martin (1995, p.3) Machlup and Porat had their attention on its economic implications, whereas Toffler (1980) and Naisbett (1982) were concerned with the social aspect of the concept. Discussing his ten ‘megatrends’ futurologist John Naisbett mentioned that ‘none is more subtle, yet more explosive, of the megashift from an industrial to an information society’ Toffler talked of an information bomb
exploding in our midst and of a power shift in society, consequent upon the extent to which it had come to depend on knowledge.

There is no consensus in the literature with regard to when individual countries “entered” the information society. However Karvalics identifies 1961 as the year when the US “tipped over” as an information society. Japan joined ten to fifteen years later and other pioneering countries at the end of the 1970s. The fast developing Asian countries attained the same status at the beginning of the 1990s. A great part of Africa, Asia and Latin America have yet to be regarded as information societies. (Karvalics, 2007, p.14)

1.5.1 Definitions

The information society is a society where information is central to social development and organizational management or one where access to information, for everybody, should be guaranteed. In a generalized manner it could also be stated that an information society is one in which information is used extensively in economic, social, cultural, and political life. A few definitions are discussed here to understand different viewpoints.

Masuda in 1970 defined information society as, (as cited in Karvalics, 2007, p.9) “a new type of society, where the possession of information (and not material wealth) is the driving force behind its transformation and development… [and where] human intellectual creativity flourishes.” Here the emphasis is on possession of information which is the prime agent of transformation and development. Cronin (1986) defines information society as “one in which labour has been intellectualized. One in which the expression to earn one’s bread by the sweat of one’s brow sounds anachronistic.” Here use of intellect in labour is emphasised instead of manual labour which was the norm in earlier societies.

Martin in 1988 tried to broaden the focus from the merely technological or economic, and portray the societal aspects of the phrase. According to him (1995, p3)

“A society in which the quality of life, as well as prospects of social change and economic development, depends increasingly on information
and its exploitation. In such a society, living standards, pattern of work and leisure, the education system and the market place are all influenced markedly by advances in information and knowledge. This is evidenced by an increasing array of information-intensive products and services, communicated through a wide range of media, many of them electronic in nature.”

The e-Europe initiative used the following definition as the guiding force to help formulate statistical indicators to benchmark the information society:

“Information Society” is (1) a society where an increasing portion of societal activities – work, economic transactions, communications, and other interactions between individuals, private sector organizations, and governments – are conducted via ICT networks or are dependent on ICT technologies, all of which are increasingly interoperable; and (2) a society where information and knowledge are increasingly important economic goods at all levels – that is as determinants of wage levels for individuals, as factors of production for firms, and as sources of competitiveness among nations and/or regions. (2001, p.9)

One perspective on information society that emerges out of the literature is concerned with the consumption of information goods and services rather than their production. This research perspective is primarily concerned with the behavioral pattern of consumption of information goods and services. Duff (2000) reports that the Research Institute of Telecommunication and Economics (RITE) attempted to formulate a precise definition of information society, concluding that such a society should have the following characteristics:

- a per capita income of more than 4,000 dollars;
- the number of service workers exceed 50 percent of the total labour force;
- university students exceed 50 percent of the total appropriate age group of population; and
- the information ratio (ratio of household expenditure for various information related activities to total household expenditure) is greater than 35 percent.

It is sometimes argued that the concept “information society” is closely linked with ICT; in fact many a times both are used as synonyms. However this restricted view leads to a loss of essence of the basic concept. The true dimensions of information society should be sought not within the limited area of telecommunications, but rather
in education, science, innovation, the new economy, content and culture. It is evident that these definitions are based on different preconceptions regarding which areas of life change significantly. Some are centred on resources, others around products, or industries, or activities, or society and people.

1.5.2 Characteristics of Information Societies

Moore (1997, p. 274) points out that it is not at all easy to go beyond generalized definitions; however it is possible to identify some common characteristics of information societies.

Bell (1980) identified five important dimensions of the concept of post-industrial society, on the basis of which the framework of the information society is built.

- Economic sector representing the change from a goods-producing to a service economy;
- Occupational distribution representing the pre-eminence of the scientific, professional, managerial and the technocratic class;
- Axial principle representing the centrality of the codification of theoretical knowledge as the source of innovation in technology and of policy formulation for the society;
- Future orientation representing the control of technology and technological assessment;
- Decision-making representing the creation of a new intellectual technology as a key tool of systems analysis and decision-making.

Martin (1995, pp.6-11) suggested the following criteria for an information society:

- Economic criteria: In the information society, information is regarded as key economic factor, as a resource, service, commodity, a source of added value and employment. The information sector is regarded primarily as a device for scrutinizing progress towards the information society.
- Technological criteria: Information Technology is regarded as the key enabling force in the information society. The convergence of computing and
telecommunications continues to make itself felt in just about every area of life in modern societies.

- Social criteria: Information is seen as an enhancer of the quality of life. Widespread information consciousness and end-user access to high quality information can be considered as the social criteria of the information society.
- Political criteria: Freedom of information leading to a political process characterised by increased participation and consensus is considered as the political criterion of the information society.
- Cultural criteria: Recognition of the cultural value of information through the promotion of information values in the interests of national and individual development is regarded as the cultural criterion of the information society.

The World Information Report, prepared in 1997-98 by UNESCO outlined the characteristics of information societies. These societies have three main characteristics. First, information is used as an economic resource. Secondly, it is possible to identify greater use of information among the general public. The third characteristic of information societies is the development of an information sector within the economy. The function of the information sector is to satisfy the general demand for information facilities and services. It could be observed that this set of characteristics, is similar to the criteria suggested by Martin.

It is often reiterated that the work force in an information society consists of more people working in the information sector. Classification of information workers by Porat and Rubin (1977) is useful in understanding categories of information workers. According to him there could be four principal categories. These are: (i) information workers, who create new information or package existing information into more appropriate forms; (ii) information processors, who receive and respond to information inputs as the basis for further operations; (iii) information distributors, who convey information from the initiator to the recipient; and (iv) the information infrastructure workers, those responsible for the installation, operation and repair of machines and technologies used to support information activities.
Thus there are two major interrelated characteristics that underlie information society claims. Firstly, the society is becoming increasingly centred on information handling, processing, storage and dissemination using microelectronics-based technologies above all those made available through the convergence of the computer with telecommunication, namely, information technology. Secondly, that this shift is reflected in an emerging occupational structure in which the category of information workers has become predominant.

1.5.3 The role of Information and Communication Technology

Technological change has been the major contributor to the process of development. In recent years, rapid development of ICT has vastly increased human capacity to process information and has undoubtedly accelerated growth in the information-intensive tertiary sector. According to Moore (1997) the impact of information technology arises from three of its characteristics. Firstly, it is an enabling technology. It can be applied in a wide range of different circumstances and can itself contribute to further technological change. Second, the capacity of the technology has been increasing at an exponential rate and shows no sign of slowing down. Finally, and perhaps most important, the cost of the technology has fallen rapidly over the same period and, again, seems likely to continue to do so. These three factors have led economies to reason that information and communication technologies have triggered a new long wave of economic growth stimulating the development of information societies. (p. 273)

UNDP has depicted the interconnections between human development, role of information and the technological changes, as given in the figure 1.1. The figure depicts that human capability, through creative knowledge, results in technological change which in turn builds human capabilities through advances in medicine, communication, agriculture, energy and manufacturing. The mutual relationship between economic growth and technological change is shown in the inner cycle. The figure shows how the availability of information and deployment of information and communications technologies can make a positive contribution to development.
1.5.4 Models of Information Society

Several models of information society are available in the literature, three of them being well recognized. In the first model Bell surveyed characteristic differences reflected by the social-historical phases, simplified into three main periods, namely pre industrial, industrial and post industrial, along nine distinctive aspects. These are: economic sector, resources bringing about change, strategic resources, technology, knowledge-base, methodology, time perspective, planning, and guiding principle. (as cited by Karvalics, 2007, p.10) The second model is based on Masuda’s comparison of the industrial and information society, divided in three main areas: innovational technology, socio-economic structure and values; each of them being divided into sub categories. In contrast to Masuda, Schement and Curtis (as cited by Karvalics, 2007, p.11) restricted the essential components to six categories namely information...
Based on the three classical models Karvalics (2007, p.10) proposed a more complete model. He presented a synthetic table which partly improves the previous models and partly specifies them. This table included formulations to make individual elements measurable and thus answer the question of from which point and to what extent of deviation from absolute or relative indicators can a society be regarded as an information society. He also included metaphors corresponding to particular categories, emphasizing that the term information society is an umbrella term incorporating them all.

**Table 1.1: Synthetic basic categories of information society, their measurability and metaphors**

<table>
<thead>
<tr>
<th>Basic category</th>
<th>Measure and “tipping point”</th>
<th>Metaphor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>The proportion of businesses forming part of the information sector and producing information and knowledge products in relation to other sectors (relative dominance: when it is the largest sector; absolute dominance: when the sector alone produces over 50%, i.e. it is larger than all the others put together).</td>
<td>information industry, knowledge industry, information and knowledge industry, information economy, knowledge economy, knowledge-based economy</td>
</tr>
<tr>
<td>Employment</td>
<td>The number and proportion of those employed in the information and knowledge sectors in relation to other sectors (relative dominance: when it is the largest sector; absolute dominance: when the sector alone produces over 50%, i.e. it is larger than all the others put together).</td>
<td>white-collar workers, information and knowledge workers, immaterial workers, knowledge class intelligentsia</td>
</tr>
<tr>
<td>Work</td>
<td>How many people and to what degree are engaged in information activity “as a profession” according to the type of work done. (threshold level: 50%)</td>
<td>symbol manipulators (Reich, 1991), intelligence, brainworker mind worker</td>
</tr>
<tr>
<td>Resource and technology</td>
<td>Information and knowledge appear as resources and forms of capital in addition to traditional forms - the theory of growth and accounting strive to mathematise this but so far there are no accepted algorithms. (However, the contribution of information and knowledge technology to growth is already measured).</td>
<td>intellectual capital, human capital, information capital, corporate information and knowledge assets</td>
</tr>
</tbody>
</table>
### 1.5.5 Information or Knowledge Society

A conceptual dilemma is noticed on the terminological front. Some argue that the term “information society” should be overwritten by the term “knowledge society”. If information is “organized data which are (or rather can be) communicated” (Porat and Rubin 1977), knowledge is information that has been meaningfully aggregated into a reservoir of facts and concepts that can be applied, that is, information that has been absorbed or “appropriated.” Hence, some say that information society is one of the components of knowledge society since information is only one of the constituent

| **Income and wealth** | GNP on a national level, monthly income on an individual level. There are no accepted measures in regard to the amounts; what is more, these amounts vary depending on the time of joining the information society. $5,000/person/month was the threshold level at the turn of the 1960s in the USA. | affluence, welfare state |
| **Consumption** | The proportion of purchased information and cultural goods, means and services in the consumer basket, especially in regard to media contents (threshold level: 33%). | consumer society, prosumers |
| **Education (level of education)** | Proportion of those with a qualification earned in higher education (degree holders) in society. Threshold level: 50%. | learning society, meritocracy |
| **Cognition** | Results and scales in the measurable dimensions of cognition; microscopic dimensions, astronomical distances and scales, discovered genocombinations, sign processing, etc. The scale to measure this is still to be worked out. | life-long learning, scientific revolution, nano-scale, petascale |
| **Conflict management method and power technique** | Replacement of traditional forms of warfare, placing economic conflicts into an information context (business intelligence, innovation competition). The “state of democracy” of society, types and mediators of control. There are some methods used to measure the “degree” of democracy. | information warfare, cyber wars, business intelligence, bureaucracty, control, crisis and revolution, risk society |
| **Interconnectedness** | The degree of mutual connectedness (objective in the case of telephone networks: provision over 50%). | telematic society, “wired society” |
| **Worldview and logical framework** | Has the static and energy centred worldview been replaced by an information-centred one? Have the global system level and the “space age” become a framework for analysis and interpretation? Is orientation to the future a characteristic feature? | global village, technoculture, information civilisation |
parts of knowledge. They believe that as a term information society is continuously becoming weaker (Karvalics, 2007, p.8)

This unproductive, contradictory and incoherent state developed because of the inherent ambiguity between the two terms information and knowledge. In fact the separation between the two terms is artificial. As Machlup pointed out as early as in 1962, it is redundant to talk about knowledge and information; in fact, we are talking about the same quality. According to Neelameghan, the issue of ‘whether is it knowledge or information?’ and which of the associated terms information society or knowledge society depend on the sustained benefits to the society. As we know development is the bridge between the hopes and aspirations of people on the one hand and the realities of the world on the other. In this context information and knowledge are the pillars of that bridge. For sustained development, it is not a question of information or knowledge; both are required. (1999, p 111)

Karvalics agrees with Machlup and opines that the terminological confusion is due to the fact that the “general social science of information” has not yet come into being. However some of its preliminary axioms can already be articulated efficiently. (2007, p.8)

- The processes of information production take place in the minds of individuals, not in natural or artificially maintained “exterior” locations (this immediately places the investigation of the flow of information into a “human” and “social” frame, while technology becomes a secondary consideration).
- The systems of information technology operate with information converted into symbols, computers and machines process symbols, minds and intellects process information.
- Knowledge can be defined as further transformed or contextualized information.

Thus when one talks about information and knowledge, one is talking about two indivisible components of a single, unified, cognitive universe. When reference is made to ‘the information society’, the entire territory or range of the concept’s
interpretation of all the meanings and connections that appear undivided in the clusters of expressions related to the processes of information and knowledge are condensed into it.

1.6 MEASURING THE IMMEASURABLE

Once an organism is born or a phenomenon uncovered, there is an almost irresistible urge to measure its growth. (Porat, 1977) This is inevitable for several reasons. When society devotes considerable amount of its resources to any particular activity, economists will want to look into this allocation and get an idea of the magnitude of the activity, its major breakdown, its relation to other activities. (Machlup, 1962) Further Eysenck has argued that “if it cannot be measured it does not exist.”

‘Development’ and ‘Information’ do exist, hence should be measured. However the two concepts have proved to be nebulous and difficult to define and the challenges of measuring them are even greater. Since 1990 attempts to measure human development have been made using various indicators and a human development index (HDI) has been constructed. The HDI is itself not perfect and suffers from inherent inaccuracies. It attempts to measure multiple complicated variables in one dimensional scale. However it is widely accepted.

Information has been even more difficult to measure. Information theory quantifies information as the signs carrying a message. It is described in terms of the statistical quantity of signs, and their combinations, produced by a source. The concern of people associated with telecommunication is generally towards achieving the accurate transmission of message, and information theory remains the cornerstone of engineering practice. But it must be noted that accurate transmission of inaccurate information does not make that information any better. The communication engineer does not as a rule concern himself with the content or quality of information, the words ‘quality’ and ‘better’ introduce the element of subjective judgment into the notion of information, which may be considered as the combination of content and representation.
Boulding (1966) argues that the bit, the only measure of information in general use, abstracts completely from the content of information. The bit is indeed a useful measure in discussing the capacity and method of operation of communication channels and for situations where the content of a message can be rapidly encoded, but it is not helpful for measuring things like scientific and technical articles whose contents are not easily encoded. Nor, is it the number of bits which determine its value. A further difficulty arises because the good information is mainly an investment good although, it has consumption aspects. Generally, we obtain information in order to use it with other information to make decisions. When obtained it becomes part of the capital stock of information from which decisions can be better made. But, we may consume information for its own sake.

Social scientists have sought other ways of measuring information. These too have not been able to measure the quantum of information and have ended up measuring the information container e.g., newspapers, books, patents, journal articles, technical papers, etc, or measuring the channels used in information communication e.g. telephone lines, television ownership internet users, computer users etc. Till date no other measure has been used and one needs to be satisfied by using these indicators of information.

Measuring the relationship between development and information has been an even greater challenge. Economists, development scientists and information scientists have been struggling for decades to identify criteria for the assessment and measurement of the impact of information on development. Since information has proved to be impossible to measure from the social perspective the focus is currently on measuring information technology rather than on measuring information itself.

There have been attempts to assess and measure the role of information and ICT in the development process. The World Information Report and the World Communication Report are noteworthy as state-of-art documents which assessed the global scenario. World Bank projects like Information for Development, which is now called Knowledge for Development and Knowledge Assessment Methodology are important attempts in measuring the knowledge economy. Other ICT based development tools measure e-readiness or network readiness of a region.
It is interesting to compare three indexes namely, the Human Development Index, by UNDP of 1999, Technology Achievement Index by UNDP of 2001 and the Knowledge Index by the World Bank of 2008. As the following table shows there is a fair amount of similarity between them. When graphically expressed the similarity trends are very clearly visible as per the Figure 1.2. Statistically too, the parallel trends are clearly indicated by the correlation values between the three as shown table 1.2

<table>
<thead>
<tr>
<th>HDI Rank</th>
<th>Country</th>
<th>HDI 1999</th>
<th>HDI 2001</th>
<th>HDI 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Norway</td>
<td>0.939</td>
<td>0.579</td>
<td>0.927</td>
</tr>
<tr>
<td>2</td>
<td>Australia</td>
<td>0.936</td>
<td>0.587</td>
<td>0.917</td>
</tr>
<tr>
<td>3</td>
<td>Canada</td>
<td>0.936</td>
<td>0.589</td>
<td>0.914</td>
</tr>
<tr>
<td>4</td>
<td>Sweden</td>
<td>0.936</td>
<td>0.703</td>
<td>0.963</td>
</tr>
<tr>
<td>5</td>
<td>Belgium</td>
<td>0.935</td>
<td>0.553</td>
<td>0.87</td>
</tr>
<tr>
<td>51</td>
<td>Mexico</td>
<td>0.79</td>
<td>0.389</td>
<td>0.548</td>
</tr>
<tr>
<td>115</td>
<td>India</td>
<td>0.571</td>
<td>0.201</td>
<td>0.294</td>
</tr>
<tr>
<td>127</td>
<td>Pakistan</td>
<td>0.498</td>
<td>0.167</td>
<td>0.218</td>
</tr>
<tr>
<td>129</td>
<td>Nepal</td>
<td>0.48</td>
<td>0.081</td>
<td>0.146</td>
</tr>
</tbody>
</table>

The close relationship between human development, technology achievement and knowledge is statistically reflected in the co efficiency scores between the three indexes in the following table; the same is graphically shown in Figure 1.2.

<table>
<thead>
<tr>
<th>Correlation between</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDI &amp; TAI</td>
<td>0.976</td>
</tr>
<tr>
<td>HDI &amp; KI</td>
<td>0.989</td>
</tr>
<tr>
<td>TAI &amp; KI</td>
<td>0.990</td>
</tr>
</tbody>
</table>
1.6 REPORT SCHEMA

It is against this context of information and development that the present study “Information Index: An Analytical Study of the Theoretical and Empirical Issues” was undertaken. Extensive readings on the issues were undertaken before beginning the study and were continued throughout its duration. These are reported in Chapter 2 Review of Literature.

Chapter 3: The Study: Objective and Methodology describes the operationalisation of the entire research. Beginning with the rationale, objectives and the scope of the study it goes on to describe the methodology used. The conceptual model, its operationalization, data collection, statistical techniques used and the index generation are included in this chapter, which ends by recognizing the limitations of the study.

The concept of indexes and the various methods used to construct them form the substance of the next chapter. Various attempts at the global and national level to measure development, information and other related concepts are described in Chapter 5.

Chapter 6: Developing the Information Index details the indicators and methodology used in fulfilling the objectives of the study. It uses the index so constructed and applies it to 15 states of India to find out the values and ranks obtained by them. The concluding chapter summarizes the study and indicates the directions for further work.
REFERENCES


Menou, M.J. (1993). Measuring the impact of information on development, Ottawa, ON, IDRC.


