CHAPTER 2
REVIEW OF LITERATURE

Literature review is an important and integral part of any research effort without which the investigator cannot proceed. The search and review of literature dealing with various aspects of Information Index revealed many useful works such as reports, indexes, data sources, journal articles, books, and web links. The review of literature presented here is basically divided in two sections. Section A covers a review of readings on basic concepts like information, its relation with development, the concept of information and knowledge society, relationship between ICT and development and articles describing the Indian scenario. Section B includes literature and reports on the methodology of the study. It covers articles on indexes construction and indicators, the various indexes examined, the statistical sources used in the present study and the style manual used in preparing the report.

SECTION A: REVIEW OF LITERATURE ON BASIC CONCEPTS

2.1 INFORMATION

During the necessary background reading on information, its definition and meaning the following books were found useful. In his influential book ‘The Global Information Society’ William Martin (1995), discussed what information is, its meaning, its detail study based on various perceptions, and everyday uses of information; he distinguished between data, information, and knowledge and established links between information and communication. Satyanarayana’s ‘Information Technology and its facets’ (1996) also presented a clear distinction between related terms like data, information, knowledge and communication, and outlined the nature of information, its historical perspective, definitional problems, information generation, use and flow. He also deliberated on various related points like quality, cost and value of information.

Standard dictionaries, glossaries and online resources like The Oxford English Dictionary, The New Webster’s Dictionary of English Language, Random House Dictionary of English Language, Webster’s Third New International Dictionary, Merriam-Webster Online Dictionary, Online Dictionary for Library and Information Science (ODLIS), Harrod’s Glossary, UNISIST document etc. were found handy and valuable in retrieving definitions of information and related concepts.

A significant contribution by Shera (1972) ‘The Foundation of Education for Librarianship’ gave meaningful explanation of how the term information is used in a generic sense and justified how it is the building block of knowledge. The mathematical theory of communication (Shannon, 1948) interpreted information as a technical concept, totally devoid of any semantic connotations. Babe (1994) traced the origin of the definition in economics and communication theory citing Knight and Arrow. Similarly a definition by Machlup and Mansfield (1983) is also based on the observation that
information does not necessarily reduce uncertainty. On the other hand information was defined as the sum total of facts, figures and their meanings by Hoffman (1980). According to Porat (1977) and Meadow (1967) information is organised data and it includes facts and documents. Davenport and Prusak emphasised the necessary context and knowledge in the message based on which information is referred to as data that makes a difference. (Davenport and Prusak, 2000)

Bhattacharyya’s (1997) very compact article on definition of information for service professionals was found to be useful in getting a basic insight of the concept. It proposed that where there is communication, information is integrally associated with it. He also analysed the senses denoted by the term information along with varieties of information.

A few references based on the classification of different types of information were also found useful. (Koblitz, 1963, Hertz and Rubenstein, 1953) Similarly attempts based on the analysis of quantitative and qualitative definitions of information were also noteworthy such as Garderen (2007), Baeyer (2003) and Bates (2005). The summarisation of the concepts of information by Madden (2000) and Braman (1989) was found to be useful in categorizing the definitions and concepts.

A few more works such as Gupta (1987), Darnton and Giacometto (1992), Milner (2000) were referred to get an overview of information communication process in various sectors, its changing role in the backdrop of the wide ranging developments in the field of information technology. To understand factors creating information demand, the study of information transfer process, channels of communication of information and the social approach to information, views of Vickery and Vickery (1987) provided a primary background.

Traditional perception of information and the uses to which it can be put was explained by focusing upon the concept of information-as-thing, the notion of information-as-resource, and information-as-commodity, were also discussed by Buckland (1991), while Machlup viewed information as an intangible. (1983). Martin elaborated on how information has become the lifeblood of modern societies. (1995)

Various types of information carriers are discussed by Kundu (2010) and the need and importance of information in today’s context is emphasized. He has suggested that traditionally known documentary sources of information could be treated as information products and developed as a marketable commodity.

Classification of information and impact of information technology developments illustrated by Gopinath (2001) helped in identifying indicators of information generation, communication and use. He enlisted growth points of information technology, media of communication, information carriers, and implications for organizations, and organization systems for each.
Narasimhamurthi (1996) discussed the general information theory in detail which was helpful to understand the concept. According to him this theory is one of the youngest branches of applied probability. The central question that is addressed in information theory is regarding the best way to communicate information from a sender to a receiver.

2.2 INFORMATION AND DEVELOPMENT

Issues such as contribution of information activities to development and how it could be assessed, which indicators could help establish a relation between the two, have been of interest to researchers from many fields. Similarly institutions in developing countries and development assistance agencies have for many years, exerted considerable effort on various information projects, on the assumption that these activities contribute to overall economic and social advancement. There had been no substantial study conducted, however, to prove this assumption. With support from International Development Research Centre (IDRC), a group of the world's leading information scientists participated in a 7-month long computer conference to identify those parameters or indicators by which the impact of information programmes or services can be assessed to ensure the relevance of information activities to development and to provide concrete answers to decision-makers regarding the value of information. (Menou, 1993) This publication proved useful to get a better understanding of a number of theoretical and conceptual issues, like how to assess the much talked about role of information activities in development, causality between indicators of information activities and development, categorisation of benefits resulting from the use of information, socio cultural influences of information activities and policies, and various kinds of information systems, services and infrastructure.

Information cannot be the only resource required for development, as there are number of resources such as physical and intellectual, which are required to be strengthened for dynamic development, but information is fundamental for all these resources. Boulding’s path breaking study on ‘the economics of knowledge and knowledge of economics’ helped emphasize that development, even economic development is an information and knowledge based process (1966). In order to sustain economic development, a society needs to build up its human capital, which in turn can utilize all the available resources, based on the level of knowledge acquired through intellect and experience.

Saracevic’s article was useful to get an overview of the needs for scientific and technical information in less developed countries. While examining the relationship between information and development he observed that there is no systematically consolidated qualitative empirical evidence which could help establish a link between the two. (1980)
In a three part series of articles on information support for socio-economic development planning Neelameghan (1996) presented an overview of the development process from social, economic, political and philosophical points of view, and the challenges of re-orientation and change required in the structure of development planning in the first part. He further discussed the information requirements of multilevel multi objective planning and enumerated the same. Data sources, collection, processing, and networking were also briefly discussed. Part two of the series discussed the data and information needs of urban planning for socio-economic development. In part three he emphasized that any development planning exercise must be supported by a whole range of information sources and systems. Further government and administrative information systems are described in detail. These articles were useful in understanding role of information in socio-economic development planning.

Information and rural development was discussed by Neelameghan (1998) in another article. According to him information and its communication has three fold purpose viz. to enable them become more productive and efficient in their economic activities; to enhance their capacity to disseminate the valuable native knowledge they possess; and to facilitate reliable village data collection and analysis needed for development planning. He also discussed the scope and issues relating to development information and communication, use of ICT to support rural development, and related policies and strategies.

A recent Information Economy Report of the United Nations focuses the potentials of ICTs to contribute to development, with particular reference to their fight against poverty. It recognises that poverty has an important informational dimension. Poor people often lack access to information that is vital to their lives and livelihoods. Such lack of information adds to the vulnerability of the people concerned. In terms of livelihood strategies, information plays a dual role: (a) informing and strengthening the short-term decision-making capacity of the poor themselves; and (b) informing and strengthening the long-term decision-making capacity of intermediaries that facilitate, assist or represent the poor. Using specific examples from various countries it highlights the thesis that ICT can be used to leverage development.

Mangla (2003) discussed the issues based on the relationship between information systems and national development. He categorically emphasised the role of information in national development by citing examples from South East Asia and especially the Indian scenario. His paper was also found useful to understand the elements of a country’s national information infrastructure, as identified by Atherton, which is the national capability for making information and knowledge accessible for wider uses. Mangla’s views on importance of information in the development planning, inclusion of a separate chapter on information sector in the development plans, and emphasis on consideration of information handling capability as a socio-
economic development indicator, were also helpful in clarifying interplay of information and development.

Martin’s views (1995) facilitated identification of obstacles to the implementation of policies which would help a nation develop fast. He reiterated to exploit the potential of existing channels and incorporate local requirements in design of information systems and strengthening them. The question of why ‘informatization’ is now seen by many emerging nations as the route to overall development is well explained by him.

Several studies focused on the role of ICT in development. Neelameghan in a keynote address discussed at length the applications of ICTs in developing countries (1996). He described how emerging ICTs tend to effect conventional institutional structures, information flow pattern and interactions among individuals and institutions. He emphasized that technologically it was possible to access most of the available information globally, much of which was still under-utilised due to the low level of R & D and the inability of the users to exploit the information.

Rasmussen (2001) stated that ICT and the new global information infrastructure could have both positive and negative impacts on development. It can empower the information have-nots and can also widen the disparities between information haves and have-nots. This paper was found useful as it discussed the ways in which the developing countries could benefit from the information revolution, and also the issues involved in measuring the impact that the use of information makes on development, which Rasmussen termed as “the information effect” and the methods measure it.

Several studies which attempted to measure to and quantify information and development were found to be of great value in clarifying the concepts. The research of Lau, (1988) provides excellent information necessary for understanding the economic and political complexity of social developments and information activities. He assessed the relationship between information growth and social development in 31 countries from 1960 to 1977. Five variables representing the meeting of basic needs of the population, and fifteen variables representing information activities were used as proxies of social and information development at national level. The statistical technique used to analyze these variables was cluster analysis. The results obtained suggest that information development is achieved mainly by countries which have also achieved social development. Therefore, nations with high incomes, but without social development lack information development. Moreover, the results show that the information gap between rich and poor nations i.e. developing and highly developed nations seems to be greater than the social gap. His results also suggested that increased information
development as shown through library indicators is associated with positive change in social development. (Lau, 1990)

Studies from other fields like IT and corporate world, also suggested that better performance occurs when information is effectively used. Strassmann emphasised that the corporate sector should pay attention to information management as a resource of greater economic leverage than any other input. In terms of its value the total costs of information will certainly warrant at least the same concentrated attention as is presently bestowed on capital costs. His works were based on the transformation of work in the electronic age and the use of management productivity as a method for evaluating the business value of computers. (1985, 1990) A relationship between information services and productivity was also reported by Koenig (1990). Gopinath (1998) described the information-knowledge spectrum and the properties of information which lend themselves to econometric studies. He identifies the value analysis of information and suggests further studies that can connect information and productivity.

Vaughan, (1999) attempted to quantitatively measure the contribution of information to business development. For this two studies were carried out in Shanghai, China: one on small businesses and the other on medium-sized businesses. Linear structural relations model was applied in both studies to determine the magnitude of the contribution. Both studies showed that the use of information does contribute positively and in a statistically significant way to business success.

Menou (1985) observed that the rise of the information society calls for quantitative and qualitative measures of information activities at the sub national, national, and international levels, which could help us better understand the issues and make sounder decisions. His article helped to get a review of developments in this direction as they relate to sectoral studies centered around kinds of information, information institutions and services, messages and communication technologies, and to global studies, concerned with the production and consumption of information, social change, information channels, policies and information indexes. An account of efforts in the area of information statistics is also given along with the limitations of the various kinds of measures used. Menou advocated that consistent, comprehensive, and meaningful information measures need to be compiled regularly, evaluated, and upgraded to properly monitor, interpret, and control the far reaching changes taking place nationally and internationally. (1985)

Godin’s paper (2008) analyzes the history of the concept of information and its role in public discourses about the economy and society through the lens of statistics. It argues that the preoccupation with the growth and management of scientific publications was the first step toward the construction of the concept of information economy. Over history, the concept evolved from an understanding of information as knowledge, to information as commodity or industrial activity, then information as technology. An international organization; the OECD, is discussed as emblematic of the conceptual and statistical work conducted on information over the period 1949 to 2005.
2.3. INFORMATION SOCIETY

The role of information and knowledge in the society was aptly emphasized by Parekh (2003). She reiterated that both have conventionally supported and underpinned all developments be they social, economic, scientific or technical. It was rightly mentioned that they were and are part of the “intellectual infrastructure” of society. Her article helped in understanding the concept of information and its role in the society.

The survey of literature on information society revealed that this concept is equally popular amongst futurologists and academia. It has also attracted numerous institutional efforts and government initiatives at various levels. The World Information Report-1997-98 by UNESCO had a useful chapter on Information Society. In it Moore (1997) discussed the origins and causes, characteristics of information society along with its impact on employment, methodological issues such as definitional problems and measurement of information society, emergence of information industries, and policy framework. This chapter proved to be a primary reading on the concept.

Equally informative and handy is the information society course book by Karvalics (2007). This work is referred extensively in the present study to explain various facets of information society such as the origin of the term information society, its evolution, various other terms used to denote this concept and their connotations, chronology of information society attainment by various nations, definitions and models of information society. He also provided a thoughtful insight into the controversy of using the term “knowledge society” instead of information society, relation between the two, and rational for choosing information society as an umbrella term.

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. (Neelameghan, 1999, p.110) Works of Toffler (1980) and Naisbett (1982) Daniel Bell (1980) and Cronin (1986) also proved as the basic readings which helped to understand the fundamental issues of information society. The five important dimensions of the concept of post-industrial society, on the basis of which the framework of information society is built upon, were taken from Bell’s Social Framework of the Information Society (1980). Cronin’s definition based on intellectualized labour has been cited in the present study to emphasis importance of information based intellect which is an important characteristic of the information society. Similarly a definition from the eEurpoe initiative to develop the statistical indicators for benchmarking information society is also referred to as an institutional effort in this direction.
Martin’s classics (1988, & 1995) on information society gave an authentic definition which helped broaden the focus from merely technological or economic aspects and portray the information society as society. The major trends and inter-relationship between information, information and communication technologies, and the global economy and society have been traced along with the direction of information based change by Martin (1995). The implications for ordinary citizens, the quality of everyday life, economic and social life were revealed. The prospects of nations and trading blocs based on the development of the global information society were examined by him. This work was found useful as it suggested the criteria of information society.

Carrasco and Vanderkast (1998) Discussed important changes the society has undergone. Advances in computers, ICT, and progress made in information science are mentioned as change agents. Issues such as globalization, information society, its elements and various definitions along with role of information professional are discussed at length.

In order to comprehend categories of information workers, the classification given by Porat (1977) was helpful. He outlined four principle categories of information workers based on their contribution in the information society. His definition of information and knowledge helped confirming that information, and access to it, should be regarded as the main source of potential benefits. This also helped in the much discussed issue of an “information society” versus a “knowledge society” and the conceptual dilemma between the two

Neelamegham (1999) also discussed this issue and opined that for sustained development, it is not a question of information or knowledge; both are required. First part of his article series on Information Economy and Knowledge Society was based on definitions and indicators, the second part covered international and national aspects of information access, and the third part discussed economic and policy aspects of information economy and knowledge society. According to Neelamegham human survival and development and hence 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. (1999, p.108) He included landmarks such as oral communication, markings on rocks, caves walls, papyrus, paper and printing, films, telegraph, telephone, xerography and electronic valve, transistor and microchip in the information and communication axis (p.108)

Mukherjee (2008) has explored infostate framework for measuring information societies in developing countries and argued that this risks giving policymakers a false sense of clarity when shaping poverty reduction policies in developing countries. He further suggested a thorough critical study of a wider set of frameworks used for policymaking. Boucas (2008) identified an empirical gap in the examination and analysis of the information society in semi-peripheral and middle income countries, and discussed the evolving characteristics and forms of the Greek case as the Information Society (IS) Drawing on historical sociology he emphasised that historically developed relationship between the state, the national economy and the society interacts with global Information Society processes, and creates differentiated national IS outcomes.
2.4 THE INDIAN SCENARIO

Several articles describe the Indian scenario particularly in terms of ICT and development. Some of them were general and provided an overall picture. The concept of information society, its origin, definition, global scenario of transformation into information society, its impact on information professionals and socio-economic system are discussed by Baruah (2001). The Indian scenario along with data and applications is also described in the article which helped in getting a clear picture of information society in India. Srivastava (1991) and Dasgupta, (2000) have also deliberated on implications of information society in India. The role of information as a key resource in the society is highlighted by Husain (1998) Discussing the concept of information superhighway, its impact in the present day society is also discussed. The author stressed on the implementation of National Information Policy in Indian context.

Neelameghan (1995) discussed the IT and telecommunication scenario in India and the opportunity offered by the international market. In order to tap this expanding market, he conceptualized user education exercises and Informacy programme at various levels leading to developing information oriented culture in the society. According to him every individual collects, processes, generates, communicates, receives and uses information. These natural abilities of every person must be cultivated, refined and fine-tuned from early childhood so that the person fits in and contributes to a sustainable information society. Such transformation of the human being may be termed as Informacy (made up of literacy and numeracy)

Lahiri (1996) surveyed information market scenario in India and found that the path on information flow from the generators to the end users, was complex and there were hurdles on that path. Due to low demand the creation of an elaborate information resources base and a service system were discouraged and lack of facilities on the other hand restricted strengthening of the demand force. This was typically the early stage of development of an information market. All the players of these market- information providers, promoters, intermediaries and end users have to work in unison and generate enough thrust to develop this market. This article proved to be a helpful background reading on various aspects such as the growth of public funded information systems, private enterprises, data networks, international linkages, transformation of the book trade, endeavours in business and commercial information provision, market dynamics, Indian database ventures, Online services, commercialization of public funded and supported information activities etc.

National Research Professor Yash Pal (1995) spoke on the importance of information and technology and need to go beyond both. He described how village children in Rajasthan were interested in camel drawn mobile library, and how each village in Kerala has a library. On the other hand in Bihar an unused collection of a college library was also a reality in our country. He stressed that a complete change in outlook, in philosophy of handling and using information needed to be brought forth. The
third wave as noted by Toffler is in the scene. The world needed a new agenda. He urged the librarians and information professionals to take up a neo-Gandhian attitude and look beyond information, towards a humane use of all the technical facilities available.

A review of ICT in India was reported by Raghavan, and Seetharama, (1997). They have reported proceedings of the symposium on 50 Years of Information Technology in India which was held at Chennai. Three vital aspects affecting the nation, namely, education, health and environment and the role of IT in these sectors formed the major foci of the symposium. The strategies needed to be adopted for effective and efficient utilization of IT in all these sectors have been outlined which provided a useful reading.

Vijaykumar, (1997) discussed developments in the Indian telecom sector and its implications for libraries and information centres. He emphasized that achievements and landmarks of the telecommunication sector in India are worth taking note of and are influencing LIS sector in such a way that better services could be provided. This article was helpful to understand Indian telecom sector developments. Farzana (2007) deliberated on various indicators of telecommunications and information sector in India for socio economic development and made projections for future.

Maity (2010) argued that measurement of the proportion of newspaper information generation in India to its consumption might help to establish an indicator for newspaper communication flow in Indian context. He attempted to measure the quantity of both newspaper information generation and consumption, and uncovered the ratio between these two. Based on his findings he inferred that the communication flow of newspaper information indicates a state of information overload and that a newspaper information retrieval system was much needed.

Sources of information for farmers of Karnataka were listed by Biradar (2000). He studied rural libraries in the region and noted opinion of the farmers. According to him major sources of information are radio, newspaper, television, library, films, leaflets and brochures. Other sources included friends, neighbours, relatives gramsevakas, and agriculture extension officers. This article reiterated our list of traditional sources of information and its importance in the lives of Indian citizens.

The government of India recognised the need to consider IT as an agent of social transformation. As the first step in this direction it created a national task force on IT and software development. This task force submitted an action plan in July 1998. The action plan arising from the report comprised of 108 Action Points at three basic objectives of Info-Infrastructure Drive, Target ITEX-50 and IT for All by 2008.

Several specific examples of experiments using ICT to develop village level information infrastructure are available. Balaji, Rajamohan, Pandy, and Senthilkumaran (2000) described the Information Village experiment launched by M S Swaminathan Research Foundation (MSSRF) in January 1998 in the
Pondicherry region of India to determine the manner in which information use and ICT made an impact on rural livelihood. This experiment drew world attention and indicated that it is possible to develop a technology-based information system for the benefit of rural families. This article was useful in providing an impetus to the present study in emphasizing the importance of information in everyday life of citizens.

The rational and justification for a similar experiment of TARAhaat COM: an Internet-enabled rural market place reported by Khosla (2000) proved to be an inspiring reading as it highlighted how new technologies could be employed to develop rural markets. Technology and Action for Rural Advancement (TARA) is a not for profit business that markets environmentally sound technologies for livelihoods and basic needs. Haat is a village market-fair, a bazaar, held periodically in all rural areas of India. TARAhaat is a window to the world connecting to local and national resources, access to worldwide information, to health services, weather forecast service, land ownership certificate, monitor food grain prices, offer career counselling, admission forms, educational opportunities, distance learning courses, job options, entertainment, etc. This proves how flow of information through use of IT could transform life in rural India.

SECTION B: REVIEW OF LITERATURE ON METHODOLOGY

2.5 INDEXES AND THEIR CONSTRUCTION

Initially to clarify terms such as index and indicator various dictionaries and online sources were consulted. The Online Dictionary of the Social Sciences and the OECD Glossary of Statistical Terms were found very handy. An Index is heavily used in the financial, commodities or any other such markets to give information about the price movements of its products for which examples of Nifty and SENSEX were used. This information was retrieved from http://www.nseindia.com/


The above sources particularly Saisana and Tarantola, (2002) and OECD (2005) provided a very clear picture of the different methods - both statistical and non statistical - used to compile an index; they were of great use in the actual construction of the index. Various indexes have used these methods. These include the Information and Communication Technologies index by Fagerberg, J., (2001). Innovation Scoreboard of DG Enterprise, (2001) Environmental Sustainability Index by World Economic Forum (2001). They provided helpful examples on methodological issues.
A paper by Saltelli, Nardo, Saisana, and Tarantola, (2004) presented an example of how Composite Indicators ‘naturally’ emerge in a context where country performance is being benchmarked and some salient aspect of the composite indicators controversy, pitting “Aggregators” and “Non-Aggregators against one another, and showing pros and cons to the use of composite indicators are discussed. Some examples of JRC experience in the quest for a methodology for ensuring quality of composite indicators including the use of uncertainty and sensitivity analysis was offered. Finally two crucial issues in composite indicator building such as correlation and compensability, which have not received the necessary attention had been analysed.

An EU document (2005) on Tools for Composite Indicators Building reviews the steps involved in a composite indicator’s construction process and discusses the common pitfalls to be avoided. The need for multivariate analysis prior to the aggregation of the individual indicators is stressed. The problem of missing data and the techniques used to bring into a common unit the indicators that are of very different nature is dealt. Different methodologies for weighting and aggregating indicators into a composite are explored and test of the robustness of the composite using uncertainty and sensitivity analysis is done Finally it is shown how the same information that is communicated by the composite indicator can be presented in very different ways and how this can influence the policy message.

Muldur argues that since the concepts to be measured cannot be represented by a single indicator, it was necessary to use statistical methods such as multiple linear regression analysis, principal component analysis and factor analysis. Indexes which use these methods are Internal Market Index (DG MARKT, 2001), and Science and Technology Indicator by National Institute of Science and Technology Policy, (1995).

Another method namely Cronbach Alpha has been utilized in the index of “Success of software process improvement” (Emam, Goldenson, McCurley and Herbsleb., 1998).

In the non statistical methods performance and target oriented method of efficiency frontier is found to be extremely economical as regards to the weighting, because it lets the data decide on the weighting issue (Storrie and Bjurek, 2000). Using the distance from target method “Environmental Policy Performance Indicator” was developed by Adriaanse, in 1993 and in 1990 Human Development Index by UNDP was also based on goalposts. Detlof and Edwards point out the difficulties in using opinion based methods. Since opinions diverge, it is essential to bring together experts who have a wide spectrum of knowledge, experience and concerns, so as to ensure that a proper weighting system is found for a given application (1986). The above cited literature was useful in helping the researcher to decide which method could be used in the present study.

Salzman (2003) raised the methodological issues associated with index construction and commented that they have often been neglected or inadequately treated by index developers. The paper provided a comprehensive review of the methodological choices involved in the construction of indexes of economic and social well-being and the implications of the choices for the properties of the index. It
also addresses issues related to the choice of functional form of variables, scaling issues, the aggregation operations, weighting schemes, and the choice between single and complementary composite indexes.

The identification and selection of indicators is an important issue. UNESCO series of papers in the social science deals with various issues. One such paper (1974) explores the problem of definition and selection of social indicators whether of development on which it hinges or of the indicators themselves with which it deals. It was in the context of the UNESCO project on human resources indicators.

2.6 VARIOUS INDEXES

A large number of indexes were referred to during the course of the study. Some of them have been directly used in the present research while others have been helpful in developing a better understanding and insight into indexes, their construction and use.

The World Development Reports, the HDRs, the National Human Development Report-2001 and Gujarat HDR-2004 attempted to measure development. These have been directly used in the present study and have been described in greater detail in a subsequent chapter. The Human Development Index was one of the first indexes referred to by the researcher and was better understood by referring to some other supplementary documents.

Based on the Human Development Index an indexing exercise workshop was held in Colombo. As a result of that workshop a simple exercise was developed and has been published as “Cracking the HDI: Human Development Indexing Exercise” by Asia Pacific Regional HDR Initiative. (2005). The indexing exercise divided in three sections, aims to demystify the principles and calculations in indexing, and demonstrates that indexing is a simple idea and the actual steps can be mastered by anyone. Section one is about measuring human development, Section two contains an exercise based on data for three imaginary countries and Section three provides the solutions. This document helped in understanding the HDR clearly.

Since first global Human Development Report was published in 1990, more than 600 regional, national and sub-national human development reports (HDRs) have been launched by 143 countries. Sound statistical analysis provides the foundation for all work supported by the United Nations Development Programme (UNDP), the UN family and its partners. Hence in order to provide a timely set of guidelines and tool to support empirically based research and analysis ‘Measuring Human Development: A Primer’ was introduced by UNDP in 2007. The primer is intended to strengthen the efforts of HDR teams, as well as other practitioners working together to achieve the Millennium Development Goals (MDGs), human rights and broader human development objectives.
There are several indexes which seek to measure technology. The Technology Achievement Index was published as a part of Human Development Report in 2001, The Global Information Technology Report: Readiness for the Networked World 2007-08 by World Economic Forum, The Digital Opportunity Index 2007 developed as a result of an action plan of the World Summit on the Information Society, and the India: e-Readiness Assessment Report for States and Union Territories 2006 by NCEAR. These have been directly used in the present study and are described in detail in chapter 5.

Several other attempts to measure ICT were identified. An OECD study on ICT and economic growth was carried out in Spain using new sectoral data on investment and capital services in 1985-2002. The contribution to output and labour productivity, growth of employment, non-ICT and ICT capital, labour qualifications and Total Factor Productivity were calculated. Results are given for 29 different branches; individually and grouped into four clusters according to their ICT use intensity. Three ICT assets (hardware, communications and software) were considered. It was found that although the ICT intensive group appeared to be the most dynamic cluster, most of the impact on productivity was still to come. There was some evidence of a reversal of the productivity slow down of the nineties starting in the year 2000.

Another OECD (2006) paper presented a revised OECD model survey on information and communication technology (ICT) use by businesses. The model survey was intended to provide guidance for the collection of statistics on business use of ICT, including e-business and e-commerce. A similar OECD (2005) model survey on information and communication technology (ICT) use by households and individuals was intended to provide guidance for the collection of statistics on household access to ICT, including broadband access to the Internet and use of ICT by adults.

In an article by Purbo (2005) a community based unsupported activity by the Institute of Technology in Bandung, Indonesia was described. In the initial stages several schools in Bandung city were linked using a slow 1200bps packet radio technology running on Very High Frequency (VHF) band, with no financial support from the government, the World Bank or the IMF. This became Indonesia’s initial largest pre-Internet network installation. He has documented the path and experiences in facilitating a community movement to build its own infrastructure from VHF to WiFi.

A core set of ICT indicators was published by International Telecommunication Union (ITU) in 2010. An earlier edition of Core ICT Indicators had been released during the Tunis phase of the World Summit on the Information Society in late 2005. It followed an intensive consultation process between statistical agencies and policy-makers that was facilitated by members of the Partnership on Measuring ICT for Development. Like the 2005 edition, the 2010 edition provides definitions, model questions and other statistical standards relating to the core list of ICT indicators. In addition, advice is provided on significant statistical issues associated with each indicator. Considerable experience with the collection and compilation of the core indicators since 2005 has resulted in new recommendations on how to report core ICT indicator data.
One of the many challenges facing the countries in the Asia-Pacific region today is preparing their societies and governments for globalization and the information and communication revolution. Policy-makers, business executives, NGO activists, academics, and ordinary citizens are increasingly concerned with the need to make their societies competitive in the emergent information economy. The e-ASEAN Task Force and the UNDP Asia Pacific Development Information Programme (UNDP-APDIP) share the belief that with enabling information and communication technologies (ICTs), countries can face the challenge of the information age. With ICTs they can leap forth to higher levels of social, economic and political development. In order to help policy and decision-makers, planners, researchers, development practitioners, opinion-makers, and others a series of e-primers on the information economy, society, and polity has been launched. The e-primers aim to provide readers with a clear understanding of the various terminologies, definitions, trends, and issues associated with the information age.

The Information Technology Annual Report for the year 2006-2007 was published by the Department of Information Technology, Ministry of Communication and Information Technology, Government of India. It reported Indian Information Technology – Business Process Outsourcing (IT-BPO) growth, including the growth of software and ITES exports from India.

Shifting focus from technology to information and information society several reports and indexes are also used directly in this study. These include World Information Report 1997-98, World Communication and Information Report 1999-2000, Johoka Index, European Union Initiatives 2001 to 2010, Information Society Index 2006, The Knowledge Index, and The Knowledge Economy Index 2008 and are described in detail in a subsequent chapter.

In a paper related to KEI a few fundamental questions have been raised by Saisana and Munda (2008) in Joint Research Centre Scientific and Technical Report. Five main research questions are raised. These are 1. Is it possible to measure the knowledge economy? 2. What are the drivers of the knowledge economy? 3. How does knowledge economy relate to other complex dimensions? 4. Is it possible to reduce the total number of individual indicators of KEI conceptual framework without loosing any relevant information? and 5. Are rankings useful at all for deriving policy suggestions? A multi-modelling approach was applied to weight and further aggregate the sub dimensions scores into dimensions and finally into a composite indicator.

An interesting paper for LIS professional, though not entirely relevant to the present study, by UNESCO (2008) provides a list of potential international indicators for information supply, access and supporting skills. A conceptual framework for the identification of indicators of Information Literacy (IL) is developed. The paper includes definition of IL; a model that links information literacy with other adult competencies including Information and Communication Technology (ICT) skills; and a
description of IL standards in education. Issues of IL equality and the implications for cultural diversity are identified.

In a conference held at Budapest in October 2000, Eurostat, the statistical office of the European Communities, presented a set of statistical indicators of the information society. It defined each indicator along with a definition of data required and plan of action to be implemented.

A UNESCO (2003) Publications “Measuring and monitoring the information and knowledge societies: a statistical challenge” prepared for the World Summit on the Information Society summarized some of the most worrying questions in the field of information and knowledge societies and helped participants to take measure of the upheavals brought about by the emergence of the new information and communication technologies. It dealt with the potential for development, the difficulties encountered, possible solutions, and described the various projects implemented by UNESCO and its many partners.

Various heads of State and Government approved a Plan of Action during the first phase of the World Summit on the Information Society (WSIS), which was held in Geneva from 10 to 12 December 2003. Among other things, the Plan of Action requested that all countries and regions develop tools to provide statistical information capable of measuring progress made towards the information societies. In addition, the Plan stipulated that priority be given to establishing coherent and internationally comparable indicator systems, taking into account different levels of development. In recognition of the need for improved data and indicators on the information society, a global initiative entitled Partnership on Measuring ICT for Development, was launched during the eleventh United Nations Conference on Trade and Development (UNCTAD XI) which was held in Sao Paulo, Brazil, from 13 to 18 June 2004.

In keeping with these directions the Economic and Social Council for the West Asian Region (ESCWA) published a document (2005) to facilitate evidence-based policy-making aimed at building an information society. The guidelines illustrated the issue of defining and using indicators, provided several examples of ICT-based indicator development exercises, reviewed suggested indicators for the ESCWA region, and proposed core ICT indicators. This document helped in identifying indicators for the present study.

The United Nations Conference on Trade and Development (UNCTAD) which was also a founding member of the global Partnership developed a core of ICT indicators for the production of internationally comparable statistics; this was endorsed by the United Nations Statistical Commission in March 2007. The UN Statistical Commission encouraged countries to use that list in their data collection programmes and a first version of the Manual for the Production of Statistics on the Information Economy was published at the end of 2007. UNCTAD prepared this Manual to guide statisticians from developing countries in all steps involved in the production and dissemination of
business ICT statistics. To reflect the evolving nature of many ICTs, the core list of ICT indicators was revised in late 2008.

OECD’s Guide to Measuring the Information Society documents the statistical work of the Working Party on Indicators for the Information Society (WPIIS) and related work being done in the OECD and elsewhere. The Guide is a standard reference for statisticians and others working in this field. In particular, the Guide assist newly participating countries to start or further develop information society measurement programmes. The 2009 revision of the Guide reflects changes in the field of information society measurement since the first edition was released in 2005. The most significant revisions are to information economy classifications, reflecting the considerable changes in that area that occurred between 2006 and 2009.

The Global Information Society: A Statistical View is a UN document (2008) which uses information and communication technology statistics to provide a view of the information society in both developed and developing economies. As well as presenting available statistics, this publication assessed progress in measuring the information society by exploring the data gaps that remained. It observed that availability of data for core indicators for developed economies is good and improving for some developing economies; for most of the core indicators, data availability in the developing world is limited. In addition, more work is required by most countries that already collect core indicators to better align their statistical programmes with the requirements of the core indicators in order to improve the international comparability of ICT statistics.

Several other indexes and papers which sought to measure related issues were also referred to. Quantification of scientific progress has not been done systematically in India although it is measured and monitored rigorously by many advanced nations. First India Science Report, based on a custom-designed survey, the India Science Survey 2004, funded by INSA, was conducted by the NCAER to provide reliable data and statistics needed to measure the impact of S&T on development. This document helped in understanding S&T scenario in India.

Based on the data of India Science Report a NCAER project aimed to extend EU’s analytic framework of public attitudes so that it is adequate to both developing (India and parts of new EU and EU candidate countries) as well as developed contexts (EU15). The project addressed the issue of public understanding of science which is increasingly recognised to play a role in R&D policy making, as it expresses the national aspirations with regard to science and technology.

NISTADS undertook a study of scientific productivity for the Department of Scientific and Industrial Research in 1998 using the bibliometric assessment approach. The results of this study reported in Information Today and Tomorrow of (1999) makes interesting reading. It presents desegregated data for Indian technical papers by states, disciplines and sectors. In another paper in the same journal Lahiri
Gopika Kannan proposed to create a National Knowledge Index (NKI) as an attempt to measure India’s performance as a knowledge economy and to provide decision support for growth and government policy making. This index was meant to be a support tool and by product of the National Knowledge Commission which would facilitate the establishment of actionable goals and national growth policies. No document was found which supported NKC’s involvement in the project or whether the proposal materialised or not.

In “The Knoware Tree and the Regional Intellectual Capital Index: An assessment within Italy” (Schiuma, Lerro, and Carlucci, 2008) investigated the relevance of intellectual capital (IC) as a strategic resource and source of regional value creation dynamics. Adopting a knowledge-based approach, the authors argued that knowledge assets represent the IC’s components, and proposed the Knoware Tree and the Knoware Dashboard as frameworks to assess the IC within regions. For the global assessment of the IC, the Regional Intellectual Capital Index (RICI) was suggested and its application proposed for the assessment of IC within Italian regions.

Though not directly useful, they are listed below:

▪ The Composite Learning Index (CLI) developed by the Canadian Council on Learning (CCL) in 2006.


▪ The Water Poverty Index (WPI) designed by Sullivan in 2005

▪ Education Indicators: Technical guidelines by UNESCO in 2009

▪ Indices of social vulnerability to natural hazards: a comparative evaluation by Gall in 2007

2.7 STATISTICAL SOURCES

A major effort in the present study went towards collecting reliable up-to-date data on the identified indicators. Since governments are the main sources of such wide scale data, publications of various ministries and departments of the central and state government needed to be identified. In India, Statistical agencies responsible for collection, processing and dissemination of socio-economic statistics in a decentralised set up, release data mostly in the form of serials and reports. (Goswami, 1998 & 2000) Proper and easy access to data depends on factors such as release of users’ guides, methodological handbooks, timeliness in release of data, provision of access to unpublished data and
use of electronic media for data dissemination. He describes in brief the serials and ad-hoc publications compiled by government statistical agencies in India. A small write up by Lahiri (1996) and the team of Information Today & Tomorrow which reported findings of a study by the Institute of Social Analysis and Communication gave insight into information available with government departments in India.

It is not possible to mention the large number of reports identified, scrutinized and rejected either because they did not contain the data, or the data was very old, the data was not segregated or was not in a usable form. Data on some indicators was located in more than one source. In such a case the researcher had to locate the most recent and reliable source of data and recheck it with various sources. In the final analysis the following data sources were used.

- Selected Educational Statistics for 2005-2006
- Projected population data for the year 2005.

The definitions and calculation methods used by these sources have been explained at the point of use in a subsequent chapter.

**2.8 RESEARCH METHODS AND STYLE MANUAL**

Throughout the study reference had to be made to certain standard books on research methods and statistical techniques. These included Busha and Harter's (1980) Research Methods in Librarianship: Techniques and Interpretations, Krishna Kumar’s (1999) Research Methods in Library and Information Science etc. For the Delphi technique works of Dalkey and Helmer (1963) and (Dalkey, 1972) were used. Miller’s paper (2006) on this technique was also used in the study.

Statistical Concepts by Brown, Amos, and Mink (1975) was fundamental in understanding the statistical concepts. Further techniques like Unitization and Scaling, Normalisation and Correlation were also employed in data processing. For the background reading on these techniques works of Chen and Dahlman, (2005) and a few online sources were used. An article on statistical methods in information science research by Kinnucan, Nelson and Allen (1987) was also found to be useful.

For writing the research reports several style manuals are available. In the present the APA style manual is consistently followed.
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