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ICT as Tool for Information, Knowledge Management and Intelligence[1]

S.D. Sharma
Director, Indian Agricultural Statistics Research Institute, New Delhi

PROLOGUE

I feel greatly honoured to have been elected by the members of the Indian Society of Agricultural Statistics as the Sessional President for the 59th Session of Annual Conference of the Society and giving me an opportunity to deliver the Technical Address during the conference. I feel greatly obliged by this kind gesture. As a topic for the technical address to this august gathering I have chosen to speak on the Information and Communication Technology (ICT) as a tool for building up competitive intelligence in this era of global competition.

1. INTRODUCTION

Information is a key to the progress and development of the mankind. Right information at the right time is an essential ingredient of good planning and the decision support systems. More informed we are, better decisions we are likely to make. Information about the geography of a country, the geographical and natural resources available, the mineral resources, the manpower resources, the agricultural resources besides of course, the quality of these resources, the information about the political system, the population composition of various social groups, understanding the voting behaviour in elections and so on, are often needed for understanding the inherent problems of national development. The criticality of the right information is equally crucial for scientific development, in any area of research. Further, the primary objective of optimal resource allocation in any endeavour, for example, the manpower deployment, budget allocation and so on, can be adequately addressed only through obtaining the right information in the right context at the right time. Thus gathering information has always been an important pursuit of the mankind. Collecting information, storing, analyzing and dissemination of information has been witnessed as a major human effort in the history of mankind. Statistical systems have been developed for collecting, summarizing and analyzing quantitative information for drawing meaningful inferences. Library systems have been developed to fulfill the needs for storage, sharing and communication of information. The information has to be processed and analyzed to be really meaningful and one can say that the analyzed information leads to knowledge. I should emphasize that information as such may not constitute knowledge. Whereas Information can be dealt within fragments and the compilation of these fragments, the Knowledge, on the other hand, provides us with models, hypotheses, principles and laws derived from the analyzed information. A knowledge-society should have adequate means of accessing and employing the knowledge for its routine necessities. Knowledge management has therefore become very important in this modern age. Given that the intelligence is the capacity to apprehend facts and propositions along with their relations and to be able to reason about them, one can go a step further and say that an intelligent accumulation of the knowledge leads to wisdom and obviously we need more wise people and a wise society. Moreover, the communication and sharing of information and the knowledge is equally important and one can say that Information together with adequate means of communication has been a major pillar on which the human development stands. In the quest for the means of sharing information among themselves, the human beings have gradually developed the skills of communication, developing sign language in the primitive ages, then the oral language and ultimately the written script of the languages. Consequently they were increasingly able to share the experiences of one another for better social affinity and in the process enhanced learning of newer information

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and became more knowledgeable and wiser. Thus, the knowledge and intelligence of human beings is primarily due to the development of excellent communication abilities.

Storing information has always been one of the major problems of mankind since ages. Often the information gathered was lost and forgotten over time and space and the same had to be re-discovered in the latter periods of human development. Attempts for documenting the information have been made through primitive writings on the rocks, rock paintings, clay tablets, leaf writings and inventing paper for writing books recording the information for sharing with other people and posterity. Further, in order to compress the increasing volume of available information, the techniques for expressing information in very concise and summarized form were developed. Especially, the quantified information provided a precise and concise description of the information. Numerically expressed information was referred to as **data** and the tabulations and compilation of these data along with various arithmetical and logical operations led to the concept of **data processing** leading to the development of statistical science methodology along with development of various computing devices. Calculating machines and automatic computers were developed to ease these operations to a great extent. The digital automatic computers carried out electronic data processing, handling the data and data processing through electronic computers. The electronic data processing, gradually, gave way to information processing which included besides data, the handling of written text, graphical images, video clips and sound files as well. In fact the increasing capacity for information processing helped in spreading the computer culture and in combination with certain other factors such as cost reduction; greater processing power etc. resulted in an explosion of information. The computers have revolutionized the life of a common person and left an indelible mark on the growth of mankind.

At the same time, newer developments taking place in the communication technology led to its convergence with the information technology and enabled Information Technology (IT) to move beyond the information processing prowess of computers. The ability to communicate among remotely located computers added to the growth of information base through computer networks. The major credit for current information revolution goes to information technology, communication technology and computer networking technology convergence. Information technology–information processing, the communication technology–information transmission and the emerging modes of audio/ video/ data transmission technology as switched data packets, through common means of communication, have converged into what is now known as **Information Communication Technology (ICT)**. Consequently, a component of data transportation has been integrated with data collection and data processing components. Further, due to wide spread demand of computer related equipments and the consequent spurt in large scale production of these equipments, the equipment prices have come down considerably while at the same time processing power and the functionalities have grown exponentially. Thus, more powerful technology became available at affordable rates within then reach of the masses.

In recent past, India has made substantial progress in information technology in general and software development in particular. Indian software products and services is the fastest growing economic sector in the country with turnover of Information Technology (IT) segment in 2000-01 estimated to be around Rs. 40,200 crore, out of which almost three-fourth is exported. Share of IT services sector has gone up to 2.9% of Gross Domestic Product (GDP) in 2001-02 from 2.8% in 2000-01. The export revenue from IT software and services of Rs. 36,855 crore during 2001-02 is estimated to have grown by nearly 30% over the export revenue of Rs. 28,350 crore during 2000-01. By the year 2008, the Government of India is targeting the growth of this export by eight times with the share of IT software export alone being around 35% (NASSCOM report). Such seemingly stiff targets are considered, easily achievable in view of the abundant English speaking and skilled Indian software talent available in the country.

2. ICT FOR RESEARCH AND DEVELOPMENT

Computers have been used for statistical processing of data since long. Processing and analysis of data involves handling massive data for cross tabulations and carrying out complicated computations which consumes considerable amount of time thereby delaying the availability of results. With the availability of statistical software packages, the drudgery of computational labor has been eliminated reducing the time lag in publication of results. Moreover, multivariate statistical techniques

are often complex and so computation intensive that researchers shy away from using these powerful and logically correct techniques on the plea that data analysis would consume lot of time. It has thus become possible to use highly computing intensive techniques for data analysis, which were not being used earlier. The graphic visualization of data has become possible which can be used in adopting exploratory data analysis techniques. Many model validation tests can be run on the analytical results obtained under one set of conditions in order to see as to what extent the results could be in error given the actual departure from those assumptions. Sample surveys involve collection of very large data set based on the filled-in schedules on large number of characteristics of ultimate sampling units and those of higher aggregated clusters of these units. Often the probability sampling schemes are used in sample selection requiring generation of weights at various stages of sampling for building up aggregated estimates. For compilation and tabulation of large-scale survey data as well as for compilation of Census data, making cross-classified tables and applying statistical functions and procedures, computers have become very handy, reducing the time over-runs. Thus, IT is playing very significant role in applying appropriate research methodology in scientific investigations.

Statistics, as a science for studying the techniques for collection, compilation and analysis of data and drawing inferences from the given data set, provides tools for extraction of information from the data, the data itself being viewed as numerically expressed facts obtained in a given field of enquiry. If a given statistic, as a function of sample observations, is sufficient for estimating a given parameter, it captures all the relevant information from the sample data for that parameter. Since storing huge data from samples was not possible, the methodology aimed at reducing the sample data to a set of sufficient statistics so that we can replace entire data set with few values of the sufficient statistics. Availability of very powerful computers with huge storage spaces has reduced the necessity to some extent for such summary statistics. Since the computers of the older generations were able to handle the processing of numerical data only, these computers were also classified as electronic data processing (EDP) devices. On the contrary, the modern computers can process the information of every kind, be it in the form of numerical data, categorical data, qualitative attributes or even the textual information, geographic information, maps, colors, patterns, opinions, graphic images, video clips, sound files etc. Information thus transcends the data boundaries and renders the concept of sufficiency, in this sense, less relevant. There is no pressing need for data reduction and data summarization. Instead one can create a data warehouse (DW) for storing huge mass of data and using techniques for extraction and on-line analytical processing (OLAP) coupled with data mining tools one can draw quite meaningful inferences from such a data warehouse. Statisticians and computer scientists have made much progress in this field and software packages are available for creation of data warehouse and application of data mining tools.

Grid computing has opened new avenues for hiring the computing power required for a given problem from the computing power available on the computer grid networks across the globe utilizing the idle computing power of the machines which subscribe to that grid network.

IT has seen another important development for communication and dissemination in terms of the world-wide-web (www). It provides a very powerful and convenient delivery mechanism for reaching the un-reached at very affordable costs. It can be used as a very convenient tool for extension of technologies to the field. It offers a new mode of distance education for learning through the internet resources or the e-Learning. The virtual university possibilities with teaching material on the web and digital library networks provide interesting alternatives to the physical universities and the physical libraries. One can study any course at ones' own leisure and convenience sitting anywhere in the world and at ones' own pace of learning.

3. ICT IN AGRICULTURE

Since ages, agriculture has played a very prominent role in Indian economy. Numerous references to crop cultivation, animal husbandry (especially cattle rearing) practices, and rituals associated with these, can be found in ancient scriptures and these essentially form the core of Indian culture. Wide spread cultivation of crops through the length and breadth of the country, evolved over a long period of time, refining techniques and practices for cultivation, irrigation methods, implements and tools, building granary/ storage structures, developing transportation carts organizing village

markets, rearing domesticated cattle primarily for milk, cow-dung as fuel and draft power, are testimony to the wisdom and creativity of the ancient farm-men. However, it is a fact that Indian Agriculture remained a subsistence agriculture with farmers producing just enough to survive, often falling back on the livestock for supplementation in difficult times. Rain dependent agriculture, famine and scarcity have been the order of the day. India's independence in 1947, however, changed the scenario. Even though, agriculture continues to be the backbone of the Indian economy and source of livelihood, contributing about 23% to GDP and providing employment to about 58% of the people, the Green Revolution starting in 1967-68, brought about a quantum jump in food-grain production from 51 million tons (Mt) in 1949-50 to 212 Mt in 2003-04, mostly through increasing productivity using high yielding varieties.

The Green Revolution was followed by sustained efforts in agricultural research over next few decades, resulting thereby considerable increase in production of food grains. The Cooperative movement in Gujarat helped in consolidating gains to the small cattle rearing villagers giving boost to milk production considerably, touching a production of about 85 Mt by 2001-02 and consequently termed as a 'White Revolution'. Technological Mission on Oilseeds brought about 'Yellow Revolution', providing near self-sufficiency in vegetable oils. India witnessed a 'Blue Revolution' with fish production increasing several folds reaching about 6 Mt by 2001-02. Similar growth was achieved in vegetable and fruit production, consequently, India becoming second largest producer in the world, next only to China. National Agricultural Research System (NARS) in India, guided by Indian Council of Agricultural Research (ICAR) providing the refined location specific technologies has a major role in such developments and growth through development of human resources, management packages and closely working with government departments, policy makers, finance and marketing institutions. The objectives as enunciated by ICAR for the role of ICT in agriculture are the following:

- To put information close to the managers, scientists, teachers and extension workers
- To improve the capacity of researchers, teachers and extension specialists to organize, store, retrieve and exchange information
- To evolve mechanism of information sharing
- To improve the capacity to plan, monitor and evaluate research and extension programs
- To strengthen national libraries and library's network through electronic access
- To develop databases for easy access and data based decision making, avoiding accidental duplication

Need for agricultural databases cannot be over emphasized. Since agriculture has a very wide span of activities spreading over crop variety development programs, recommended set of cultural practices, plant protection practices against insects, pest and diseases, water availability and management, soil characterizations, farm implements and tools, livestock species, horticultural crops, plantation crops, agro-forestry, socio-economic characteristics of farmers etc. there is a need for an integrated database which may be called as data-bank or a data warehouse. There is a need for applying on line analytical processing (OLAP) tools on these integrated data providing a multi-dimensional view of these data. The data mining tools on these databases could provide very useful and eye-opening information as a decision support tool for the planners and policy makers.

ICAR has established an Agricultural Research Information System (**ARIS**) network in the country linking various ICAR Institutions (more than 100) spread over the length and breadth of the country, through electronic connectivity with e-mail systems, internet access and institute web-pages. Besides an on-line personnel management system namely **PERMISnet** has been established which provides on-line database of about 27000 ICAR employees' service records for the scientists, technical and administrative staff including the supporting staff. This database is being regularly updated on monthly basis. Such a database is a very useful tool for transparent administrative decisions, complete up-to-date status of administrative structure and the manpower planning. For National Agricultural Technology Project (NATP) an on-line Project Information Management System namely **PIMSnet** was developed which contained the details of about 845 research projects running at about 1700 different locations around the country and provided a powerful project monitoring system. Besides a stand-alone accounting system namely **ARFIS** has been developed

and is in use for various accounting activities of the ICAR institutions. Recently, an Integrated National Agricultural Resources Information System (**INARIS**) has been developed which integrates 59 databases on a time series (1990 onwards) based district wise agricultural statistics for various agricultural commodities, location specific agricultural technologies generated and various research projects operating at various research institutions. The areas included are the following:

• Soil resources	NBSSLUP, Nagpur
• Foodgrains & fertilizers	PDCSR, Meerut
• Horticulture	IIHR, Bangalore
• Livestock	NBAGR, Karnal
• Fishery resources	NBFGR, Lucknow
• Agro-meteorology	CRIDA, Hyderabad
• Water resources	ICAR Res. Comp. for East Region, Patna
• Plantation crops	CPCRI, Kasargod
• Spices	IISR, Calicut
• Plant Genetic resources	NBPGR, New Delhi
• Agro-forestry resources	NRC-AF, Jhansi
• Agricultural implements & machinery	CIAE, Bhopal
• Socio-economics	NCAP, New Delhi

Each of these 13 institutions developed from 3 to 7 databases which were then integrated at IASRI, New Delhi as a Central Data Warehouse at a Server located at IASRI. The country-wide GIS thematic maps have been developed for various areas of interest in this data warehouse. A data warehouse essentially comprises of the **Data** comprising of facts, aggregates, maps and metadata about the databases along with a **Process Manager** for loading, storing and querying for generating desired reports in most expeditious way, with an acceptable response time and at the same time ensuring that the information processing is highly secure. Thus, data warehouse provides a repository of information processing system for data mining from the time series data. Future projections can be easily made on this time series and pockets of bottlenecks can be identified with very user-friendly on-line graphics which can be employed even on the internet sitting at remote places. This is a very useful database and is able to provide critical analytical insights into the problems and challenges before Indian Agriculture. In a way this could be a platform for developing agricultural intelligence in the country.

There is a great scope for using ICT as a medium for agricultural technology delivery to the farmers. In one of the national workshops organised by NAAS, TAAS, ISAS and APAARI on 'The Role of ICT in Taking Scientific Knowledge/ Technologies to the End Users' during January 2005, this matter was discussed at length and some of the recommendations are very noteworthy. It was noted that there is a strong need to establish joint ventures with private sector & NGOs to enrich the ICT resources in terms of hardware/ software and content creation. It was also felt necessary that the ICT Agricultural Forum should prepare site relevant policy and strategic action plans. A judicious mix of traditional knowledge with modern technologies for ICT based dissemination will be useful. The ATIC centers of the ICAR/ NARS system can facilitate in extending community access to ICT since they already have in place a very large network. To achieve knowledge society in agriculture at least one agricultural information center should exist in each village. There is also a strong need to develop and strengthen portals to provide agricultural trade related information for import-export of agricultural products. To keep the portal dynamic and informative, ICT should ensure a two-way interactive flow of knowledge i.e. from experts to farmers and from farmers to experts. This will encourage dynamic flow of knowledge and will enable better understanding of the changing needs of the farmers. The details of the recommendations are given in **APPENDIX- 1.**

4. ICT AND INTELLIGENCE

With the advent of globalization, lowering production costs and increasing productivity and enterprise competitiveness have become a must in the new information society. Knowledge is now increasingly considered a key corporate asset that enables enterprises to maintain their market competitiveness. The concepts of **competitive intelligence, strategic intelligence, economic intelligence** and **business intelligence** are becoming increasingly important in our knowledge based society. Some of the Internet resources related to competitive intelligence, strategic intelligence, economic

intelligence and business intelligence are given in **APPENDIX- 2.**

Intelligence gathering is collecting information about the system, the work environment, understanding the inter-relations and projections based on this information so as to assist in decision-making. Living as we do in the midst of an "information revolution", it is easy to lose sight of the reason we seek information. We **seek information to reduce uncertainty and to improve the decisions** we make. For this purpose it is imperative that the information should be focused, understandable and timely. Intelligence gathering is a mechanism to gather information in the area of our interest, such as agriculture and is oriented towards making it more competitive, nationally and internationally by identifying the growth patterns and underlying subtle transformations taking place in the world agriculture including that in our own country. Intelligence gathering is an emerging discipline and is also sometimes termed as ***Competitive Intelligence***. It is defined as a value added process of **ethically and legally collecting information, analyzing, and disseminating accurate, relevant, specific, timely, foresighted, and actionable intelligence** regarding world agricultural environment, possible marketing competitors and the agricultural system itself so as to reduce uncertainty and support better decision making and action. Intelligence gathering helps to know how competitive we are, how competitive we shall be, to have a better understanding of the market and how to collect, process and analyze competitive intelligence as part of a work plan.

Information can be obtained by keeping an eye on the marketplace, gathering information on regional, national and global competition as well as through sources such as trade magazines, journals, purchased information, Internet, industry organizations and networks. Intelligence analysis involves a systematic examination of collected information so as to identify and isolate key aspects of information and establish links among the related components. It is the process that makes information accountable, identification of significant facts and findings so as to produce actionable intelligence. **Analytical pitfalls** include **fallacies of omission, fallacies of assumption, stating hypotheses contrary to facts and misusing analogies, misuse of language** (asking leading questions, lifting statements out of context) and **biases and subjective viewpoints** (preconceived notions).

Canada established a Competitive Intelligence unit in **1997** at Agriculture, Food and Rural Development Department, Alberta. This unit developed a **Competitive Intelligence Training Manual** to introduce competitive intelligence systems and procedures. Topical areas included are the intelligence cycle, direction and planning as well as analytical frameworks. In addition, a **Competitive Intelligence Internet Users Manual** provided staff with information gathering skills from the Internet. The Quebec Ministry of Agriculture, Fisheries and Food, Canada established an **Intelligence Network in 2000** to generate a macroscopic view of the economic environment by providing access to competitive intelligence for decision making purposes, encouraging development of an intelligence culture and promoting synergy between partners.

It is also realized that for increasing innovations and competitiveness there is a need for **Agricultural Scientific and Technical Information Network** to provide intelligence on investigating innovative opportunities from emerging agricultural technologies including new products, processes and services and to determine potential for commercialization, licensing and technology transfer initiatives. The collaboration, partnerships and strategic alliances can provide useful evaluations of research and development strategies, investment and funding priorities and policy development. Such a network can provide information in the arena of agricultural research and technology availability for expert referral, searching scientific and technical literature, verification and the data on essential agro-business information such as market trends and company profiles, searching complex scientific and business databases. This can help in better dissemination of information and provision of assured access for every one in all regions.

An Agricultural Scientific and Technical Information Network has been conceived under NATP Mission Mode project namely **Integrated National Agricultural Resources Information System (INARIS)** through creating a Virtual Private Network (VPN) among the collaborating 14 ICAR Institutions (IASRI, NCAP, PDCSR, NBPGR, NBAGR, NBFGR, NBSSLUP, IRCER, IIHR, IISR, CPCRI, CRIDA, CIAE, IGFRI & AF) dealing with different aspects of agriculture to develop a National Information Resource base. However,

it needs to be extensively enriched so as to cover all aspects of agricultural science research and technologies. Based on this information an **Agricultural Technology Information Service** can be created to provide services for identification and evaluation of innovative and value-added opportunities, assessing commercialization, licensing and technology transfer potential, identifying and accessing global expert resources, providing scope for investment and funding initiatives, monitoring and assessing competitors as well as other factors that influence competitiveness, supporting strategic planning and policy development and providing early warning of technical developments, threats and opportunities.

Looking at the pace of development in the world towards Competitive Intelligence and to become more competitive and effective under WTO regime, Indian National Agriculture Research System needs to develop capacity with a team of dedicated personnel for this purpose. The capacity building in intelligence gathering should involve the following:

- Identification of indicators for agricultural growth and the change along with inter-relations that might exist
- Collection of primary/ secondary data published or unpublished from various sources of interest
- Search engines as web crawlers for compiling information from Internet resources
- Maintenance of databases of compiled information
- Data mining from the database to unearth the underlying patterns and changes
- Disseminating the trends and patterns for assisting decision-making

Intelligence gathering should include **Marketing Intelligence** as well. An awareness of the available markets for primary/ processed agricultural produce, the possible channels involved (producer/ wholesale/ retail), prevailing price structure, the demand and supply position at a given point of time are necessary ingredients for maximizing returns. The main weakness that characterises the agricultural sector in this country is the inadequate linkage between primary producers, marketers and processors within the sector, and between the agriculture sector and other sectors such as agro–industry and food processing and packaging etc. Therefore inter-sectoral linkages need to be built up for reducing this constraint to the agri-business sector development. For this purpose a **Marketing Intelligence Network** needs to be established for conducting primary and secondary studies to prepare, store and disseminate

- Weekly market situation reports for members of network
- Industry studies, market research reports, market profiles
- National production and trade statistics
- Trade agreements and policies, market access requirements
- Organizational profiles, events calendar etc.

The marketing intelligence management also requires essentially a database management having information on Industry studies, Market research reports, Market profiles, Trade statistics, Trade agreements and policies, Market access requirements, Production statistics, Quality assurance protocols, Events calendar etc. and Agri-business professional listing. The Inter-sectoral linkages would require E-commerce management, Trading opportunities, Transaction facilitation, Buyer/ seller listing, Shipping schedules, Weekly market situation reports, Inter-sectoral promotion, Test market new products and Agri-business sector magazine.

The World Wide Web provides a vast reservoir of resources for agricultural intelligence. However, the large size of the Web and its dynamic nature make the task of compiling appropriate information challenging. Though the general-purpose search engines and business portals may be used to gather some basic intelligence yet the **topical crawlers**, driven by richer contexts, can leverage on the basic intelligence for facilitating in-depth and up-to-date information collation. Topical crawlers can help in extracting a small but focused document collection from the Web that can then be thoroughly mined for appropriate information using off-the-shelf text mining, indexing and ranking tools.

Thus, intelligence is essentially, more than mere collection of information. It is indeed adding value to information by ensuring the use of supportive information that provides valuable insight to generate recommendations for better decision-making. Besides conducting agricultural research and technology generation, Indian Council of Agricultural Research

(ICAR) cannot afford to forego the need to disseminate agricultural information and technology transfer to the end users, for which there is an immediate need to develop and expand in-house capacity in the area of competitive intelligence. For this purpose ICAR need to establish a core unit for competitive intelligence. Since intelligence gathering involves collecting and compiling information, from various sources in India and abroad, on the production statistics, trade statistics, price and marketing statistics, import and export statistics etc. related to agricultural produce, its marketing and their inter relations, statisticians can play an important role in such endeavours. At the back of such efforts should be a data warehouse like INARIS data warehouse. Using **data mining** tools on these historical databases one can churn out projections and forecasts of trends etc. to act as a decision support system for the research managers. Besides, intelligence gathering would also involve extensive scanning and searching of the World Wide Web resources across the world through **Topical Web Crawlers**. One needs to work in this futuristic area with adequate reorientation and capacity building so that ICAR does not lag behind in this important emerging area under current WTO regime involving global world competition.

5. SOME EMERGING ICT APPLICATIONS

Electronic Banking

With the advances in wireless technology the Mobile banking services are becoming feasible. With new technology for newer modes of payment and settlement, many banks have introduced innovative products for **e-banking** and **e-payments**. e-banking is the process of conduct of banking with the use of electronic tools and facilities. The service based areas of activity of banks have perhaps been the largest beneficiaries of e-banking. **Internet banking** has been the predominant mode of e-banking in India with the Internet offering itself as a new delivery mechanism for the banks in reaching customers. Commencing with simple transactions such as enquiry facilities, the messages through Internet, perform tasks such as fund transfer and account opening. Internet banking, however, stipulates that banks have a secure web server and a centralized database of their customers to facilitate information flow from customers to the banks and vice-versa. Effecting payment through electronic means constitute **e-payment**. Various forms of e-payments in existence today are **e-cheque, card based payments** (credit, debit and smart cards) and **Electronic Fund Transfer** (EFT).

Smart Card

It is a credit card sized plastic card which has an integrated circuit with a microprocessor chip embedded in it. These chips hold a variety of information from stored monetary value used for vending machines to secure information and applications for higher end operations such as medical/ healthcare records. They allow storage of thousands of times the information stored on magnetic stripe cards. They are more reliable and more secure because of high security mechanisms such as advanced encryption and biometrics. The cards have built-in capacity for detecting fraudulent operations. The cards can either be rechargeable or exhaustible. In either case they have built in memory and processor along with an operating system, which performs the financial operations. Besides there are multiple application smart cards such as Java Card and MULTOS which hold personal information such as driver's licence, social security, medical information, auto insurance, voter registration, workplace ID, website password keys for making digital signatures and encrypting data. There are two categories of smart cards: **Contact** and **Contact-less** cards. A contact smart card with a gold plated contact plate requires insertion into a smart card reader or terminal called a card-accepting device. A Contact-less card has an antenna coil and chip embedded within the card and requires only close proximity to a reader equipped with an antenna. Most of these contact-less cards also derive internal chip power source from this electromagnetic signal. The **Personal Identification Number** (PIN) are used to provide protection to the user against misuse. Reserve Bank has issued guidelines in June 2001 for ensuring safe and secure Internet Banking. Although the present GSM based WAP are not very suited to m-banking in view of not able to offer superior customer services and the low level of mobile phone penetration.

Expert Systems

Expert systems are decision support systems in a given field of specialization. Based on the existing knowledge base in a given field of specialization and if-then type of set of rules having associated action

points, the expert system can provide useful suggestions in a given set of circumstances. The expert systems are based on the concept of artificial intelligence where the expert system can be made to learn and develop its own set of pairs of (rule, action) set. Once the knowledgebase is large enough the advice obtained from expert system can save lot of hassles and drudgery for the experts. Even to some extent, the experts can be substituted by these computer-based expert systems. In medicine already there are few expert systems which are being employed very successfully. Besides artificial intelligence, pattern recognition and neural networks have very useful applications in expert systems.

Metadata for Heterogeneous Web Resources

To overcome the heterogeneity of data sets and information scattered in variety of formats such as text, images, sound, video etc., and the limitations of the search engines for textual searches only, proper organization and cataloguing of the web resources becomes essential. Meta data is a tool for integration of heterogeneous data sets. Meta data supports identification, description and location of network electronic resources so that data catalogue are inter-operable i.e., are accessible under one common publicly known interface by hiding their heterogeneity and distribution. As the meta data is a data about data sets itself, these represent higher level information describing the content, context, quality, structure and accessibility of a specific data set. It may reside as a header to a resource. HTML provides for a meta tag for storing meta data information in the web document. Basically meta data describes three components:

- **Content representation**: basic details about who, where and key linkage
- **Database description**: data set, model, platform, purpose etc.
- **Database coverage and availability**: spatial, temporal, limitations, access

Data warehouse makes use of meta data standards for storing and accessing information of various types. Digital libraries also make use of meta data standards for storing information about the documents such as title, author, publication year, pages etc. using Dublin Core Standards.

6. ICT FOR E-GOVERNANCE

E-Governance refers to the use of information and communication technologies to improve the efficiency, effectiveness, transparency and accountability of government. Thus E-government refers to the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and/or cost reductions.

E-Governance Goal

- Better Service Delivery to Citizens
- Improved Services for Business
- Transparency & Anticorruption
- Empowerment through Information
- Efficient Government Purchasing

Traditionally, the interaction between a citizen or business and a government agency took place in a government office. With emerging information and communication technologies, it is possible to locate service centers closer to the clients. Such centers may consist of an unattended kiosk in the government agency, a service kiosk located close to the client, or the use of a personal computer in the home or office.

Analogous to e-Commerce, which allows businesses to transact with each other more efficiently (B2B) and brings customers closer to businesses (B2C), e-government aims to make the interaction between government and citizens (G2C), government and business enterprises (G2B), and inter-agency relationships (G2G) more friendly, convenient, transparent, and inexpensive.

e-Commerce has evolved already through four stages: 1. publishing, 2. interactivity, 3. completing transactions, and 4. delivery. To date, most e-government activity has centered on publishing. A study by Anderson

Consulting indicates vast differences among countries in the maturity of their e-government effort and even the most mature countries have tapped less than 20% of the potential.

As part of the increased thrust on e-governance, Ministry of Communication & Information Technology, Department of Information Technology, Government of India, has set up a centre for e-governance (CEG) at its premises – Electronics Niketan in New Delhi in August 2000. The centre, first of its kind in the country, showcases several e-governance applications and solutions that have been successfully deployed in various states, and offers such other services like technical consultation, proof of concept and thematic presentations. Conducting programmes for creating awareness among decision makers in the Centre and State Governments and helping them in defining and implementing process and policy changes for effective e-governance are other important objectives of the Centre. The center has outlined an agenda for e-governance in Central Government departments:

- Each Ministry/ Department must provide PCs with necessary softwares upto the Section Officer level. LAN must also be set up.
- 100% training of all staff who have access to and need to use computers for their office work should be ensured. For this purpose, inter alia, Ministries/ Departments should set up or share Learning Centres for decentralized training in computers as per the guidelines issued by the DIT.
- Each Ministry/ Department should start using the Office Procedure Automation Software developed by NIC with a view to keeping a record of receipt of dak, issue of letters, as well as movement of files in the department.
- Pay-roll accounting and other house-keeping softwares should be put to use in day-to-day operations.
- Notices for internal meeting should be sent by email to the officers and submission of application for leave and for going on tour should also be done electronically.
- Ministry/ Department should also set up on-line notice board to display orders, circulars etc. as and when issued.
- Ministries/ Departments should use the Web-enabled Grievance Redressal Software developed by Department of AR & PG.
- Each Ministry/ Department should have its own website.
- All Acts, Rules, Circulars should be converted into electronic form and, along with other published material of interest or relevance to the public, should be made available on the internet and be accessible from the Information and Facilitation Counter.
- The websites of Ministries/ Departments/ Organisations should specifically contain a section in which various forms to be used by citizens/ customers are available. The forms should be available for being printed out or for being completed on the computer itself and then printed out for submission.
- Attempts should also be made to enable completion and submission of forms online.
- The Hindi version of the content of the websites should be developed simultaneously, as far as possible.
- Each Ministry/ Department would also make efforts to develop packages so as to begin electronic delivery of services to the public.
- Each Ministry/ Department should have an overall IT vision or strategy for a five year period, within which it could dovetail specific action plans and targets (including the minimum agenda) to be implemented within one year.

The introduction of information and communication technologies (ICTs) in government processes is fostering a closer relationship between citizens and states, pushing official bodies towards more transparency and accountability. They are also posing a challenge to traditional decision-making structures. In India, the language barrier poses a formidable challenge to providing electronic public services. With roughly one billion inhabitants, the country has two official languages (Hindi and English), 18 major languages and 418 officially listed languages. Optical Character Recognition technology should be developed and perfected since any local databases are written in local languages.

7. E-LEARNING

e-Learning is learning through the electronic means of communication. It may be recalled that television technology emerged due to the convergence of audio transmission and motion pictures technology. Now we have webTV where TV and computer technologies have been integrated. In fact, in this age of information explosion, the technologies related to communication, motion pictures and computers are converging. This convergence has really brought about a revolution and now the information is being made available through various means out of which electronic source has become the most popular, convenient and affordable. The electronic telephony, the digital movies, chatting sessions, blogging (web logging and posting comments on Internet with active links) the emails, the video conferencing, the electronic business, e-banking, smart card, the e-governance etc. are several such transformations which are gradually changing our vocabulary. The Internet has already captured the fancy and imagination of the people around the world, and has made easy accessibility to the information scattered across the continents. Such developments have also made the concept of e-Learning feasible. e-Learning is one component of **Distance Learning**. The distance learning involves the instructor and students separated by time and location, and training courses are delivered to remote locations via *synchronous* or *asynchronous* means of instruction, including written correspondence, text, graphics, audio- and videotape, CD-ROM, online learning, audio and video conferencing, interactive TV, and FAX etc. **e-Learning** comprises of online (Internet) and offline (CD-ROM) learning using computer technology. We have been more accustomed to learning via a teacher in person, imparting knowledge to the students through audio-visual interaction. This is an example of **c-Learning** or instructor led face to face (F2F) learning. Not so long ago this was perceived as the only possible means of learning. Though the concept of self-learning was not unknown yet the necessity of a teacher was always emphasized. As an illustration even the recognition of "A Guru" such as Dronacharya was considered necessary during self-learning. The formal learning through schools and universities has generally been recognized as a better mode of education. The informal learning could not attract the imagination of the mankind as much as it deserved.

Learning is essential for acquiring knowledge and knowledge ultimately leads to wisdom. The wise manpower is the greatest asset for the growing economies. This is an age of competitive, knowledge-based economies with shrinking national boundaries. Developing collaboration with remote institutions that matter, creating more jobs and developing a cohesive skill based manpower can accelerate economic growth. The current skills need to be sharpened, the new knowledge needs to be acquired and every body needs to be involved in this process of social transformation including women and weaker sections. India cannot afford to ignore e-Learning technology, which is a potential technology for bringing in needed economic growth. e-Learning means using new multimedia technologies, and the Internet to improve the quality of learning. Multimedia technologies allow the use of audio, video and text resources to enrich the content. Internet gives easy access to resources and services. e-Learning stimulates remote exchanges and collaboration. It empowers the learner in every situation whether learning at the school, at the university, at work or at home.

There are three **objectives** for e-Learning:

1. To help individual to realize his full potential and lead a happy and fruitful life
2. Reduce the disparities and inequalities between different individuals and groups
3. Ensure that the skills available meet the needs of the business and employers

e-Learning is the catalyst that is changing the whole model of learning in this century for school pupils, university students, employees, the ongoing training and development of professionals like doctors, nurses and teachers, in fact for just about anyone who wants to find out something on either a formal or casual basis. **e-Learning is based on a reliable technology and at the same time is pedagogy oriented. e-Learning is a social process and is capable of facilitating interaction and collaboration** among the people. It implies organizational changes and also teacher-tutor training. e-Learning is a futuristic phenomenon and in the context of National Knowledge Commission, it is likely to gain more importance in future with virtual University Campuses within the reach of the common man.

8. NATIONAL KNOWLEDGE COMMISSION, 2005

An important recent development which I must indicate is the constitution of National Knowledge Commission (NKC) towards a knowledge based society. In January 2005, during the partnership summit of Confederation of India Industries at Kolkata, Hon'ble PM of India announced the formation of National Knowledge Commission (NKC) as a catalyst for rejuvenating the knowledge institutions (schools, universities, research laboratories/ institutions, think-tanks, policymaking institutions etc.) for strengthening and building up the capacity for knowledgebase in the country. He enunciated the agenda of the National Knowledge Commission which would be shaped by a **knowledge pentagon** with **five areas for action** :

- To increase access to knowledge for public benefit
- To develop new concepts of higher education
- To rejuvenate science & technology institutions
- To enable application of knowledge by industry
- To enhance manufacturing competitiveness and to encourage intensive use of knowledge-based services by government to empower citizens

He further added that

- Science laboratories should reorient for creation of knowledge necessary to develop new products and services.
- Industries should reorient to create application of new knowledge to increase productivity, gain competitive advantage and improve conditions of people engaged in work.
- Services provided by government should be improved through the use of information technology.

He also said that we must become **not merely a knowledge producing society** but a **knowledge-sharing** and **knowledge-consuming society.** We must reinvigorate knowledge sharing units like public libraries and **create knowledge hubs in every village.** Knowledge must be used to empower the disempowered, like scheduled castes and scheduled tribes, other backward classes, minorities and women. Access to knowledge will strengthen liberal democracy at the grassroots. The business leaders as well as our political and intellectual leaders must work with the Knowledge Commission so that we can build a more open society and a more open economy. Building a knowledge economy and a knowledge society is the only way in which we can meet the challenge of globalisation.

Subsequent to this announcement, a **National Knowledge Commission (NKC)** has been constituted on June 13, 2005 for preparing the country to meet the knowledge challenges in the 21st century with Shri Sam Pitroda as the Chairperson and Dr. PM Bhargava, noted molecular biologist as the Vice-Chairperson with members, Shri Nandan Nilekani of Infosys, educationists Dr. Deepak Nayyar, Shri Ashok Ganguly, and Dr. Pratap Bhanu Mehta (Member-Convener), and noted sociologists, Dr. Jayoti Ghosh and Dr. Andre Beteille. Commission is to advise the Prime Minister on matters relating to institutions of knowledge production, knowledge use and knowledge dissemination. The mandate of the Commission is to **sharpen India's knowledge edge**. The Commission has to identify its action programme by October 2, 2005 and complete its work by October 2, 2008. The Commission is to be assisted by a Technical Support Group, while the Planning Commission would provide the logistic support. The Commission is expected to interact with different ministries that handle knowledge areas and encourage them to generate their own plans for upgrading institutional capacity.

The main terms of reference of the Commission, referred to as the **Knowledge Pentagon**, include:

- Build excellence in the educational system to meet the knowledge challenges of the 21st century and increase India's competitive advantage in the fields of knowledge
- Promote creation of knowledge in science and technology laboratories
- Improve the management of institutions engaged in Intellectual Property Rights
- Promote knowledge applications in agriculture and industry and
- Promote the use of knowledge capabilities in making the government an effective, transparent,

accountable service provider to the citizen and promote widespread sharing of knowledge to maximize public benefit.

Working groups from various related ministries HRD, Science and Technology, Commerce and Industry, Agriculture, and Information Technology will be associated with the functioning of the Commission. Moreover, ministers in-charge of the various ministries will be part of a National Steering Group, headed by the PM, to oversee the Commission's work. The Planning Commission would act as the nodal agency for the NKC as regards to administrative work, handling logistics, planning and for budgeting purposes.

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APPENDIX - 1

Recommendations of National Workshop on "Role of Information Communication Technology in Taking Scientific Knowledge/ Technologies to the End Users" held during January 10-11, 2005 at IARI, Pusa Institute, New Delhi, jointly organized by NAAS, TAAS, ISAS and APAARI

1. ICT based initiatives for agricultural growth leading to farmers prosperity should be multipurpose in nature, addressing problems of rural villages in holistic manner touching all aspects of rural life including agriculture, human/animal health, education, banking, governance, entertainment etc., for a synergy among various approaches and institutions. This can be achieved by setting up rural knowledge centers using broadband connectivity with multimedia interactive modules in problem solving mode and adequate follow-up.
2. Knowledge intensive products and services through knowledge empowerment of all the stakeholders in agriculture are urgently required. This would require establishment of collaboration among government, public and private organizations in content generation, services and their dissemination to the end users through virtual knowledge driven enterprise systems.
3. The knowledge dissemination agencies that exist in the country like ATMA project, Village knowledge centers/ ATICs/ KVKs and IFFCO, KRIBHCO, other public and private sector organizations must be networked so that everyone shares the information/ knowledge, transmitted freely to public and private in time and with assured quality of the contents.
4. There should be emphasis on gender equity by providing women access to ICT, ensuring women-oriented content, and increased women participation in application of ICT.
5. A mechanism should be developed for the creation of location-specific and knowledge enabled wealth through the establishment of knowledge centers and web portals to generate scientific opinion specific to the context of farmers.
6. Complexities in second-generation agriculture require greater role of emerging ICT tools in the existing extension system. This would require capacity building of extension functionaries for dissemination of knowledge to the end users using ICT for breaking the barriers of further growth in agriculture.
7. Village/ development block/ district level programs on ICT awareness need to be initiated for helping the farming community. Young entrepreneurs should be trained as ICT agents to help in disseminating the knowledge to farmers.
8. There is a need to reorient the agricultural extension curriculum so that agricultural extension workers become spatial and information specialists. The National Agricultural Research System should be proactive and provide user friendly, need based and

locally relevant content which should be periodically assessed and kept relevant.

APPENDIX - 2

Some References for Competitive Intelligence

- **Guide on Competitive Intelligence**
  http://strategis.ic.gc.ca/epic/internet/inee-ef.nsf/en/h_ee00499e.html

It is an excellent guide on competitive intelligence developed by Industry Canada and proposes an action plan which can help a company to become a stronger competitor in the present e-business environment.

- **Info-Guide-Technological and Strategic Intelligence**
  http://www.infoentrepreneurs.org/english/display.cfm?code=6022&coll=QC_PROVBIS_E

This Info-guide provides basic information on the concept of strategic and technological intelligence and provides guidance on the government services and programs relating to this subject. Although focused on Quebec it can be used by anyone as it will enable one to understand various types of intelligence and various levels of monitoring for intelligence purposes that exist.

- **CI Resource Index**
  http://www.bidigital.com/ci/

The Competitive Intelligence Resource Index is a search engine and an annotated meta index on competitive intelligence. The index is divided in eight categories (associations, books, companies, documentation, education, jobs, publications and software) and includes 1961 sites directly related to competitive intelligence.

- **Veille.com**
  http://www.veille.com/

Veille.com represents the first online community on economic and strategic intelligence. The site includes a directory on economic intelligence and strategic watch, a guide on search tools and search agents, discussion lists, etc.

- **Internet Intelligence Index**
  http://www.veille.com/

Compiled by Fuld & Company Inc, a leading consulting company on competitive intelligence, the Internet Intelligence Index is designed to help one gather information from a wide variety of public services, in support of one's competitive intelligence efforts. This meta-index contains links to over 600 intelligence-related Internet sites.

- **Strategic Road**
  http://www.strategic-road.com/

Strategic Road has the ambitious objective of achieving a truly strategic watch function at the crossroads of economic intelligence and online information search. It provides essential information on strategic intelligence, info-strategy, geopolitics, security and risks.

- **Brint.com**
  http://www.brint.com/newswire.htm

Describing itself as the "Premier News and Business Intelligence Portal" this site is a well known and reputed resource for Business Technology Management and Knowledge Management. The section on latest news and business intelligence is quite interesting.

- **A Tutorial for Researching Companies Online**
  http://www.learnwebskills.com/

This business research tutorial presents a step-by-step process for finding free company and industry information on the World Wide Web. It is a very good tutorial which demonstrates that one can gather a tremendous amount of business intelligence information on prospects, competitors, vendors, suppliers, customers, or other companies in just a few hours.

- **Super Searchers on Competitive Intelligence**
  http://www.infotoday.com/supersearchers/ssci.htm

This meta index includes 261 referenced sites useful for the competitive intelligence researchers.

- **Society of Competitive Intelligence Professionals**
  http://www.scip.org/

The Society of Competitive Intelligence Professionals (SCIP) is a global nonprofit membership organization for everyone involved in creating and managing business knowledge. Its mission is to enhance the skills of knowledge professionals in order to help

their companies achieve and maintain a competitive advantage.

- **The Role of ICT in Competitive Intelligence**
  http://www.bi-kring.nl/bi-kring/community/partners/contentlev/abk/01chap.pdf

This report on the role of Information and Communication Technology (ICT) in competitive intelligence discusses possible uses of ICT for intelligence activities. In this discussion particular attention is paid to ICT tools such as the systematic use of the Internet for collection of information, groupware applications for uncovering information requirements, specific applications for supporting the analysis of information, the use of an intranet for disseminating intelligence, and data warehouses or data mining tools. It is a very interesting report which also makes the distinction between competitive intelligence as a product and competitive intelligence as a process.

- **Economic and Competitive Intelligence**
  http://www.loyola.edu/dept/politics/ecintel.html

From Loyola college in Maryland this meta-index lists sites related to military intelligence, strategic intelligence, economic espionage, business intelligence, competitive intelligence, technology transfer and national security, etc. It is an interesting site, though somewhat outdated and focused mostly on military intelligence and national security.

- **Research Guide on Competitive Intelligence**
  http://www.scu.edu/library/research/business/competit.html

From the library of Santa Clara University this small research guide combines bibliographic information and list of Internet resources. The focus is on how to find information on competitors in a given industry sector.

- **International Association of Strategic Management**
  http://www.strategie-aims.com/

The International Association of Strategic Management is a frank-on-phone professional association whose members are researchers in management, strategy and organization. Its mission is to promote research on strategic management, disseminate information and help its members in their professional development. It is a very rich and interesting site although not directly focused on competitive intelligence or strategic intelligence. However, its focus on strategic management makes it very relevant.

- **Intelligence Online**
  http://www.intelligenceonline.com/p_index.asp

Intelligence Online describes itself as the first system of political and economic intelligence. It deciphers all influence-bringing activities around the world whether they originate from lobbying groups, intelligence services, or economic intelligence units, and it evaluates emerging risks around the world (terrorism, proliferation, organised crime, money laundering, political instability). Potentially interesting but one has to pay to access the information.