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MANAGEMENT INFORMATION SYSTEMS & DATA PROCESSING

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UNIT I

LESSON

1

IT CHALLANGES

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1.0 AIMS AND OBJECTIVE

After studying this lesson, you will be able to:

- Discuss IT based innovations
- Understand IT challenges
- Discuss progress in processing data
- Discuss real world cases of IT

1.1 INTRODUCTION

IT or Information Technology, in simple terms, is concerned with all forms of tools, techniques, and technology applied for transmitting, storing, processing and disseminating information. The Information Technology Association of America (ITAA) defines Information Technology as "the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware." In short, IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit and retrieve information, securely. It refers to any combination of equipments and procedures that facilitate the acquisition, creation, retrieval, storage, searching, viewing, updating and transmission of information using electronic means. Usually, information technology is viewed as a synthesis of developments in the field of computer science and the developments in telecommunication technology.

The term 'Information Technology' originated during the 1970s. Its basic concept, however, can be traced back even further. From the outset of the 20th century, an alliance between the military and various industries has existed in the development of electronics, computers, and information theory. The military has historically driven such research by providing funding and innovation in the field of technology and computing. The developments in the area of computer technology are not of recent origin; computer owes its roots to the ancient machines which could perform simple calculations. The oldest, perhaps is the adding machine developed by French scientist Pascal in 1642, then calculating machine of German scientist Liebnitz around 1700, after that the difference and analytical engines of Charles Babbage in early 1800, and then the tabulating machines developed by Dr. H. Hollerith around 1880 to process US census data. The first commercial computer developed for the US Census Bureau was UNIVAC-I designed by J. Presper Eckert and John Mauchly. The late 1970s saw the rise of microcomputers, followed by IBM's PC in 1981. After that within a short span of time the technology progressed remarkably from the so-called First Generation computers that were bulky,

unreliable, expensive and very difficult to operate, to the Fourth Generation computers that are 'miniaturized', with a very high speed and huge storage capacity, very economical, reliable and simple to use. Each generation has taken a further leap on the path of development and with each step the size of hardware has decreased and the capabilities have increased manifold.

The real thrust to the development of computers came during the second half of the 20th century with limited use of computer for data processing. The rapid developments in all technologies making up different components of the computers led to unprecedented growth in computer industry. This development led to mass scale spread of powerful computing resources at a very affordable price to the users and trend in use of computers shifted from users approaching central computers for data processing to computers moving to the users desk for all the activities like word processing and note preparing, data processing, data analysis, trend and pattern analysis as well as scenario building.

The developments in the telecommunication technology in the 20th century led to the installation of worldwide telephone systems, radio and television networks and later, the development of satellite-based telecommunication. The continuous research and development efforts in telecommunication have made communication more efficient, reliable, cost-effective and has also increased the coverage as the technology matured. Today, the term Information Technology has extended to encompass many aspects of computing and technology, and the term is more popular than ever before. The Information Technology umbrella is quite large, covering many diverse fields. Thus, information technology is a logical development arising out of confluence of computing technologies and telecommunications which has narrowed down the difference between collecting, storing and processing information and transporting the information elsewhere thereby driving the geographical distances to irrelevance. Broadly, IT covers the following areas. (The below-mentioned components of information technology have been discussed in the subsequent chapters in detail).

- Computer Hardware and Software
- Information Management
- Computer Networking
- Database Systems Design
- Software Development and the Tools used for Developing Applications
- Information Systems

Being knowledge-based industry, IT has the tremendous potential of becoming an engine of accelerated economic growth, productivity improvement for all sectors of the economy and means of efficient governance. It enhances access to information, protects consumers, provides access to government services, makes skill formation and training more effective, improves delivery health services, and promotes transparency. It provides tremendous employment potential and linkages between government and the people both at the rural and urban level. Investment in knowledge based industries will determine the level of the country's dominant position in the world economy in the next decades.

India's IT industry ranks among the fastest growing sectors within the country's economy. Driven primarily by software exports, the industry has been logging in extremely impressive year on year growth. The software industry in fact has been growing well over the 50% mark. India's international-class manpower that creates high quality software and services solutions is finding favour among

overseas customers. Indian technology products and solutions are accepted globally. Our country, India has emerged as the IT superpower.

1.2 INFORMATION TECHNOLOGY CHALLENGES

Is this new technology worth the headaches and heartaches associated with all the problems that can and will arise? Yes. The opportunities for success are endless. The new technologies do offer solutions to age-old problems. Improvements are possible to the way you operate and do business.

1.2.1 Strategic Business Challenge

Companies spend thousands of dollars on hardware and software, only to find that most of the technology actually goes unused. "How can that be?" you ask. Usually because they didn't pay attention to the full integration of the technology into the organization. Merely buying the technology without exploiting the new opportunities it offers for doing business smarter and better doesn't accomplish much. Think and rethink everything you do and figure out how you can do it better. Change is inevitable, and information must be managed just as you would any other resource.

Creating a digital firm and obtaining benefit is a long and difficult journey for most organisations. Despite heavy information technology investments, many organisations are not realising significant business value from their business systems, nor or they become digitally enabled. The power of computer hardware and software has grown much more rapidly than the ability of organisations to apply and to use this technology. To fully benefit form information technology, realize genuine productivity, and take advantage of digital firm capabilities, many organisations actually need to be redesigned. They will have to make fundamental changes in organisational behavior, develop new business models and eliminate the inefficiencies of outmoded organisational structures. If organisations merely automate what they are doing today, they are largely missing the potential of information technology.

1.2.2 Globalization Challenge

The world becomes smaller every day. Competition increases among countries as well as companies. A good Management Information System meets both domestic and foreign opportunities and challenges. The rapid growth in international trade and the emergence of a global economy call for information systems that can support both producing and selling goods in many different countries. In the past, each regional office of a multinational corporation focused on solving its own unique information problems. Given language, cultural and political differences among countries, this focus frequently resulted in chaos and the failure of central management controls. To develop integrated, multinational, information systems, businesses must develop global hardware, software and communication standards; create cross-cultural accounting and reporting structures; and design transnational business processes.

1.2.3 Information Architecture Challenge

You have to decide what business you are in, what your core competencies are, and what the organization's goals are. Those decisions drive the technology, instead of the technology driving the rest of the company. Purchasing new hardware involves more than taking the machine out of the box and setting it on someone's desk. Remember the triangle of hardware, software, and persware. Take care of the people and they will take care of the rest! Information architecture describes how to incorporate technology into the mainstream processes in which the business is involved. How will the

new Information System support getting the product produced and shipped? How will Advertising and Marketing know when to launch ad campaigns? How will Accounting know when to expect payment?

Many companies are saddled with expensive and unwieldy information technology platforms that cannot adapt to innovation and change. Their information systems are so complex and brittle that they act as constraints on business strategy and execution. Meeting new business and technology challenges may require redesigning the organisation and building a new information architecture and information technology infrastructure.

1.2.4 Information Systems Investment Challenge

Too often managers look at their technological investments in terms of the cost of new hardware or software. They overlook the costs associated with the non-technical side of technology. Is productivity up or down? What is the cost of lost sales opportunities and lost customer confidence from a poorly managed E-Business Web site? How do you determine if your Management Information System is worth it?

A major problem raised by the development of powerful, inexpensive computers involves not technology but management and organisations. It's one thing to use information technology to design, produce, deliver and maintain new products. It's another thing to make money doing it. How can organisations obtain a sizeable payoff from their investments in information systems? How can management make sure that the management information systems contribute to corporate value?

1.2.5 Responsibility and Control Challenge

Remember, humans should drive the technology, not the other way around. Too often we find it easier to blame the computer for messing up than to realize it's only doing what a human being told it to do. Your goal should be to integrate the technology into the world of people. Humans do control the technology, and as a manager, you shouldn't lose sight of that.

1.3 IT BASED INNOVATIONS

1.3.1 Telecommunications Strategy

Telecommunication is the backbone of e-commerce and the Internet. From 1980s, the Indian government has accorded priority to the development and funding of the telecommunications infrastructure. State investment in international telecommunications alone went up from $150 million in 1985-1990 to $200 million in 1990-1995. From 1990, overall government spending on international and domestic communications grew by 15% annually. Until recently, India possessed international telecommunications channels with a total capacity of 396 Mbit per second. The number of Internet users in India was 3.2 million people by March 31, 2000.

The technology is available but its costs are very high — especially for a large country like India. Therefore, rather than attempting to provide Internet and satellite links across the country, India followed the strategy of providing Internet access initially to only important commercial centres. Satellite earth stations were set up by VSNL2 and STPI3 at key locations for providing 24 hour guaranteed access to software companies for export activities, much before the Internet was available on the existing telecom channels. This was the major strategy on which the software revolution was built and this has been one of the key reasons for India's success in IT.

Software exports and IT-enabled services like medical transcription and call centres, which were and are directly exported to specific partners or clients in the US or Europe, need just basic connectivity not even the Internet. This was provided through the VSNL and STPI satellite links. Therefore, bandwidth, legal e-commerce framework, and a payment gateway were not major issues in the last few years. Today, as the industry grows and e-commerce develops, bandwidth has become an issue as the number of companies and domestic Internet requirements have expanded. Similarly, legal framework and payment gateways were not needed as the transactions were via traditional methods between specific partners. Today, for e-commerce market places, digital products like music or videos etc., or large automated supply chains, all these are essential requirements and are only now coming into place.

1.3.2 Software Technology Parks

India's experience provides clear evidence of the fact that government support is crucial for building a strong IT software and services industry. India has given priority to export-oriented IT development, IT-friendly regulations in investment, taxation, administrative management, and other policies. Apart from that, India has established Export Processing Zones, Export-Oriented Units, and Software Technology Parks. At present, there are 19 Software Technology Parks (STPs) controlled by the Ministry of Information Technology. They all form an autonomous unity called Software Technology Parks of India (STPI). STPI contributes 60% of the overall software exports from India. The basic characteristics of the Indian Software Technology Parks (STPs), Export Processing Zones (EPZs), and Export-Oriented Units (EOUs) are:

- Simplified, duty free export-import procedures;
- Single window for all bureaucratic dealings;
- Subsidies on sales and excise taxes;
- Five year corporate tax exemption for STPs and ten year tax exemption for EPZs and EOUs;
- Simplified foreign exchange operations;
- Permission to establish companies with 100% foreign venture capital;
- Developed telecommunications infrastructure, access to international telecommunications links;
- Availability of office space and preferential terms for constructing new business premises;
- Subsidies for and reduced rates of space rent and municipal services charges, e.g. electricity, water etc.;
- Well developed infrastructure facilities, etc.

1.3.3 The 'English' Factor

Indians are not merely English-speaking, but are also capable to quickly adapting to the English or Western thinking. While a Chinese immigrant may take years to become 'American', an Indian software professional from one of the engineering colleges of India will probably do so in months. That is the key to their success not just in software but in several other business and cultural fields. We cannot forget the fact that India was the former British colony. Today, as English standards and business practices become the norm, English-speaking employees can be a tremendous asset. This accounts for the success of call centres and web-enabled services located in India, catering to the US market and manned by employees speaking English with an American accent.

1.3.4 Government and Private Sector Collaboration

Government and private sector collaboration in the field of IT and software export promotion represents a unique and momentous export success story. Such collaboration is unprecedented for most of the developing countries.

Since the whole software production base was essentially built on and for exports, it won for itself tremendous support of the bureaucracy, which was keen to show success in the earning of valuable foreign exchange for the nation. Software exports occur mostly digitally, and exports in India have not been subject to customs duty while export earnings are exempted from income tax. This provided an environment having the least contact of businesses in this area with the lower echelons of officialdom. Coupled with a supportive policy regime, the result has been much higher levels of efficiency in delivery and production for the sector.

1.3.5 Legal Framework

A legal framework for e-commerce has been provided by the Information Technology Act, 2000, making India only the twelfth country worldwide which has such a comprehensive legislation for e-commerce in place. This Act also effects consequential amendments in the Indian Penal Code, the Indian Evidence Act, 1872, and the RBI Act, 1934 to bring them in line with the requirements of digital transactions. Similar amendments are being planned for the Companies Act, 1956 also to facilitate e-commerce and e-governance. Basically, the IT Act seeks to address the following areas:

- To make possible e-commerce transactions—both business to business and business to consumer
- To make possible e-governance transactions—both government to citizen and citizen to government
- To curb cyber crime and regulate the Internet.

Rules under the IT Act have been formulated and a national controller for enforcing the Act appointed. This controller will regulate the certifying authorities that will issue the digital signatures and the systems for authentication. These steps need to be matched by sorting out the issues of security and payments. Security and authentication arrangements need to be recognized and accepted globally.

1.3.6 Liberal Approach

Liberal traditions and democratic environment have been a feature of the Indian philosophy. India's welfare and social policies have given birth to a very strong private business environment. The introduction of the structural adjustment programme in 1991 resulted in the promotion of policies of liberalisation and trade reforms, strengthening the economy and export sector. Despite the democratic changes of governments with elections since then, the thrust towards liberalising the economy has not been given up which has resulted in favourable conditions of growth for the export sector in general and the software sector in particular.

1.3.7 Change in Business Environment

The powerful worldwide changes have altered the environment of business. These changes in the business environment and climate are classified into political, social, economical and technological categories.

Environmental, organizational, and technological factors are creating a highly competitive business environment where customers are the focal point. Further, environmental, organizational, and technological factors can change quickly, sometimes in an unpredictable manner.

Therefore, companies need to react often and quickly to both the problems and the opportunities resulting from this new business environment. This dramatic change is due to a set of business pressures or drivers. They maintain that in order to succeed (or even to survive) in this dynamic world, companies must not rely only on traditional actions such as lowering cost, but also encourage innovative activities by empowering employees.

Organizations are composed of five major components: IT, organizational structure and corporate culture, management and business processes, organization's strategy, and individuals and roles. These components are in stable condition, called equilibrium, as long as no significant changes occur in the environment or in any of the components. However, as soon as a significant change occurs, the system becomes unstable and it is necessary to adjust some or all of the internal components since all are interrelated.

1.3.8 IT and Organizational Design

An important and fast growing technological innovation during this century is computer-based information systems. Computer-based Information Systems (CBIS or only IS) provide an opportunity for businesses to improve their efficiency and effectiveness, and even to gain a competitive advantage. IT is also a catalyst of fundamental changes in the structure, operations and management of organizations. Most businesses in the industrial world could not compete, and many could not even survive without computers and software. Now IT is an integral part of the products and services delivered to customers.

Competition leads to environmental uncertainty and increases both the need for and the rate of innovation adoption. By adopting IS, businesses will be able to compete in three ways:

1. IS can change the industry structure and, in doing so, alter the rules of competition;
2. IS can also create competitive advantage by offering business new ways to outperform their rivals; and
3. IS spawns new businesses, often from within existing operations of the business.

IT-enabled Organizational Transformation

There is a growing body of conceptual papers and case studies on IT-enabled organizational transformation in the information systems literature. Most of the studies suggest that the use of IT without concomitant organizational changes is unlikely to yield significant gains in terms of organizational performance.

Four R's of Business Transformation

Business Transformation can be defined as "The orchestrated redesign of the genetic architecture of the corporation, achieved simultaneously - although at different speed - along the four dimensions of reframing, restructuring, revitalization and renewal." By this definition a biological model has been developed that we call the Four R's of transformation are:

1. Reframing
2. Restructuring

3. Revitalization
4. Renewal

Reframing is the shifting of a company's conception of what it is and what it can achieve with new visions and a new resolve.

Restructuring is a girding of corporate loins, getting it to achieve a competitive level of performance by dealing with the body of corporation and competitiveness. The need to be lean and fit is the primary consideration.

Revitalization is about igniting growth by linking the corporate body to the environment.

Renewal deals with the people side of transformation, and with the spirit of the company. It is about investing individuals with new skills and new purposes, thus allowing the company to regenerate itself.

Five Levels of IT – Induced Reconfiguration

The five levels includes two basic dimensions - the degree of business transformation and the range of potential benefits from IT. Organizations thereby proceed to higher levels of transformation as the demands of competition and value creation for customer increases. The first two levels are evolutionary, requiring relatively incremental changes in the existing organizational processes. In contrast, the other three levels are conceptualized as revolutionary, requiring fundamental changes in the nature of business processes.

These five levels are explained as following:

1. ***Level 1:*** Localized Exploitation (Automation), which is concerned with the exploitation of IT within business functions.
2. ***Level 2:*** Internal Integration, a logical extension of the first in the sense that IT capabilities are exploited in all the possible activities within the business process. Two types of integration are critical here: technical integration and the organizational integration by using common IT platform to integrate the organization's business processes to enhance efficiency and effectiveness.
3. ***Level 3:*** Business Process Redesign, involving the reconfiguration of the business using IT as a central level.
4. ***Level 4:*** Business Network Redesign concerned with the reconfiguration of the scope and tasks of the business network involved in the creation and delivery of the products and services.
5. ***Level 5:*** Business Scope Redefinition concerned with the underlying principle of a corporation, pertaining to the possibilities of enlarging the business mission and scope (through related products and services) as well as shifting the business (through substitution of traditional capabilities with IT-enabled skills).

IT as a Solution to Environmental Change

The cost of IT has plunged since the 1960s resulting in enormous investments in IT applications that have stimulated increasingly complex organizational change.

The increasing global interdependencies and the accelerating pace of change demand more flexible and adaptive organizations. Organizational flexibility in terms of "vulnerability" and "adaptability": Effective implementation of IT would decrease vulnerability by reducing the cost of expected failures and enhance adaptability by reducing the cost of adjustment.

IT may be considered as comprising of five basic components - computers, communications technology, work stations, robotics, and computer chips.

Other Factors

Within a relatively short period of time, India has become an important player in the global IT market. The export orientation of India's IT industry and a surge in software development has enabled the country to dream as an IT superpower. The rapid growth of India's IT industry has become possible due to many factors as discussed earlier. The following initiatives by the government also proved to be the key factors responsible for the IT boom in India:

- Gradual reduction of customs duties on import of IT software from 114% to nil in accordance with the 1999 Government Notification.
- Zero import duty on books, magazines, periodicals on CD-ROM under the 1998 Customs Notification.
- Step-by-step reduction of import duty on computers and peripherals.
- Zero import duty on computers and peripherals that after two years of import and use are donated to public institutions, hospitals, schools and government establishments.
- Liberalization of Internet e-commerce, etc.
- Granting tax benefits for software companies; special favourable conditions for joint ventures and private educational institutions.
- Allowing 100% foreign venture capital for IT companies.
- Allowing 100% foreign capital share in e-commerce.
- Granting tax benefits for those buying shares of large foreign companies.
- Granting tax benefits for venture capital funds that invest in software companies.
- Removing licensing for IT industry.
- Simplification of registration procedures for IT software and services companies.
- Establishing state structures to stimulate the growth of the IT industry.
- Reforming IT education system at secondary and higher educational institutions.
- Introducing certification schemes for skills.
- Stimulating standardization of education and accreditation schemes for educational institutions.
- Encouraging young people to major in computer science through subsidies, tax benefits, and other incentives.
- Stimulating private and foreign investments in IT education and training.
- Providing government support for and financing of educational institutions.
- Encouraging private and foreign capital investments in telecommunications development.
- Privatizing state telecommunications companies.

- Eliminating the state monopoly on various types of services.
- Providing government support for and financing of telecommunications development.
- Financing and crediting high tech research and industrial projects.
- Encouraging standardization and international certification (ISO 9000, SEI CMM).
- Introducing the system of state orders that provides incentive to development and implementation of high-tech production and management processes.
- Improving the legislation and stringent punishment measures for intellectual property rights infringement.
- Economic incentives for use of licensed products for instance, zero import duty on IT software.
- Introducing additional financial measures to regulate the activities of the IT companies.
- Providing support for private IT education, and private IT research and development.
- Ensuring industry oriented personnel training within the state education system.
- Developing infrastructure and reducing its costs.
- Expanding state marketing to promote IT companies in the global market.
- Pursuing more aggressive anti-piracy policies.
- Implementing the strategy of state contracts.
- Speeding up and simplifying red-tape procedures.

1.4 DRAMATIC PROGRESS IN PROCESSING DATA

Our primary discussion on management, information and system is aimed at evolving a definition of management information system. MIS has become a generic term of information systems for management. It is most intriguing to peep through the stages of emergence in information systems and highlighting some of the emerging trends. The phenomenon of MIS recognition as a generic term began in 1970s when the MIS supplanted the data processing systems. The stage of data processing systems was set in 1960s with the advent of computers. The revolutionary upsurge in computing and communication technologies in 1980s led to further development and up gradation of MIS. The most significant development marking the computer based information system is the evolution of Decision Support Systems (DSS). The highlights of DSS may be realized by distinguishing it from the traditional view of MIS. Decision support systems ought to be necessarily and entirely computer based whereas, as discussed earlier, the MIS need not necessarily be so. The decision support system provides an interactive environment and seeks the help of computer for each specific area involving decision making at any point of time. This is due to the fact that the decision support systems aim at instantaneous, online and interactive information within an organization. The traditional MIS aim at a management reporting system based on deriving information from the available data from various sources and subsystems. In our opinion it is logical to extend the traditional view of MIS to encapsulate all the information systems assisting the management process within the purview of MIS. Modern view of MIS should encompass transaction processing systems, management reporting systems, decision support systems, office systems, knowledge based systems, expert systems, artificial

intelligence based systems and communication systems. When these systems are discussed and analyzed in subsequent lessons, the inter-relationship and symbiosis amongst these systems shall be traced out to substantiate our view. Other trend in the computer based information systems is development of techniques in the field of system analysis and design. The object oriented systems are continuing to gain importance primarily due to the popularity of graphical user interfaces and windows in the computer applications. Window based computer applications enable the sharing of resources from the multiple application sources simulating a multi-tasking environment conducive to sharing and exchange of information. Graphical user interfaces in a computer application makes it user friendly as the user does not have to type in details to access information. The user may just click the graphical icon on the computer screen to retrieve the desired information. The object oriented systems aim at usage of reusable codes to develop the application of similar types. As the technology is evolving, the business processes are improving, the competitiveness in the business world is becoming intense, the need for incorporating the principles of total quality management and business process re-engineering in the information systems is gaining momentum. The focus of the business is shifting to the customers needs and perspectives.

It is pertinent to realize the importance of growth of MIS in stages in order to encounter increasing complexity of business processes and changing scenario of management. MIS development evolves from EDP systems. The EDP systems have rudimentary technology to handle clerical and supervisory operations in an organization. This is initiation stage. The advantages of computerization are gradually realized by most of the people in an organization. This realization leads to proliferation of computer, networking technologies and computer based system applications within an organization. This is contagious stage. Next stage is typified by planning and control. As demand for computerization increases, a need is realized for cost-benefit analysis. This is imperative to plan for future MIS in a cost effective manner.

Next stage of MIS development is integration of subsystems. This comes with realization of interdependence of inflow of data from various sources for valid information. Management plans to leverage existing subsystems to a unified system. Objective of a unified system is to obliterate data redundancy and facilitate communication of information amongst various departments. After creation of an integrated system, management focuses its attention to database administration. Here impetus is on regulating data for company wide communication. This stage is also referred to as architecture stage. Next to data administration stage an organization reaches a stage of MIS maturity. This is the state when MIS department is geared up to plan future MIS needs for the organization. MIS department future development plans emanate for feedback of the users of existing MIS. At this stage, users are in complete control of MIS and become aware of their system needs.

All the applications that are centered on transaction processing and assist in streamlining operations of an organisation form the part of support quadrant. Typical transaction process oriented support applications are batch billing and financial transactions data processing applications. All the applications that are centered on on-line ready information systems and matured to operate just like a factory to a manufacturer form the part of factory quadrant. Typical on-line data processing systems like point of sales in retail shops and reservation systems of railways/airlines are examples of such systems. These systems are generally independent of further thought of modifications in content but may require some improvement in user interface. All the applications in turnaround domain are typified by a development emphasis on decision support systems for the future. These applications are thought processes for the future strategic plans. For example, the company may contemplate to device

various operational research based information models such as inventory control, budgetary control etc. with the assistance of data from support or factory applications.

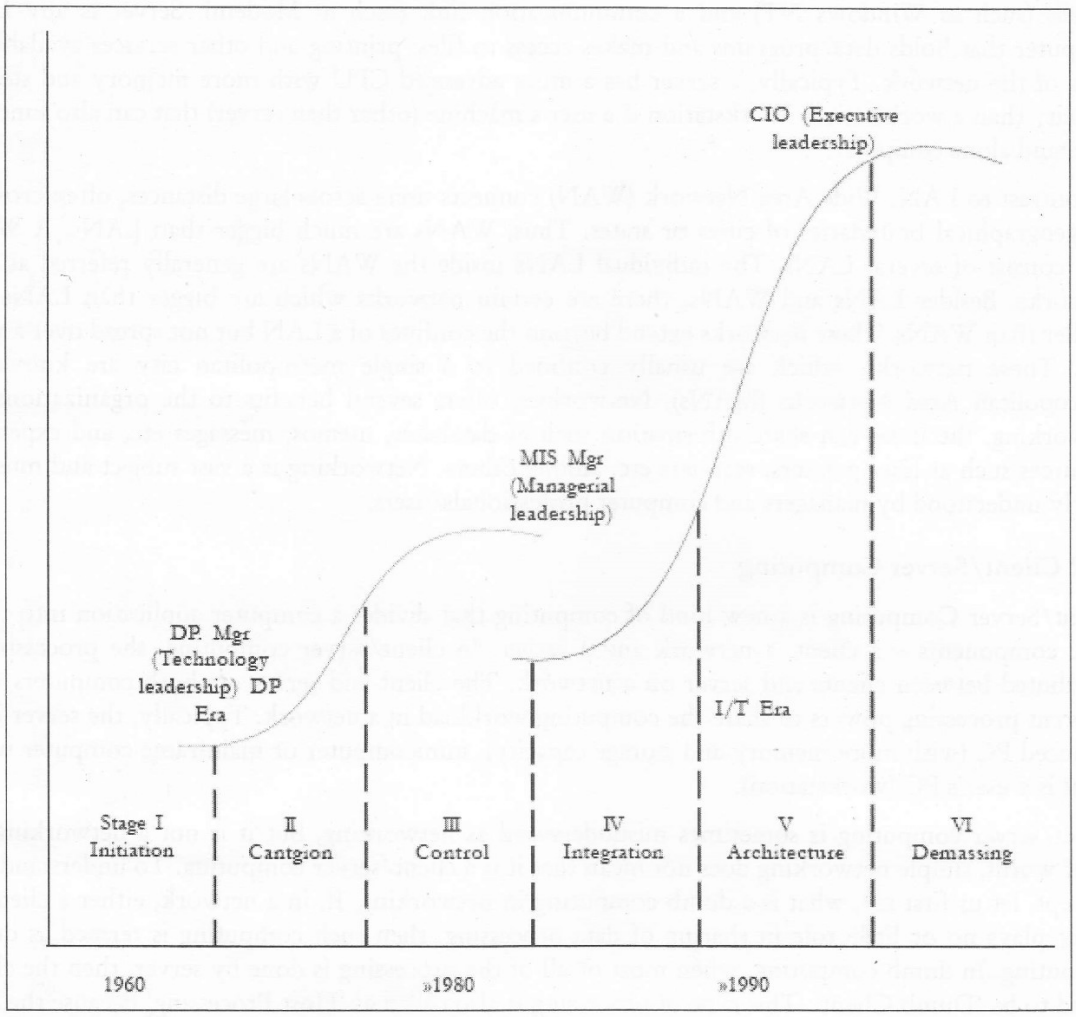

Figure 1.1: Stages of Growth of MIS

Since the advent of first commercially available computer (UNIVAC I) in 1952, there is a rapid development in the field of information technology. The IT industry continues to grow at record speed. Today, PCs are beingused much more than their original purposes of data processing. We have already discussed the role of computers in MIS and other fields in preceeding section. We are now, discussing below the latest trends in information technology, which are networking, client/server computing, data communications and telecommunications.

1.4.1 Networking

Network is a group of computers and peripherals, connected by a communications channel. It is capable of sharing files and other resources such as printers, drives etc. among many users. It ranges from local area networks to wide area networks. Local Area Network (LAN) connects several computers within a confined geographical area with permanently installed cables and dial-up-lines.

Peer-to-peer network is a local area network in which all the resources of each PC are available to other PCs on the network. A typical LAN consists of a server, workstations, a network operating system (such as Windows NT) and a communication link (such as Modem). Server is any LAN computer that holds data/programs and makes access to files, printing and other services available to users of the network. Typically, a server has a more advanced CPU with more memory and storage capacity than a workstation. Workstation is a user's machine (other than server) that can also function as a stand alone computer.

In contrast to LAN, Wide Area Network (WAN) connects users across large distances, often crossing the geographical boundaries of cities or states. Thus, WANs are much bigger than LANs. A WAN may consist of several LANs. The individual LANs inside the WANs are generally referred as sub-networks. Besides LANs and WANs, there are certain networks which are bigger than LANs but smaller than WANs. These networks extend beyond the confines of a LAN but not spread over a wide area. These networks, which are usually confined to a single metropolitan city are known as Metropolitan Area Networks (MANs). Networking offers several benefits to the organizations. In networking, the users can share information such as databases, memos, messages etc. and expensive resources such as laser printers, scanners etc. among others. Networking is a vast subject and must be clearly understood by managers and computer professionals/users.

1.4.2 Client/Server Computing

Client/Server Computing is a new kind of computing that divides a computer application into three basic components - a client, a network and a server. In client/server computing, the processing is distributed between clients and server on a network. The client and server are both computers with different processing powers to share the computing workload in a network. Typically, the server is an advanced PC (with more memory and storage capacity), minicomputer or mainframe computer while client is a user's PC (workstation).

Client/server computing is sometimes misunderstood as networking, but it is not a networking. In other words, simple networking does not mean that it is a client/server computing. To understand this concept, let us first see, what is a dumb computing in networking. If, in a network, either a client or server plays no or little role in sharing of data processing, then such computing is termed as dumb computing. In dumb computing, when most or all of the processing is done by server, then the client is said to be 'Dumb Client'. This type of processing is also called as 'Host Processing' because the host computer processes all data. If most or all of the processing is done by client in a network, then the server is called 'Dumb Server'. The networks either with dumb server or dumb client are not considered suitable for multi-user applications involving more users due to too much slow processing. In client/server computing, neither the server nor the client is dumb, but both share the workload. In client/server computing, the server must share the data processing workload with client besides sharing files, printers and other resources.

Client/Server Database Applications

Client/server computing is mainly needed in database applications, especially in development of management information system. In client/server database applications, the database runs on the server, which is called the Back End and the application program that accesses database, runs on the client, which is called Front End. The front end program requests services of the back end program by querying in the form of SQL (Structured Query Language) statements. The back end processes the SQL statements and sends the results to the front end program. The client, thus, is responsible for the Graphical User Interface

(GUI) while the server provides database access. Oracle, Sybase, Informix and Microsoft SQL servers are the commonly used back end software. The programs that run on the client computers are usually developed using front end tools. The commonly used front end tools are Powersoft's PowerBuilder, Microsoft's Visual Basic and Borland's Delhi. Besides front and back end tools, client/server computing requires software that operates between client and server. These software are sometimes termed as Middle wares. Windows NT, a popular network operating system is an example of middleware.

Advantages and Disadvantages of Client/Server Computing

Before deciding on whether an organization should go for client/server computing or not, the managers must understand the benefits and pitfalls of client/server computing. Client/server computing offers following benefits in most of the cases (not always):

- Cost savings as compared to mainframe systems.
- Flexible in all the inevitable types of hardware/software changes.
- Easy to scale the system to accommodate changes in a workgroup.
- Best utilization of disk storage and memory in both server and client computers.
- GUI interface improves the user effectiveness.

Client/server computing also have some disadvantages. The anticipated cost savings of a client/server system is not always true during real-world situations. Actually, client/server systems are rarely less expensive than mainframe systems. The organization must have the technical expertise to switch to new system. The cost of retraining staff for development, administration and using the system outweigh the benefits of the new system. Another disadvantage of client/server computing is that its reliability is inherently less than that of a homogenous centrally controlled system.

After discussing the benefits and pitfalls of client/server computing, we may conclude that the correct choices of application for a client/server computing are the key factor in realizing its benefits. Although client/server computing is important for the organization, it is not recommended for every application. The managers must also consider the alternatives to client/server before its recommendations for developing an MIS. For advanced study, the reader is advised to refer the special books on this topic.

1.4.3 Data Communications

Large organizations are generally spread over several office locations. In order to computerize such geographically separated offices, various data communication facilities are required. *The transfer of data and information from one computer to another over a communication link is known as data communication.*

As data communication is highly important for an organization for computerizing MIS applications, we are presenting a special chapter on data communications in this book.

1.4.4 Telecommunications

Telecommunication refers to the electronic transmission of all forms of information, including digital data, voice, sound and video from one location to another over some form of transmission media. This transmission media may be a telephone line or microwave signal.

The importance of telecommunications in business and personal purposes is increasing very rapidly with new developments and technologies. ISDN (Integrated Services Digital Network), E-mail, Internet, Intranet, Video Conferencing, Paging and Cellular technologies have become very popular during last few years.

1.4.5 Role of Information Technologies on the Emergence of New Organizational Forms

During the last years, a consensus is emerging that to survive in the competitive turbulence that is engulfing a growing number of industries, firms will need to pinpoint innovative practices rapidly, to communicate them to their suppliers and to stimulate further innovation. In order to be competitive, companies are forced to adopt less hierarchical and more flexible structures, and to define strategies able to combine reduced costs, high quality, flexibility and a quick answer to customer requirements. Nowadays, there are very few companies with enough resources to form its value chain on their own.

Therefore, some changes are taking place within individual companies and in their relations with other organizations, creating new structures in which relationships between customers and suppliers are suffering considerable changes. One of these changes is concerned with the formation of networks in which there is a division of labour that allows each company to exploit their distinctive advantages, and be more competitive globally.

In a network model, a set of juridically independent companies establish cooperative long term links in order to achieve a higher level of competitiveness. The enterprises that belong to a network have not all the elements needed for manufacturing a product or providing a service under their absolute control. Therefore, the success of this kind of structures is conditioned by the coordination degree obtained along the realization of inter-organizational activities, which requires an efficient communication system among the partners. The Information Technology (IT) represents a supportive element that facilitates the transfer of information across organizational boundaries. In this paper we analyze the inclusion of the Interorganizational Information Systems (IOISs) concept within the network model and discuss the role IT plays in enabling organizational transformation towards emergent forms of organization. In order to attain relatively low costs in the last two decades the enterprises followed strategies of backward-forward integration, based on the improvement of the effects of the experience curve and the scale economies. We consider that this internal growth may be inadequate to face the new situations appearing in the nineties and, no doubt, those that will appear in the next century. The individual enterprise has less capability for foreseeing the consequences of the different business decisions; however, the need for competing in a more and more complex context requires the adoption of quick decisions, which facilitate the flexibility of the enterprise. New technologies, fast changing markets and global competitiveness are revolutionizing relationships both within and between organizations. Thus, the new environment requires from the enterprises a strategy able to agglutinate reduced costs, high quality, flexibility, and a quick response to the needs of the customer.

Nowadays, the enterprises have to compete in a more and more turbulent scene, which obliges them to adopt less hierarchical and more flexible structures. During the last years, a major transformation in the strategy of many enterprises has been observed with a tendency to disintegration. This is accompanied by a need for increasing the quality of the products or services offered, which requires more interdependency among the different corporate units. As a consequence of it, several transformations both inside the enterprises and in the relationships between them are taking place, which establishes new structures through which the relationships among competitors, customers and

suppliers are changing substantially. One of these changes is the cooperation established among different enterprises, which allows them to develop their competitive capability. Companies are forming strategic alliances because there is an increasing acknowledgement that organizations operate in a relational context of environmental connectedness and that organizational survival and performance depend upon connections with other organizations.

The co-operation among enterprises allows their flexibility and their innovative capacity to be increased. Current products are based on so many critical technologies that most of the enterprises cannot keep constantly updated in all of them.

Network Structure

The concept of the network's form of organization has been particularly popular with management writers for its potential to build the flexible organization with the ability to meet the challenges of a changing and global environment. Despite both the abundant available literature and the existence of a certain consensus on some aspects, there is still too much ambiguity in the concepts used in this area. Taking into account the formation of networks, which is an interesting field of recent development with strong repercussions on the inter-organizational relationships, it is necessary to clear the existing terminological confusions in order to formulate its theory and to improve its implementation.

Starting from the definition, a network is a specific kind of relationship joining a particular group of people, objects, or events. Two factors needed for constituting a network can be obtained from this definition; first, a network is formed by a group of elements; second, these elements establish specific relationships among them. We must show that the establishment of a co-operative network is not a purpose itself but "it must be a dynamic structure that allows consolidating the competitive position of its members".

By means of a network structure, the competitive position of the enterprises can be reinforced as these concentrate on what they do best, and on what maintains their success in the market. In this way, other enterprises make the activities left, in which they have distinctive competences too. The enterprises outsource those activities that are ballast and bureaucratize them.

The enterprises that belong to a network have not all the elements needed for manufacturing a product or providing a service under their absolute control. Within the networks, the involved elements belong to independent enterprises and are placed along the value system of a product or service.

All this drives to an organizational structure in which the enterprises generate more value in those areas where they have specific competencies. The success of these emergent organizational forms seems to be based, on a great extent, on an effective co-ordination by means of the use of advanced information systems, which are based on the Information Technologies (IT). There is an increasing interest in the relationship between the emerging organizational ways and the function of the IT/IS insofar as the progresses in each field have influenced the others.

Information Technology on the Emergence of Networks

At the moment, the most spectacular and potentially powerful uses of the information systems technology go beyond the individual borders of the enterprises. In fact, the most important function of IT in the nineties is the better management of the interdependencies among the enterprises. Information Technology has to be the most powerful instrument to reduce the co-ordination costs. While the traditional uses of IT tried to facilitate the internal processes of the enterprises, the Interorganizational Information Systems (IOISs) are addressed towards the efficiency of a group of enterprises.

Most of the studies about IOISs have focused on the incidence of IT on the flows of information among the organizations, its capability of reducing the transaction costs, and its potential to achieve competitive advantages. Many authors have verified that:

- IT influences the nature, punctuality and detail level of the information shared by enterprises.
- IT reduces the transaction costs, while it provides a better management of the risks.
- IT reduces the co-ordination costs.

In order to benefit from the advantages of IT, the enterprises have to keep in mind that IT cannot be isolated from its organizational context. We do not agree with the existence of causation between the implementation of IT and the organizational changes in the enterprise driving to an increase in the competitiveness of the enterprises. On the contrary the technological and organizational implementations are both sides of the same issue, since they depend on and determine each other. We think that, although IT might have the above mentioned positive effects on the organizations, the will and capabilities of the directors of the company are needed in order to make the most of those advantages.

In order to make the most of the whole potential of the IOISs, it will be required that the managing directors get involved with the project, since they have a wider and more strategic view of the company. In this way, a system coherent with the objectives of the company would be implemented. This system would allow taking even more profit from IT, what would have positive repercussions on the enterprise and would facilitate the achievement of its objectives. The active participation of the Management Board in the planning of the IOISs brings a problem related to the fact that IT is a relatively new resource that did not exist when most of the current managers were trained. Therefore, they usually do not feel comfortable with these new technologies.

As a proof of this, we will consider an example. McKesson was a dealer company of chemical products. This company knew that its success was linked to that of its customers, which were small stores, so it established a close relationship with them. By means of an appropriate use of Information Technologies, it helped its customers to maximize their profits, since it gave them useful information for competing with the big pharmaceutical chains, which were getting a greater market share. The McKesson Corporation directors' idea was so successful that many other enterprises of the sector tried to imitate it, but they made a terrible mistake. They thought that the network created by McKesson was just a computerized system with terminals connected in other enterprises. The secret of the success of this company were not the computer links; information technology did not create the network. The network's success was due to the fact that the directors of McKesson were aware of both the relationships along the added value chain and the need to strengthen as much as possible every link within the chain, so cooperative behaviors could be established in order to provide the share of information and the quick response to the changes of the demand.

Example: Widely mentioned in the literature on Information Systems, is the one of the American Hospital Supply Company whose success has shown up the need to consider the network established not only as a mere system of electronic data exchange, but also as a better implementation of the technology found within a context of changes in the commercial relationships between the enterprise and its main customers.

They state that the implementation of this kind of technologies per se does not bring any competitive advantages; on the contrary, they must be accompanied by some particular elements, generally

intangible, which facilitate the operation of the organization by means of a better distribution of the information and the experience. They also reflect a collaborative attitude among the enterprises.

A positive consequence of the revolution of communication and Information Technologies is that there are more available options for designing the labour now, because the technology can be used to increase the capacities of the workforce, and the information can be transferred to those places were the labour is carried out. Workers do not need to be located according to parameters of time and space to co-ordinate any more. We consider that technology, although it is not the ground for the emergence of a new and innovative way of organizing the enterprises, plays an important role in its operation. Technology allows doing things in a different way, which provides the directors some organizational possibilities that would be unthinkable without its implementation. Thus, using a mathematical expression, we can state that Information Technologies are necessary but they are not enough to achieve greater business competitiveness.

Role of IOISs within the Network Structure

The enterprises involved in an alliance must decide whether to use the manual management of all the exchanged data, or to complement that management with the interconnection of their respective computer applications. This interconnection may bring, however, compatibility problems in the integration of the data from the different enterprises, since those applications would have possibly been designed without taking into account any requirement of integration among enterprises. The establishment of co-operation networks implies the need for wider communication in the organizational field, as well as the requirement of capability to integrate the information systems from different enterprises.

The enterprises inside a network cannot operate properly if they have not the possibility to communicate quickly, accurately, and over long distances. Within a network, it does not make any sense to restrict the application of modern computer technologies to the individual borders of each enterprise. The Management Board of the enterprises in the network must, on the contrary, consider the possibilities of coordinating the processing of data outside the limits of their own organizations by means of an IOISs.

The application of the IT which provides the electronic integration among the shareholders of an industry may make easier the outsourcing of activities, as well as be a basic part of the proper operation of the reticular structures. An IOISs may play an important role in the coordination of interdependent activities, which would be carried out by distant organizational units. Thus, the enterprises can reduce their dependency on strategies of backward-forward integration in order to ensure the control over the production process. The concept of network emphasizes the interdependency among enterprises, which is provoked by the presence and the sharing of the following key attributes: objectives, experience, labour, taking of decisions, responsibility, trust, and acknowledgement or reward. The enterprises within a network will adopt a common objective, namely to provide a quicker and better service to the final customer. With this aim in view, independent organizations will have to establish close interrelationships, in which Information Technologies have a vital role to play. In this way, the aim of optimizing the flow of profits along the supply chain could be achieved too. IOISs are, basically, new means to facilitate the relationships among organizations; they are, therefore, a strategic instrument. However, an IOISs allows to obtain operative advantages too, such as:

1. Reducing paper-work and manual operations;
2. Reducing the stock levels;

3. Accelerating the product and material flow;
4. Standardizing of procedures;
5. Accelerating the flow of information about changes on the demand;
6. Reducing telecommunication costs.

The IT is a basic support that facilitates the co-ordination of different enterprises through EDI systems, shared databases, e-mail, videoconferences, which will allow them to work together. They will be able to share information on the markets, on the needs for materials, on stock levels, production schedules, and delivery programs. A key factor in an efficient exchange of information within a network is the computer connection of its members. The computer links accelerate the transference of information, since it provides the automatic transmission of data between physically distant computers. These links can be used as a strategic instrument to increase the competitiveness of the enterprise, binding it electronically with its customers and suppliers through inter-organizational systems. The electronic connection facilitates the approaching of the linked enterprises, which means that the companies may provide the customers direct access to the internal databases, as well as just-in-time stock control.

1.5 APPLYING IT IN REAL WORLD

IT has improved the ability of human beings to process routine data, analyse the results and communicate the results as well as information. Collection, processing and analysis of data to form a judgment on the information is the essence of human thinking process; and communicating ideas and information with others for a common goal is the core of any social activity. As IT is essentially about these activities, there is hardly any sector of social activity where the importance of IT has not been felt. Organisations implementing IT are able to provide better services and thereby able to improve their businesses manifold. In earlier days, IT was used to a great degree in the manufacturing sector regarding product designing and development, product modification etc. The importance of IT has been strongly felt and applied in the services sector too.

Now we will discuss some real world cases.

1.5.1 Education and R&D

There has been a considerable shift in the learning paradigm due to the introduction of technology and newer methods of imparting education. New technologies are being gradually integrated into the learning environment. Perhaps, it is true that Information Technology (IT) is the greatest educational revolution since the invention of the printing press in the 15th century. As far as the IT revolution in education is concerned, the Internet allows virtual classrooms; digital libraries provide knowledge repositories; the Web offers up-to-date material for seminar discussions; computer simulation offers an alternative to labs. In spite of the fact that a majority of today's college classrooms are still dominated by the traditional lecture/discussion method, more and more technological applications are gaining hold in the classrooms. They range from very basic use of technology (using e-mail for communication and feedback, course Web pages, and course chat rooms) to enhancements of the traditional classroom (using presentation software such as PowerPoint, and computer simulations) to virtual classrooms using one-way and two-way audio-visual techniques, computer groupware conferencing, computer video and asynchronous computer conferencing, and asynchronous/CD-ROM hybrids. Technology also provides an opportunity to cross inter-institutional barriers to allow for an open class discussion