# TRANSFORMING INDIAN ECONOMY INTO KNOWLEDGE ECONOMY: THE ROLE OF HUMAN RESOURCES WITH REFERENCE TO INDIA

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The entire Ph.D study book dedicated
to my respectful mother,
Smt Shibani Chatterjee

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# Chapter-I

# Introduction

## 1.1: The Problem

In the late 1700s and early 1800s the world saw the events we now call this Industrial Revolution. We transitioned from an agricultural economy to an industrial economy. During this time, technological and economic progress gained momentum with the development of steam powered ships, railways, and later within the 19$^{th}$ century with the internal combustion engine- an electrical power generation. The GDP per capita was broadly stable before the Industrial Revolution in and the emergence of the modern capitalist economy. The Industrial Revolution began an era of per capita economic growth in capitalist economies. And we saw the American economy begin to flourish over time as the U.S became a major force in manufacturing. Over time we have seen this force of manufacturing leaving the United States. This has happened for many reasons, but the results are obvious. The US and many other industrially advanced countries began to be out manufactured by countries such as Japan- the auto industry is a prime example of this. Manufacturing began to move overseas for many reasons. The point is that manufacturing became a secondary part of the advanced countries. Agriculture's contribution to these economies has been reduced continuously.

In the case of U.S economy, agriculture constitutes only about one percent of the GDP. The main defining feature of the Industrial Revolution was a dramatic increase in the per capita production that was made possible by the mechanization of manufacturing and the processes that were carried out in factories. Its main social impact was that it changed an agrarian economy into an urban industrial society.

In an agricultural economy land is the key resource. In industrial economy natural resources, such as coal and iron ore and labor are the main resources. A knowledge economy is one in which knowledge is the key resource. It is not a new idea that knowledge plays an important role in the economy, nor is it a new fact. All

economies, however simple, are based on knowledge about how, for example, to farm, to mine and to build; and this use of knowledge has been increasing since the Industrial Revolution. But the degree of incorporation of knowledge and information into economic activity is now so great that it is inducing quite profound structural and qualitative changes in the operation of the economy and transforming the basis of competitive advantage. The rising knowledge intensity of the world economy and over increasing ability to distribute that knowledge has increased its value to all participants in the economic system. The implications of this are profound, not only for the strategies of firms and for the policies of government, but also for the institutions and system used to regulate economic behavior.

The knowledge economy is thus a term that refers to an economy of knowledge focused on the production and management of knowledge in the frame of economic constraints or to a knowledge based economy. In the second meaning more frequently used, it refers to the use of knowledge technologies, such as knowledge engineering and knowledge management to produce economic benefits. The phrase was popularized by Peter Drucker as the title of Chapter 12 in his book The AgeOf Discontinuity (1966).The essential difference is that in a knowledge economy, knowledge is a product, in knowledge -based economy knowledge is a tool. This difference is not yet well distinguished in the subject matter literature. They both are strongly interdisciplinary, involving economists, computer scientists, software engineers, mathematicians, chemists, physicists as well as cognitivists, psychologists and sociologists.

Various observers describe today's global economy as one in transition to a knowledge economy as an extension of an information society. The transition requires that the rules and practices that determined success in the industrial economy need rewriting as an interconnected globalised economy where knowledge resources such as know-how and expertise are as critical as other economic resources.

The remarkable economic growth throughout the globe is due mainly to the large extent to the advancement of knowledge combined with an increase in human resources, both in number and capabilities, and an increase in savings which have been translated into physical capital. Two factors have been important in increasing

knowledge. One is the growth of population and the other one is raising real per capita incomes.

A larger population leads to greater creation of knowledge (Kremer, 1993).This is so because the larger the population, the greater the benefit from a given improvement in productivity resulting from new knowledge. With a larger population there are also more individuals capable of making a significant discovery or adding to existing knowledge. But it is not always true that there are more of us available to add to world's knowledge. With the improvements in agricultural productivity, the expansion of the cities, and the very large increases in real per capita incomes that have occurred over the past two centuries, institutions, namely universities and research institutes of national importance, have been created specifically to advance and transmit knowledge. When 80 percent or more of the world's labour force was engaged in farming, a small percentage of a much smaller world population had the time and resources to devote to producing non-food products, such as clothing, tools, roads, and housing. More than seven times as many people as there were in1800 are now engaged in the creation of knowledge. The increase in knowledge has been complemented with improvements in the means of communicating that knowledge in an effective way, with the effect that knowledge has become much more accessible throughout the world, resulting in lower infant mortality rates, increased life expectancy, and higher per capita food supplies.

In India, great potential exists for increasing productivity by shifting labour from low productivity and subsistence in agriculture, informal industry, and informal service activities to more productive modern sectors, as well as to new knowledge-based activities – and in doing so, to reduce poverty and touch every member of society. To take full advantage of knowledge economy India needs strengthening the economic and institutional regime, developing educated and skilled workers, creating an efficient innovation system and building a dynamic information infrastructure.

The notion of a knowledge economy is not new to India. Our past achievements in science, philosophy mathematics and astronomy prove that the country has for millennia been a leading knowledge society. Indian policy makers today are keenly aware of the challenges and opportunities that India faces in different sectors and are already starting to implement some of the key actions that are

necessary to bolster India's effective transformation to the knowledge economy. Various reports, including the Indian Planning Commission's reports on India as Knowledge Superpower: Strategy for Transformation (2001) and India Vision 2020(2002); A.P.J. Abdul Kalam's 2002 Strategy India 2020: A Vision for the New Millennium (Kalam and Rajan 2002); and the High-level Strategic Group's India's New Opportunity; 2020 (AIMA 2003) underline ways to address India's transition to the knowledge economy.

India's initiatives have largely been developed around the three important pillars of the knowledge economy i.e. education, innovation and ICTs. . But to get the maximum benefits from investments in these areas, these initiatives must be part of a broader reform agenda, because some elements of our current economic and institutional regime are constraining full realizations of India's potential. We will not be able to reap the full benefits of its investments in increasing education, ramping up ICTs, or even doing more R&D, unless its broader institutional and incentive regime stimulates the most effective use of resources in these areas, permits their development to the most productive uses, and allows entrepreneurial activity to flourish to contribute to India's growth and overall development of the economy.

## 1.2: Objective of the Study

The knowledge economy is the story of how new technologies combine with human brainpower to transform the basis of economic activity. It describes how general purpose technologies have combined with intellectual and knowledge assets the intangibles of research, design, development, creativity, education, science, brand equity and human capital-help transforming the economy into its next phase of development.

Knowledge is a public good. At the physical level, one can share it with others without losing it. It is not rival in consumption, as are apples and oranges for example. It is mostly provided privately by individuals. Ownership of ideas is increasingly becoming more critical than capital. The ownership of intellectual capital is crucial to economic development. But in order to take advantage of knowledge, there is a need for appropriate institutions. The knowledge economy can result with proper

institutions in a society which is centered in human creativity and diversity, rather than in fossil fuels to power economic growth.

For the last two decades or so India has been known as a major knowledge power and thus many countries have established links with our growing economy. A World Bank Report (2005) has indicated that India has greater potentiality in increasing its productivity in all spheres of economic activities and this can enhance well-being of the population through proper and effective use of knowledge. We will seek to investigate the impact of the power of human resources i.e. the power of knowledge in agriculture, industry and service sector and what is more to see whether these sectors have been able to improve the Indian economy into a knowledge economy in true sense.

## 1.3: Research Issues and Questions

Some significant research issues have been identified to answer the following set of questions based on which we have formulated some hypotheses which in the subsequent chapters have been analyzed.

How can we define knowledge economy?

Are ICTs more effective in delivering social services to all sections of population?

Is education the fundamental elevator of the knowledge economy?

Are skilled people essential for creating, sharing, disseminating, and unique knowledge effective?

Does India possess a large pool of highly educated and vocationally qualified people?

Is tertiary education critical for the construction of knowledge economy?

Has India diffused knowledge and technology in agriculture?

How can we increase the stock of global knowledge?

Is India emerging as a major global R&D platform?

Is India weak on turning its research into profitable applications?

Is the use of ICTs in India reducing transaction costs and lowering the barriers of time and space?

Has India made global achievements in the IT sector?

Has explosive growth of ICTs been concentrated only in urban areas?

Is India a leading exporter of IT services and software?

Is the Indian Industry becoming more innovative?

Is the Knowledge technology and skills intensity of industrial Output increasing?

## 1.4: Hypotheses Tested

On the basis of overall discussion in the light of review of some related literature we have formulated some research questions and on the basis of these questions we have formulated some hypotheses. Indeed an exhaustive list of hypotheses cannot be prepared. Our investigation has forced us to formulate some hypotheses and finally we have modified some proposed ones.

The following hypotheses have been probed:

1. That the application of knowledge has helped transforming our agriculture into a more productive one is tested with the help of supportive data.
2. That Indian industrial sector has gradually been becoming knowledge based
3. That India possesses a large pool of highly educated and vocationally qualified people.
4. That India can easily increase the stock of global knowledge.
5. That India is weak on turning its research into profitable applications.
6. That India has emerged as a major global R&D platform could only be probed partially due to inadequacy of quantitative data we require.
7. That the use of ICTs is reducing transaction costs and lowering the barriers of time and space.

8. That India has made global achievements in the IT sector through the export of IT services and software.
9. That the growth of ICTs has wide in the rural areas.
10. That human resource is playing a significant role in the forward march of Indian knowledge economy.
11. That knowledge economy has positive contribution to the GDP/that GDP growth of Indian Knowledge Economy is praise worthy.

## 1.5: Methodology and Information Sources

This study seeks to examine India's transition into the knowledge economy-an economy that creates, disseminates, and uses knowledge to enhance its growth and development. This study is partly descriptive and analytical and partly it is exploratory. Exploration seems to be incomplete if we are unable to visualize the impact of knowledge into different dimensions of the economy. This in turn will usher in the growth of agriculture, industry and service sectors.

The study covers the entire Indian economy. It specifically deals with the impact of the knowledge economy to different sectors such as agriculture, industry, services and international trade and its consequent impact on the well-being of the people.

The study is taken up with the help of secondary data published by the Government (NSSO, various Ministries etc.) and data published by non-governmental-non-profit organizations. Data published by Ministry of Agriculture, Ministry of Industries ,Ministry of Finance, Ministry of Railways, etc. are utilized to explore the impact of knowledge on productivity over different periods of time. Data published by international organizations such as World Bank, IMF, ILO, UNESCO, UNO, WHO, are utilized. Published and unpublished research reports and survey data have consulted.

Method of investigation is both inductive and deductive method as used in economic investigation. For compilation and analysis of quantitative information simple descriptive statistical techniques such as average, percentage, standard deviation, growth rate have been deployed.

## 1.6: The Study Framework

The dissertation contains ten chapters. The study to probe the basic objectives stated is organized as follows.

### Chapter-I: The Introduction

In the introductory chapter, an overview of knowledge based economy is made to set the objective of the study. Statement of problem, research questions and hypotheses probed has been described. Sources of information and methodology of investigation are also included in this chapter.

### Chapter-II: Review of Literature

This chapter elaborately reviews the existing literature relevant for our investigation for deeper understanding (and framing our objective and research hypotheses described in chapter 1).

### Chapter III: Knowledge and Knowledge Based Economy

In this chapter concept of knowledge and knowledge based economy is made. Some reference is made of Indian knowledge economy.

### Chapter-IV: India as the Knowledge Economy

This chapter analyses performance of Indian economy. Penetration of knowledge in the Indian economy and consequently her increased global competitiveness with the development of education and human resource in the knowledge era is discussed in this chapter.

### Chapter -V: Information Technology and Knowledge Economy: Role of Indian Service Sector

Service sector is gaining importance across the world. The vital role of service sector in knowledge based economy cannot be appreciated without proper understanding of interconnection between IT and service sector. Investigation in this direction is the subject matter of this chapter. We have here also concentrated on participation of elderly person in the society. In the new age, chronological constraint is much diluted – due to growth of Internet. A comparative analysis is therefore is worthy to investigate participation of elderly between India and USA.

### Chapter-VI: A Discourse on Knowledge Based International Trade- Pragmatic Analysis

In the globalized Knowledge Based world, economic order and development possibility without exaggeration may be stated to lie in integrating the nations – developed and developing world. External trade is key to globalization thus development prospect lies in the participation in international trade. The subject deliberates on knowledge based International Trade.

### Chapter-VII: Impact of Knowledge Economy on Indian Agriculture

This chapter discusses the nature of Indian agriculture. The impact of knowledge on production, productivity and marketing of agricultural commodities is probed. Discussion is made on agricultural research and IT, IT in agricultural extension management, IT in agro-based rural development, role of GIS in agriculture, scope of rural internet, IT based agricultural communication in India. Some case studies are reviewed for deeper understanding.

### Chapter-VIII: Knowledge Influencing Industralisation in India

In this chapter we discuss, in brief, the growth of industries and study the impact of knowledge on the production, productivity and marketing and also on overall employment scenario. Knowledge revolution has opened up avenues of effective and wider use of human capital. Human capital like all other physical capital has to be produced. Sustain effort is necessary at the national level. Human capital is consumed in the production process and at the same time human mind is the birth place of every kind of knowledge and its application. Research is imperative with training.

### Chapter-IX: Knowledge Expansion and Human Resource Development in India

Different facets of human resource development such as skill, efficiency and organization, quality improving strategies etc. in Indian context are the subject matter of chapter-IX.

### Chapter-X: Conclusions, Findings and Recommendations

This chapter summarises, conclueds and recommends.

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# Chapter-II

## Review of Literature

### 2.1: Introduction

This chapter deals with the review of existing literature on the knowledge economy with respect to developed as well as developing country context. A large number of literatures in Indian context have also been reviewed for our purpose. Based on this review we have been able to identify some of the important aspects of the knowledge economy vital for the growth and expansion of different sectors such as agriculture, industry and the service sectors of the Indian economy. The review of literature has been done in section 2.2.

### 2.2: The Review

Knowledge Harizons (2000) edited by Charles Despres and Daniel Chauvel (Budler worth Heinemana) have arranged valuable 15 papers in four arranged valuable 15 papers in four sectors in which section I (Part I: Knowledge Management what is it?) comprises three articles, one by Kavl M. Wiig, one by Robert M. Grant and the third one by Charles Despres and Daniels Chauvel. The first article by Wiig elaborately discusses the long history of knowledge management, a major part of it being the intellectual roots of knowledge management. The present day knowledge management, according to Wiig, has many origins, like philosophical thinking, concerns for requirements of expertise in the work place, perspectives of education and business leaders.

The second article in the book by Robert M. Grant explores two specific questions relating to current knowledge revolution in management. The questions are as follows.

Why this recent explosion of interest in knowledge management? What are critically important contributions that the knowledge perspective offers to management theory and practice? The first section investigates the reasons for the

surge of interest and activity in knowledge management. The author specifically focuses in particular on the changes that have occurred in the world economy. In discussing second question the author explains that management is subject to fashion, hype, bandwagon effects, misinformation, and the activities of unscrupulous entrepreneurs. Grant views that in spite of its drawbacks knowledge management offers a set of ideas and insights that give if the potential to make the most important advance in management theory and practice of the past 50 years. The author asserts: although information and communication technology from e-mail to groupware, the Internet, and intranets have made huge strides in classifying, storing and transferring explicit knowledge, it is the management of tacit knowledge that the major challenge remains. The third article by Charles Depress and Daniele Chauvel (the editors of the book) explain, in detail, the sociology of knowledge wherein they define community and discuss models in the community. They also summarise three pillars of knowledge management as explained by Karl Wiig.

In section II of the book (Part II: Knowledge – Intensive Management) there are four important and resourceful papers relating to knowledge – intensive management. The first article in this section, contributed by Ikujiro Nonaka and Partick Reinmoellen, is about creation and utilization processes in knowledge creation theory which in effect discusses hard and soft components and structural and procedural perspectives of dynamic systems, creative routines, and hard and soft components of dynamic systems for knowledge creation and utilization. The structural perspective includes both information technology and organizational systems. IT provides the structure of creation and exploitation of explicit knowledge. IT in knowledge, the authors address, has three advantages, viz, efficiency, effectiveness and velocity. The authors give so much emphasis on human resource and career development programmes because these are the systems promoting internalization of explicit knowledge.

Another paper in this edited book by Anthony K.P. Wensley and Alison Venwijk – O' Sullivan discusses knowledge management and the nature of the tools that we may have at our disposal to manage knowledge. The authors in this article state that knowledge management has to do with the management of all stages in the generation, codification, refinement, and transmission of knowledge. They also discuss that web offers a powerful platform for tools supporting all stages of

knowledge management such as SAP, ERP/ ERM package, AFC (Active Collaborative Filtering) etc.

David J. Teece in his "Managing Knowledge Assets in Diverse Industrial Contexts" analyses that competitive advantage (superior profitability) at the enterprise level depends on the creation and exploitation of difficult to replicate no tradable assets among which the most important one is knowledge assets. It also discusses that competitive advantage flows from the creation, ownership, protection, and use of difficult to imitate knowledge assets.

J. C. Spenden in his "Managing Knowledge Systems" clearly mentions that knowledge is a corporate asset which must be managed scientifically. But it is not possible to manage knowledge until and unless it is identified properly. It also considers knowledge as an asset that can be privatized and objectified. Knowledge assets also present special management problems when knowledge needs to be transported, transferred, traded, or stored. Much knowledge management is about identifying and protecting and exploiting knowledge such as patenting. Another is about managing the processes of invention and innovation and is also managing information systems. Section III (Part III: knowledge – Intensive Organisations) comprises five most relevant papers.

Peter Murray, in his paper (Designing for Business Benefits from knowledge Management) develops a programme of action for organizations that are considering knowledge management and for this draws on a survey of 260 European businesses conducted by the Information Systems Research Centre at the Canfield School of Management. The paper specifically examines the perceived need for knowledge management, its nature, how success can be ascertained, and what learners there is to be effective knowledge management, and suggests some ways of implementing the programme. Michael J. Earl and Ian A. Scolt in their paper (What do we know about CKOs?) in 1997 made a study in the title the Chief knowledge officer or CKO and their results were published in 1999. They studied 20 CKOs in three steps, namely, they conducted interviews, administered a personality test and held workshops with the participants in London and New York to discuss their survey results. The CKOs are appointed by the CEO and they are not the permanent staff. Their aim, as the paper suggests, is to initiate knowledge management and ensure that the philosophy

and practice become embedded in the organization. Thus the CKOs have two particular leadership qualities – they are the entrepreneurs and the consultants.

Regarding the functions of the CKOs the authors add: "……. they have to create awareness of knowledge management, faster language and develop frameworks to help managers understand what it is, what is new and what can be done to sell the promise and to create support and demand for knowledge management initiatives".

Etienne Wenger (2000) in his paper "Communities of Practice: The Structure of Knowledge Stewarding" [knowledge Horizon (2000), Edited by Charles Despress and Daniele Chauvel, Butter Worth Heine Mana] discusses that communities of price have been around for a long time. These are in fact the first forms of knowledge organization. Communities of practice are found everywhere at work, at school, at home, at gatherings it. This consists of three elements it has a sense of joint enterprise. This brings members together. It works as a community which creates a relationship of mutual engagement among the members. In this system learning takes place through joint activities with a concrete relationship of trust and mutual understanding. This produces the shared repertoire of communal rezones among the members through their mutual engagement. This includes routines, lessons learned, semibilities, artifacts, standards, tools, stories, vocabulary, styles, and so on. The communities of practice are also found with the businesses, across business units across institutional boundaries, and across multiple organizations.

Theories of the firm are concerned primarily with predicting the behaviour of firms in external markets. Neoclassical theory of the firm uses, in most cases, partial equilibrium analysis to predict firm's purchase decisions in input markets and supply decisions in output markets. Robert M.Grant(1996) in his paper explores the coordination mechanisms through which firms integrate the specialist knowledge of their members. Here 'knowledge' is viewed as residing within the individual and the primary role of the organisation is knowledge application rather than knowledge creation. The author assumes that the critical input in production and primary source of value is knowledge. An interesting feature of the knowledge-based approach, as the paper suggests, is that it offers a theoretical basis for understanding a number of recent organizational innovations and trends which include the renovation of traditional organizational structures through delaying and empowerment and the development of new organizational forms including horizontal and team-based

structures and inter-firm alliances. The knowledge-based approach also calls into question other contemporary trends in corporate management. The primary driving force behind corporate restructuring and strategic change has been the quest for shareholder value maximization and enhanced shareholder power. The paper states that if primary resource of the firm is knowledge if knowledge, is owned by the employees, if more of this knowledge can be exercised by the individuals who own this, then the theoretical foundations of the shareholder value approach are challenged. The paper gives emphasis on the application of knowledge and the role of individual.

Surendra Gera (1998) in his paper analyses industrial structure in Canada over 20 years from 1971 to 1991.In analyzing the role of knowledge in enhancing the level of output in the Canadian economy the author relies on Statistics Canada's national input/output data for three sub-periods: 1971-1981, 1981-86 and 1986-1991.The study basically addresses three questions: Is the Canadian industry becoming more innovative? Is the knowledge technology and skills intensity of industrial output increasing? What are the key factors driving this structural change-domestic final demand, exports, imports, and/or changes in production techniques? The study analyses structural change at the sectoral and industrial levels. Industries have been identified as "high-growth" and "low-growth" industries. Canadian changing industrial structure has been analysed under three headings: change at the aggregate level, change at individual industry level, and the pace of structural change. Analysis at the aggregate level shows that there has been a dramatic decline in the manufacturing sector and a rise in the service sector. It also shows that primary industries and construction sectors have not shown any major changes in the output share. Analysis at the individual industry level shows that of the 13 leading growth industries in 1986-91 eight appear among those which led in the two preceding sub periods. Eight industries such as computers and office equipments, communication equipment and semiconductors, communication services, real estate and business services; community, social, and personal services, pharmaceuticals; Electricity, gas, and water; and finance and insurance are Canada's growth engines.

The industries in decline are textiles, clothing, footwear,and leather;food,beverages,andtobacco;wood,woodproducts, and furniture; electrical equipment and appliances; iron and steel; other transportation equipment; other

manufacturing and heavy industries. As regards the pace of structural change statistical measures suggest that the Canadian economy experienced the greatest degree of structural change during the first half of 1980s.

The overall manufacturing sector in Canada, as the paper explains, has been declining over the long term consistently losing output share to the service sector since 1970s.This shows that there has been a clear shift in the composition of manufacturing output towards knowledge-intensive industries.

The shift from the industrial economy into knowledge economy shows how people think and what value they assign to all parts of their lives. Christopher S. Rollysen (2006) in his paper shows that knowledge economy will transform roles between all parties in the economy. It will see extensive collaboration in which buyers will tap into sellers resources to participate in the design and delivery of products and services. Similarly, sellers will access buyers' knowledge about experiences and emerging desires. This, in fact, according to Christopher, will benefit buyers and sellers immensely and bring significant wealth. The knowledge economy, as the paper states, will be able to bring a quantum leap in productivity over the industrial economy. This is so because all economic agents (players) gain competence in creating, managing and showing digitized knowledge.

The Indian software industry has made an impressive track record especially since early 1990s.It is everywhere discussed that India can transform itself into a knowledge-based economy by riding the information technology bandwagon. Prabhudev Konana and Sridhar Balasubramaniam (2002), in their paper , give stress on sustainable and effective changes in information technology in India and in this discussion they expressed doubt about this situation because of the fact that nearly 80 percent of India's population lives in villages with limited basic infrastructural facilities .Not only this ,nearly 40 percent of the population is illiterate .Obviously, they will not be able to take the benefit of information technology such as the use of internet for gathering market information. A majority of the people whom we call literate also are unable to go beyond the ability to read and write simple words. This criterion does not support the growth and expansion of knowledge economy. It is a fact that economic development is cumulative. If industry develops, for example, it must help the agriculture sector to become more vibrant and productive. The productivity in agriculture multiples because of industrial and biological innovations

including tractors, irrigation systems, fertilizers, pesticides and genetically engineered seeds. This certainly improves standard of living across societal divides. This was noticed in the developed nations during the age of industrial revolution. The paper states that the IT sector employs a few million people. But the alarming fact is that the IT industry holds limited potential for wealth to trickle down to the poor. This means that the rich and the educated can derive the full advantage of IT industry while the uneducated and the poor are oblivious to its impact. The IT can, the paper describes, change the way a society communicates, collaborates, lives, works and plays. The growth of IT sector in India symbolizes the potential of industry to perform at world-class standards. But the fact is that the success of IT at the corporate level in India cannot solve its unending social and economic challenges.

Resource-based theory tells us that there is perhaps no direct evidence to verify the fact that intrinsic characteristics of resources and capabilities such as their tacitness, complexity and specificity prevent imitation and thereby prolong exceptional performance. Susan K. Mcevily and Bala Chakravarthy (2002) in their paper investigate whether imitation barriers can protect advantages that stem from unique knowledge. They have tested this resource-based proposition by examining whether the complexity, specificity, and tacitness of a firm's technological knowledge affect the speed with which competitors match its product performance improvements. An improvement, the paper explains, is any increase in product efficiency above and beyond the level of performance previously offered by products on the market, although it is distinguished between major and minor improvements according to the degree of advance. The authors expect that resource-based predictions for persistence will apply only to major product improvements because these are based on distinctive knowledge. Resource-based theory maintains that if a firm's performance advantage is based on a unique resource, it should persist longer when a firm's rivals cannot easily recreate or gain access to that resource. The authors continue that competitors must mimic a firm's product design to match its performance, and this requires possession of comparable technological knowledge and that unique knowledge that is better protected by imitation barriers should confer more persistent product advantages. The overall explanation is that imitation barriers are at least partly located in resources, and suggest that the theory can be applied to knowledge resources. One of the important qualifications offered to this theory is that the size of a firm's advantage may moderate the efficacy of these barriers.

The knowledge economy can transform the roles between all parties in the economy. All economic agents can be beneficial from the effect of knowledge economy. Manorama Tripathi's paper(2006) gives an exposition of current developments in the information and communication technology (ICT) sector in India and their implications in transforming the country into knowledge economy. It specifically analyses the ICT infrastructure, policies, present states within the framework of India Vision 2020.It also describes India's rank in global IT infrastructure , digital opportunity Task Force of G8 (Dot Force) World Summit on the Information Society(WSIS) Geneva 2003 and Tunis 2005.The paper dwells upon the challenges which must be overcome to attain the status of knowledge economy of the country.

Technology and knowledge are the key factors of production with increased mobility of information and the global work force, knowledge and expertise can be transported instantaneously around the world, and any advantage gained by a firm can be reduced or eliminated by competitive advantage within a short time span. The only thing that a country can enjoy is its comparative advantage of knowledge economy. Carl Dahlman and Anuja Utz (2005) in their paper have modified the definition of knowledge economy and have described that it would be appropriate to use the concept more broadly to cover how any economy uses the new and existing knowledge to improve the productivity in different sectors of the economy such as agriculture, industry and service. This would ultimately increase overall well-being of the country .They predict that India can increase its output at a maximum level if labourers can be shifted from low productivity and subsistence activities in agriculture, informal industry, and informal service activities to more productive modern sectors and knowledge based activities. This effort can be able to reduce poverty and touch every member of society. In their paper they have indicated that India has a number of favourable points to become a leader in knowledge creation and use. The paper states India has a critical mass of skilled, English speaking knowledge workers, especially in science and technology. Not only this India has a well functioning democracy and has a huge domestic market. It has macroeconomic stability, dynamic private sector, institutions of free market economy, a well developed financial sector and a broad and diversified science and technology infrastructure. The paper gives stress on strong basic education system and improvement of tertiary education. It states that tertiary education is critical for the

construction of knowledge economies. India, as the paper describes, currently produces a solid core of knowledge workers in tertiary and scientific and technical education, although the country needs to do more to create a larger cadre of educated and agile workers who can adapt and use knowledge. In this paper, the authors explain that, in India, with its relatively small formal sector, a very important part of its innovation system relates to how modern and more efficient practices can be diffused to the greatest number of users. India has done a remarkable stride in diffusing knowledge and technology especially in agriculture.

The rise in knowledge intensity is being driven by the combined forces of the information technology revolution and increasing pace of technological change all over the world including India. Rajarshi Majumdar(2007) in his unpublished paper (available in the website) states that since late 1990s, a large segment of mainstream media and economists have been giving emphasis on the emergence of knowledge economy in OECD countries and its consequent development in the developing countries. This new model of growth, the paper addresses, depending more on human knowledge and efficiency rather than on difficulty to disperse physical capital, is supposed to be more egalitarian. Proper policies in developing countries are advocated to build up large volume of working capital in terms of human resource crunch and meagre stake in global- trade. The paper looks at some of the issues related to knowledge economy in the context of Indian experience.

Ruben F.W. Nelson (2000) in his paper has rightly defined the knowledge economy and its impact on the different spheres of the economy. The paper says that it is the knowledge-in-use, and not merely the possession of information is the key to sustained success in every area of life and it is revealed in the growing preoccupation with the formation and transformation of cultures, whether in families, organisations or whole societies. It stresses upon the fact that social cohesion can no longer be achieved by either the assertion of one's authority-technical or structural-or by the use of majority votes. Unconvinced minorities, as it describes now undercut virtually and become ungovernable if it does not develop the capacity to create, trust and act on knowledge that is both reliable and widely acceptable. The author gives a caution to us: " If we are to survive as free persons and societies, we must develop a much deeper capacity than is now possessed by the citizens of any industrial society, to democratically co-create and agree upon that which, for us as persons, organizations

and society will be true and binding knowledge." The author, in his paper, further asserts that it is time to grow into a full adult maturity and to use this as the only standard by which we will judge our knowing, believing and behaving.

The changing dimensions of the Indian economy in the light of the growth of knowledge based society has been portrayed in the writing of Rajesh Kumar Jhamb and Sanjay Kaushik(2008). They have indicated that in the knowledge-based economy, knowledge management has received considerable attention in the economy and it has in fact now become a mainstream priority for any business organisation. The paper relates the issue with globalization and concludes that information and knowledge society have increased the comfort of living.

Multinational corporations are essential global players in terms of global production and exports of goods and services. They are also more than enough competent in the home market relative to foreign markets. Keller and Yeaple's paper (2008) explains all these aspects in detail with supportive data. This paper explains that multinational firms face increasing costs to transferring the technology abroad. This is contrary to the technology abroad. This is contrary to the general belief that multinational corporations enjoy cost advantage because of cheap labour and lower transport cost if produced in the developing countries than at home. The authors state that due to increasing cost conditions abroad the MNCs are mush successful if they continue to produce in the domestic market. This paper highlights the importance of intermediate inputs in international market flows. The authors have introduced a model of multinationals explaining a rich array of multinational behaviour by the interaction between physical transport costs and technology transfer costs. This model also considers physical transport costs and the ability of firms to fragment their production technology into traceable components. An additional assumption in this model is adopted. This assumption is that there also exist technology transfer costs that are increasing in the complexity of components in the production process. This also increases marginal costs of serving foreign markets as the size of transport costs increase. A set of hypotheses have been tested. One such hypothesis is that the cost of intermediates imported from the parent in total affiliate costs should be decreasing in transport costs between multinationals slower for firms with relatively complex production technologies. Another hypothesis that has been tested is that the probability that a given multinational opens an affiliate in foreign location should be

decreasing in transport costs and the rate of decrease should be faster for firms using technically complex production technologies. The authors have empirically tested the hypothesis and found that when technologies are relatively complex, affiliates have less opportunity to substitute for imports from their parent with local production. Also it is found that both the extensive and intensive margins of affiliate activity contract as transport costs rise, and this is true for firms with relatively complex production technologies.

Vinod Kumar, Harsha Sinvhal and Vinay K. Nangia (2009) study the impact of some thirteen areas in shaping a knowledge economy. They, in fact, elaborately analysed a proposal / project titled "National Competitiveness in the Knowledge Economy" prepared and submitted by Indian Institute of Technology – Roorkee to the Department of Information Technology of the Ministry of Communications and Information Technology in 2006. The key areas highlighted in the paper are demography, socio-economic scenario, IT-based and non-IT based technology, environment, natural resources – renewable and non-renewable, energy resources – renewable and non- renewable water management, national, regional and global inequalities, health, military, geo-political realities, agriculture and global system. It is stressed that India is going to be country of young people while the so-called developed nations may have a large size of population who are in relatively older group. In their paper a set of questions were raised regarding national, regional and global inequalities. The questions are as follows. What factors will decide the national, regional and global inequalities, and evolve strategies to bridge the gaps? Will knowledge economy widen the divide or bridge it? How can knowledge economy deal with the issue related to equal rights and opportunities, irrespective of colour, race and gender? It is stated that with better technology and knowledge of modern techniques, in developing countries also there may be a major shift of population from agriculture to other sectors of economy. It is also stated that the effect of knowledge economy on agricultural sector may ensure a better life for the majority of Indian population.

K. Narayanan and Savita Bhat (2009) in their paper have analysed the structure and behaviour of the IT fibers in India. The pattern of growth for the three segments of IT industry i.e. computer hardware, software and IT-enabled services has been attempted in this paper. An overview of IT industry in India has been analysed in

which the details of the initiation of IT industry in India during 1960s and 1970s and the role India can play in this sector have elaborately been provided. By 1980s India was capable of exporting software and computer peripherals. Also India permitted import of mainframes and super computers for the purpose of modernizing the Indian IT industry. The paper highlights the major policy issues India Government took during 1960s and 1970s, 1990s and during 200-2006 for the growth of Indian IT sector and its consequent effect on the growth of income and the growth of the gross domestic product (GDP). This sector alone had an impact of over 35 percent to the total exports. An empirical analysis of the sample data from the Indian IT industry has been done wherein the growth, profits and technological behaviour of IT firms have critically been described.

Arindam Banik and Pradip K. Bhaumik's paper "India's Transition to knowledge Economy: Variation Across States" (2009) makes a comparison between human and economic capital in developing country perspective. They have shown in this paper the interdependence of economic and human capital. It is found that the productivity of economic capital depends on the intensity of human capital and vice-versa based on data published by the CMIE, Economic Survey data 2005 – 2006 published by the Government of India and the data published by Indiastant.com Only the data of 2003-2004 were considered to especially explain the time dimension of the transition of Indian economy into knowledge economy. The findings reveal that the rise of knowledge economy is very important aspect for the overall growth of Indian economy in the 21$^{st}$ century.

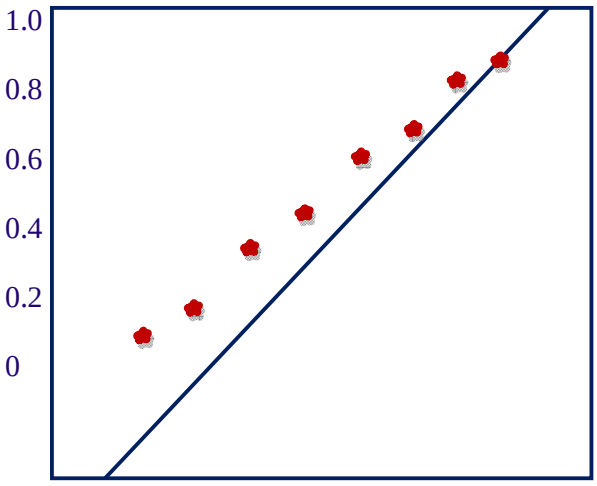
Siddharth Mahajan, Ashoka Chanda and Mainak Sarkar in their paper "An Approach to Developing Knowledge Economy Indicators for Individual States" (2009) have developed a knowledge economy methodology for the states of India with a discussion on knowledge assessment methodology framework developed by the World Bank.

The knowledge assessment methodology (KAM) developed by the World Bank is based on four pillars, namely education and training, innovation and technological advancement information infrastructure and economic and institutional regime. The variables related to first pillar (i.e. education and training) are adult literacy rate, secondary enrolment & tertiary enrolment. Innovation and technological advancement include researchers in R & D (per million population), patent

applications granted by the USPTO (per million population). The third pillar i.e. information infrastructure includes telephones per 1,000 persons, computers per 1,000 persons and internet users per 1,000 persons. Economic and institutional regime comprises tariff and non-tariff barriers, regulatory quality and rule of law. The authors have measured the performance of a particular state over time with the help of knowledge economy indicators (KEI). KEI is calculated by taking the average of the normalized scores on the four pillars of the knowledge economy for each state. A state KEI between 0.9 and 1.0, the authors estimated, implies that the state is in the top 10 percentile amongst the states in moving towards a knowledge economy. A state KEI between 0.2 and 0.3 indicates that a state is in the bottom 30 percentile but above the bottom 20 percentile in moving towards a knowledge economy.

The comparison of a state's KEI in a reference year (for example, 2000) with its KEI in the current year (May, 2013) can be seen in fig.-2.1 shown below.

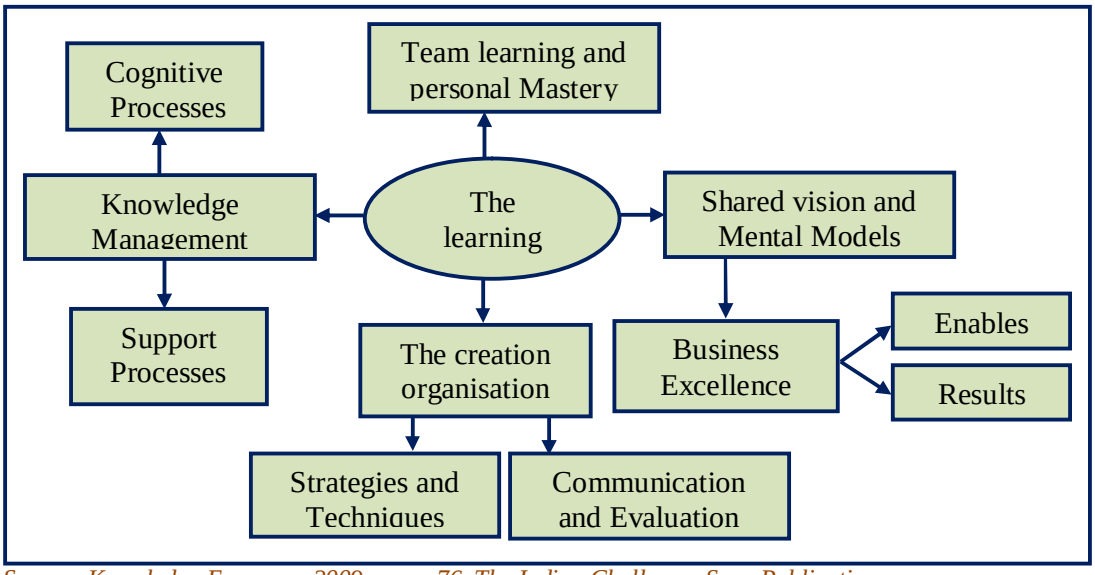
**Fig-2.1:**




In figures-2.1, the X axis indicates state KEI in the base year and the Y axis the state KEI in the current year. The solid line bisecting the figure in the line y = x, that is the state KEI in the current period is the same as the KEI in the base period. A point to the left of the solid line in the figure indicates that the state has improved its relative performance i.e. the state KEI in the current period is higher than the state KEI in the base period. Similarly, a point to the right of the base line indicates that the state KEI in the current period is lower than the state KEI in the base period.

The authors also have tried to show a relationship between annual economic growth and knowledge economy indicators in the country level. Himanshu Joshi, Vidhu Shekhar Jha and Siddharth Mahajan (2009) in their paper have analysed that knowledge and learning are the fundamental factors for achieving business excellence. For this, the authors consider, it is necessary to establish and sharing. In their paper the authors have established a relationship between knowledge management and learning organization. It is a great challenge before any organization to properly manage its intellectual capital. In any business enterprise today knowledge has become power and learning rapidly has become a pre-eminent strategy for success. Obviously, knowledge is becoming more important to organization than financial resources, market positions, technology and other tangible assets. The authors have adapted the model of learning organization and business excellence from causal model of Eskildsen et al. (1999). This model is shown below in fig.2.2.

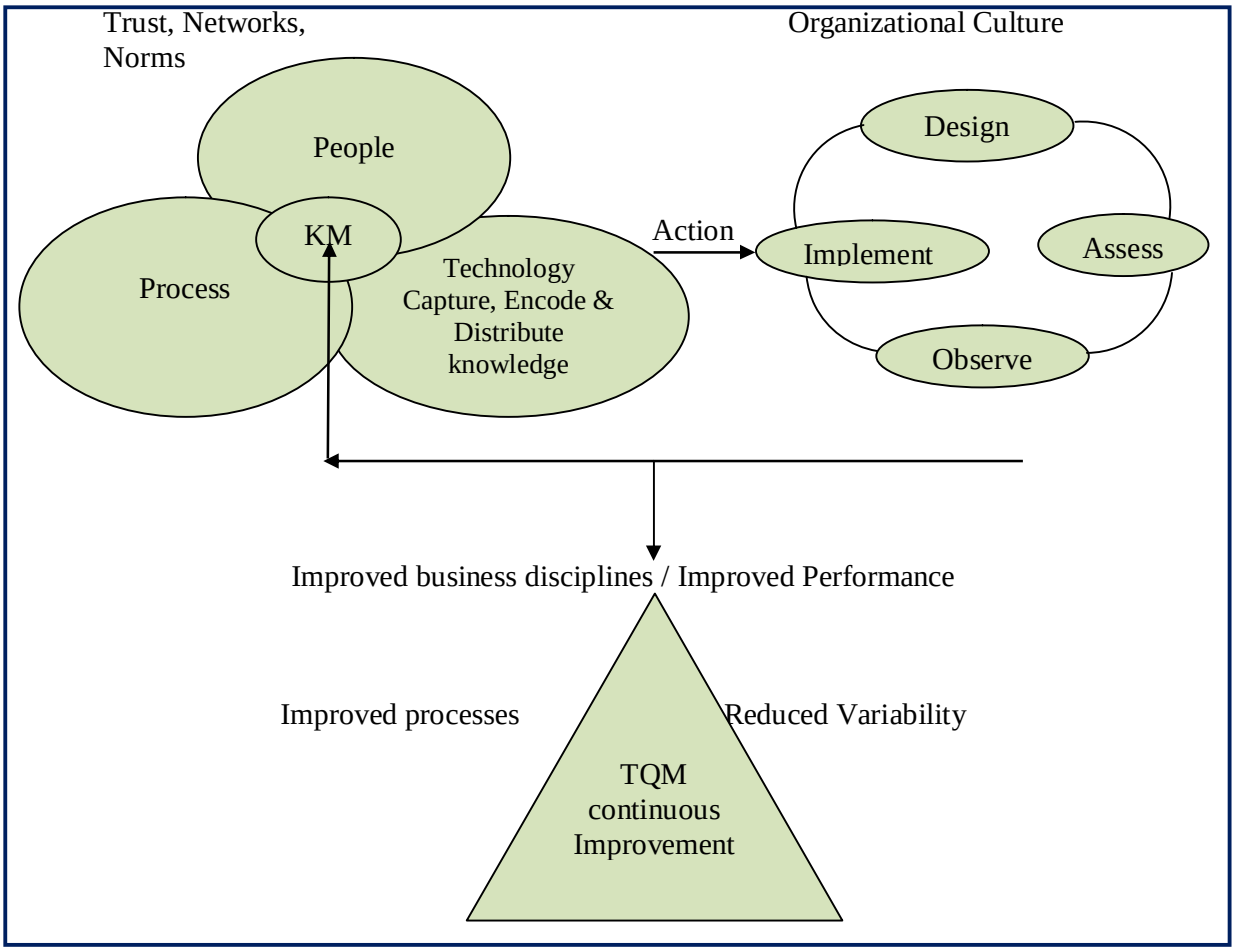
**Fig – 2.2: Model of Learning Oganisation and Business Excellence**




*Source: Knowledge Economy, 2009, page, 76. The Indian Challenge, Sage Publications.*

Organizational transformation and the proposed benefits have been nicely described in the paper. The authors have built up a reinforcing model of knowledge management practice towards a learning organization for achieving business excellence. The model development by the authors is shown in figure-2.3.

**Fig.-2.3: Reinforcing Model of Knowledge Management Practice towards a Learning Organisation for Achieving Business Excellence**




*Source: Joshi, Jha & Mahajan, 2009*

Prema Rajagopalan and M.S. Matheds (2009) in their paper entitled "Indentifying New knowledge stream in the Evolving Knowledge Economy" have described eight core areas as streams of knowledge that evolve knowledge economy. These areas are identified in a workshop held at the Indian Institute of Technology, Madras. The Key areas thus identified are power and communication, computer science, biotechnology, infrastructure, nanotechnology, energy, manufacturing and mechatronics. It is stressed to recognize the existence of multiple knowledge economics in the global context and the scope and dimensions of each economy can range from a small community of a country to a regional integration of even many

countries. It is also hoped that each individual knowledge economy is well developed based on its distinct characteristics.

For economic development of a country the role of knowledge is paramount. Knowledge plays an extremely important role in the three pillars of development, i.e., economic development, environment development and socio-cultural development and it is the innovation and competitiveness that are vital for knowledge economy. Rajeeva Ratna Shah's paper entitled 'Innovation in Knowledge Economy' explains elaborately the key drivers of innovation, viz, technology, global competitiveness human resource, role of public and private sectors, public – private partnership etc. In a knowledge society, the author states, knowledge benefits the common man. Due to innovation and the consequent growth of the ICT it is now possible to have a complete list of all the villages and the names and addresses of all the villagers in India. Naturally, the implementation of rural development programmes such as MGNREGA can easily be monitored, although data capture is still a problem.

A.K. Sengupta in his paper 'Intellectual Property Rights in Knowledge Management' (2009) has described some issues concerning the interplay of intellectual property rights (IPR) in the knowledge management processes, in the industry and traditional knowledge sectors in Indian context. A detailed discussion has been made on the agreement on Trade- Related Aspects of Intellectual Property Rights (TRIPS) in which eight categories of intellectual property have been defined. These are patents, copyrights, trademarks and service marks, design registration, layout designs for integrated circuits, trade secrets and undisclosed information, geographical indications and new plant varieties.

An elaborate analysis has been made to patents throughout the paper. It is said that an effective intellectual property rights system can speed up the process of identification, development, dissemination and undertake of innovations through the expansion and development of knowledge economy in India.

Arundhati Chattopadhyay, G.S. Krishnan and U.S. Singh sponsored mechanisms, such as, 48, Association of Southeast Asian Nations (ASEAN), South Asian Association for Regional Cooperation (SAARC) and Organisation for Economic Cooperation and Development (OECD) establish international networks in the economic field.

International networks in the cultural field are established through increased communications and opportunities to travel. The core factors behind the current phase of globalization, the authors suggest, are least possible barriers to trade and investment, to minimum transport cost, least possible IT costs and the rule of internet. A broad and informative discussion has been made in this paper about the importance of knowledge network where the key elements of knowledge network are people, hardware, software, and procedures like access, navigation, observation, analysis, repository and learning. In this paper the authors explain that the problem of poverty in the Indian economy may be eliminated if India's natural and human resources are fully utilized for building competence and technologies that lead to the qeuvation of high – income employment and value addition in different sectors of the economy and for this purpose it is of utmost importance to create a knowledge society through the creation and maintenance of knowledge society infrastructure, development of knowledge workers, and the increase in productivity through creation, growth and utilization of new knowledge.

K. Sankaran (2009) in his paper explains the impact of cultural and social factors that promote self-organization among those who are trying to bring about effective social IT networks. In the course of analysis the author describes that inter-organizational arrangements such as just–in-time (JIT) and business process outsourcing (BPO) enhance overall effectiveness of network participants. The success of inherent and the firms like Google, as stated by the author, attribute to the power of collective minds together based on principle of self-organization. Mr. Sankaran has referred to a qualitative study conducted on how information technology (IT) can facilitate social capital among institution in the coastal areas of Karnataka. The objective was, the author explained, to find out the extent to which internet and IT are used by institution to exchange information among them, create and further 'associations' among them and receive and offer e-enabled services. In this study five types of organizations are indentified. These organizations are businesses, professionals, service providers, non-governmental organizations (NGOs) and government. The issues covered in this survey are of two types: Level 1 and Level 2. Level 1 issues are surmountable through better resource availability and use. Level 2 issues are related to how individual view themselves and their roles in an IT-enabled society. In this paper (chapter) the author argues for a more inclusive and open approach to IT network creation that is sensitive to both technical abilities and social,

cultural and behavioural factors. Surinder Batra in his paper titled 'Promoting the use of Knowledge Management as a Tool for securing Larger Good of the Society' (2009)describes about the importance of knowledge for development and for this purpose he refers two reports- World Development Report – Knowledge for Development, 1998-99(1999) and the OECD Report (1996). According to World Development Report, 1998-1999, knowledge is assured to be critical because knowledge depends on every economic activity. Since resources are scarce thus such resources needs to use in such a manner so that ever-higher return can be possible. This will be possible only through wider and judicious application of knowledge in production and management activities. The author discusses some of the characteristics of knowledge in the context of development identified by Ferreira and Neto (2005). The first characteristic/ feature of knowledge is that knowledge 'leaks' from the innovators to a large spectrum of society. The second feature is: when knowledge spreads in society it becomes a public good. Another characteristic is that linguistic, social and cognitive barriers impede knowledge from being transferred to whoever may need this knowledge. The author analyses the region of knowledge society in the Indian context and in explaining this he refers to the report of the task force **India as Knowledge Superpower: Strategy for Transformation,2001** (Government of India). In this report a detailed discussion is made about our saints, poets, philosophers, scientists, astronomers and mathematicians towards our new thoughts, principles and practices. The report observes that India possesses a huge potentiality to be a leading knowledge society. In this report it is stressed that Indian knowledge society has three drivers, namely, societal transformation for a just and equitable society, wealth generation and protection of traditional knowledge.

Mainak Sarkar and Siddharth Mahajan (2009) in their paper (chapter in an edited book titled Knowledge Economy - The Indian Challenge, edited by Ashoka Chandra and M.K. Khanijo, Sage 2009) raise the question whether the government can improve its ability to provide services such as health, education, governance to its citizens through better management of knowledge. In this write up the authors discuss how knowledge management at the societal level is different from that at the company level. An interesting section in this paper discusses how typically knowledge management is implemented in a company and lesson for governments. Some interesting case studies have been highlighted wherein it is seen that governments are likely to face in implementing a knowledge management system.

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# Chapter III

## Knowledge and Knowledge Based Economy

### 3.1: Introduction

We, the human species – *homo sapiens* - are ambitious- since we became the dominant species of the earth. Our journey started with our ability to adjust and utilize the natural surroundings – which we now call the resource – gift of nature. We ourselves are the most valuable resource of the nature – the knowledge creator and user.

Our physical strength while we were savage is exaggerated as our survival tool and progress. However, our knowledge – the ability to comprehend and utilize nature to our advantage has contributed immensely to our forward march. Physical power was necessary to protect but the sufficiency lied with identifying the danger – in identifying consumable material and possibility of attack from other species – physical strength is not so much necessary to avoid snake bite . Knowledge and efficient utilization of knowledge are jointly contributing in our progress. Our achievement is spectacular

Our ambition is unbounded – monotonically increasing. Our optimistic attitude wants to overcome all sorts of difficulty. Source is our past achievements in various spheres. We have been successful to utilize the natural phenomenon of animal fertilization for reproduction of future man power. Greatest achievement seems to be overcoming the hurdle of gravitational force. Mass energy relation - transformation of mass into energy. Energy from wood and coal may be now regarded as primitive, even the utilization of potential difference of water flow into energy are superseded by nuclear energy . We have long been stepped into nuclear age. We want to develop commercial process to utilize sun ray. We are yet to imagine some other form of energy to substitute electricity or power.

We have diluted the physical distance of communication and spread of information, with the passage of time it is possible at increasing speed. Optimistic statement is without losing any time – time is marginalized.

Transforming knowledge into human use – technology is upheld. Creation of knowledge is not the end in itself. Technology helped us to widen our production frontier. That the pride of human civilization live and let live required for sustainability is a multidisciplinary sphere. Both Wealth creation and judicious distribution are equally important. While the contribution of scientific knowledge (Physical Science and Mathematics) is relatively more in wealth generation, contribution of social science is greater in the latter field . It is therefore worthy to comprehend the concept of knowledge with particular reference to economic growth and development. Defining knowledge economy is a difficult proposition like knowledge. However, understanding knowledge based economy is necessary. Primacy obviously lies with the latter one. In what follows, section I is brief on conceptualizing knowledge. Section II deliberates on knowledge based economy.

## Section I

### 3.2: Knowledge: application focuses concepts

Conceptualizing knowledge is difficult for its complexity but application or utilization of knowledge is within our perception – like air or quality. We have realized the novelty of knowledge in the forward march of civilization.

In our personal life and in society, application of knowledge normally occurs without being conscious about its utilisation of acquired (simple knowledge) focuses the ability of human mind or society as the case may be, to comprehend and to derive optimal benefit. Translation of knowledge into action in our life is complex, nevertheless we are continuously practicing. However, interpersonal and transnational differences persist. Explanation is various – two most significant factors are efficiency and stock of knowledge. Knowledge is to be produced – the end product of our enquiries which may be directed or in other words gained by conscious disciplined endeavor. Human civilization has also been benefited by knowledge gained as by-product of some seemly unrelated experiment investigation. Examples of indirect

invention are numerous – discovery of X- Ray Photography by German Physicist Wilhelm Rontgen in 1895 while experimenting with cathode rays is a classic example .Discovery of America is well known to us as well. I cannot resist my temptation "Great works are often born on a street corner …" - Albert Camus realized. Collection or gathering also influences stock of knowledge.

Without loss of any generality , it may be stated that , human mind - workplace of knowledge production - at the dawn concentrated more on survival and subsequently attention turned to wealth creation and devising means of wealth creation . As a matter of fact knowledge (due to social scientists) has also contributed by fashioning different stages of human bondage required for optimum wealth creation. Means of production is important but no less significant is mode of production at the aggregate level and organization and management at the grass root or micro level. Good governance is prescribed at all micro and macro level for optimal harvesting. We are convinced about the power or necessity of good governance to influence the environment for productivity and to bring about more harmony in the society. However, relatively more primacy is attached with productivity augmenting knowledge – technology. We can understand and appreciate the contribution of technology in the material progress of the world. However, 'knowledge belongs to humanity and is the torch which illuminates the world',Louis Pasteur .

## 3.3: Knowledge or application of knowledge

Means of production or techniques of production owes to scientific knowledge and innovation – none are end in themselves, they are in general supplementary and constitute the state of knowledge at any given period. Knowledge is dynamic and ever changing and expanding.

Discussion on knowledge is ancient – the cognitive science is the oldest discipline. The philosophical discourse on the concept of knowledge can be traced in all the significant civilization. Researchers are deeply engaged on discussing various facets of the knowledge. We may satisfy ourselves with " ***Gyanjogena sankhanang karmajogena youginam" Geeta - Creative mind is endowed with the trait and***

***responsibility of Knowledge expansion and the beauty of knowledge lies in its application***

Both elongation or addition to knowledge and judicious and efficient utilization of knowledge are earnestly required for influencing our quality of life, happiness included. We get ample support from the dictionary meaning of the term – as noun ***(i) awareness and (ii) range of information***. But hitherto it seems more appropriate meaning of the term lies in its use as an **adjective (i)** ***a theoretical or practical understanding of a subject*** **and (ii)** ***justified belief, certain understanding.***

### *Interplay between social and physical science*

Widening the stock of knowledge is a continuous process, it seems knowledge generation is a self sustaining process and immensely contributes both at individual and social level .Domain of Social Science .is to supervise application and utilization of knowledge for improving the quality of human face in best possible way .In the process social sciences generates knowledge. However, we overrule the misinterpretation- knowledge contribution of social sciences is at the root of humanity and development of civilization. Social Science Knowledge and Physical Science contributes in fashioning civilization they are mutually dependent and constitute the stock of knowledge at any region and at any time,. Interplay between the two sets widens the horizon of knowledge in dynamic fashion, Dissemination of knowledge across the world as a continuous process is helping knowledge creation, on the other hand. Knowledge improves by sharing and paves the way of better and effective utilization .Historical evidences are enumerable,

### *Wealth generation: the arena of economics*

It seems worthy to restrict ourselves to the outcome of scientific knowledge. Effect of knowledge is material well being has long been understood by our ancestor – Bidya Datati Binoyang , Binouyang dati Patratam Patratat Dhnamapnoti Danath Dharma Tat Sukham - knowledge ultimately creates wealth .

***Economic discipline inter alia concentrates on production of goods and services.*** Modern underpinning is that knowledge is the prime source of wealth creation and expansion. There is a strong tendency to consider knowledge as a

commodity which is however the unique attribute of non-exhaustibility has and allows itself for repetitive use. Knowledge is considered renewable - the stock of knowledge is not depleted by use. Further recurring use of knowledge helps perfection and enhances efficiency in use. Indeed, the value of knowledge to an economy comes from sharing with others. However sharing in some circumstances may be restricted for competitive advantage - ensuring intellectual property rights is a global issue.

## Section II

## 3.4: Knowledge Based Economy

In conceptualizing Knowledge Based Economy researchers have concentrated more on technology - application of knowledge for improving or influencing production frontier. Nevertheless as discussed in the previous section ,Knowledge also contributes in changing economic order or socio economic and political economy for example ameliorating various types of asymmetry in the world –inter and intra regional inequality in the level of development.

### *Embryonic to contemporary*

Economic order of the society has been undergoing continuous (mutative) changes. Primitive – prehistoric society- has been modeled in the literature as traditional. Traditional Economic society was simple – technology was unheard. Collection, gathering and hunting were the means of production and survival. Utilizations of knowledge and experience were sublime. Agriculture society from scattered nomadic societies was born from Knowledge of how to use seed to sow and harvest .Development of agriculture society was influenced by discovery of variation of land fertility and crop suitability of land and understanding of seasonality.

Utilizations of knowledge or invention in the material world are continuously been supplemented by social science in the growth and development of human societies. Civilization marched forward by inventing the power of exchanging necessities and information in the society. Bartering was the centrifugal element .Primitive Traditional economy or barter economy has not completely been abolished.

We experience mutative changes in many spheres; nevertheless we continue to brand it as traditional system.

Feudalism was born and successfully pushed forward production and productivity. Barter or Exchange system became mostly inoperative – money and market mechanism replaced exchange of goods and services in kind. We rarely understand that market system is our powerful social invention. Regime of traditional economy is however continued to operate in which agriculture was the main stay. Economists ignored the governance part which also underwent changes for efficient operation of market mechanism and early stage of economic expansion is univocally termed as agricultural economy. Feudalism prevailed for considerable part of Agriculture Economy in which land was the primary resource. Growth of market economy was facilitated by revolutionary changes in sociopolitical outlook on the one hand and scientific knowledge on the other hand,technology is relatively more emphasized in the literature. We therefore mostly observe Economic expansion discussed with reference to traditional agriculture economy and industrial economy. Take off Rostov is the classic example.

The systems have always been complex- superimposed mapping of sociopolitical and scientific knowledge is ignored. Knowledge development in every sphere is contributory to socio economic development and shaping the presently emerging Knowledge Based Economy. As discussed earlier scientific invention translated into technology has been at the centre and still dominating the under pinning of Knowledge Based Economy.

**In knowledge based economy utilization of knowledge and information are playing important role directly in** production and distribution. Market and consumption demand in consequence are undergoing changes. Discernible trend in 'growth in high-technology investments, high-technology industries, more highly-skilled labour and associated productivity gains' is regarded as the prime feature of knowledge economy .

It has just been elaborated that knowledge has since pre historic age been playing crucial role in economic life of human being. We are more conscious now. In what follows changes in production sphere and economic agents - important factor

in economic growth, economists are now exploring ways to incorporate more directly knowledge and technology in their theories and models. "*New growth theory*" reflects the attempt to understand the role of knowledge and technology in driving productivity and economic growth. Spending on research and development, education and training and new managerial work structures are key to knowledge economy.

The next shift, from agricultural to industrial society, occurred in the eighteenth century when we learned how to use machines, particularly the internal combustion engine and the steam engine, to transform fossil fuels into controlled physical power. The `fuels' of industrial society are fossil: coal and oil. The industrial revolution was driven by knowledge about how to use the new fuels.

Both the agricultural revolution and the industrial revolution had one thing in common: the adoption of new fuels and new knowledge about how to use them. In both cases the standards of economic progress were associated with the increasing use of these specific `fuels': land in the agricultural society, and fossil fuels in the industrial society. As societies prospered and human settlements expanded, land and fossil fuels have been extensively used in the pursuit of economic progress.

The current revolution is also driven by knowledge. As with the two previous revolutions, it involves new knowledge about how to use a new and different fuel: information technology. This fuel is fundamentally different because it is not physical, like land and fossil fuels. Therefore, economic progress no longer means using more physical resources. This revolution brings the hope of a society in which economic progress need not mean increasingly extensive use of the earth's resources.

The most dynamic sectors in the new society are of course those which benefit most from the use of information technology as an inexpensive and abundant fuel, exactly as the most dynamic sectors in the industrial society were those that benefited from the use of fossil fuels as an inexpensive and abundant input, and those in the agricultural society were the sectors using inexpensive and abundant land products. The new dynamic sectors are therefore those producing goods which use information technology to expand the ability of the human brain to save, process, retrieve and communicate information. Examples are computers and software, telecommunications and biotechnology, entertainment and financial markets, design

and animation, and all services based on human knowledge such as medical services and education. These are sectors where the main input to production is the ability to store, organize, process and communicate human knowledge. This is 'knowledge-intensive' sector.

The knowledge sectors will expand more quickly than the rest and therefore the resulting society will produce mostly goods which are knowledge-intensive, much as the agricultural society produced mostly agriculture related goods, and the industrial society produced mostly industry-related goods. This is why I call this new society the `knowledge society'. The logic for this term is the same as behind our use of the terms `industrial society' and `agricultural society'.

None of this means that we will cease to produce food or machines. Indeed, the industrial society did not cease to produce agricultural products. On the contrary, the industrial society used more land and produced more food than the agricultural society did. However, the proportions of economic production were altered in the industrial society: most produced goods involved industrial components. Similarly in the knowledge society we will still produce food and machines. It is all a matter of proportions. An increasing fraction of economic output will be 'knowledge- intensive', and will involve proportionately more use of knowledge than land or machines.

## 3.5: Knowledge Codification: Efficiency in Use

The ability to store, share, and analysis knowledge through networks and communities using the new ICT technologies allows firms to exploit the unique properties of knowledge to gain competitive advantage. Perhaps the most important property is that knowledge is the ultimate economic renewable - the stock of knowledge is not depleted by use. Indeed, the value of knowledge to an economy comes from sharing with others.

A distinction is often made between codified or rule based knowledge that can be written down and stored and tacit knowledge that is acquired on the job and resides with the individual as know-how and experience. Some argue that one of the key distinguishing features of the knowledge economy is deploying new technologies to allow the more systematic exploitation of tacit knowledge. The latter can of course

walk out of the door – and firms may make strenuous efforts to retain key workers or impose restrictive clauses in their employment contracts about future employment.

### *Knowledge: economic underpinning*

In our above discussion it was implicit that knowledge has to be produced like other economic commodities. We may compare knowledge with improving quality of human capital, Utility of both are focused and similarly improvement of both involves spending, Knowledge is an end product of societal process utilizing resources thus expensive product in general.

Knowledge has fundamentally different characteristics from other commodities. Knowledge has the feature of a public good because knowledge leaks It is a `public good' because, at the physical level, one can share it with others without losing it. Thus differs from other development augmenting goods / fuels- such as land and machines. They are `private goods' but the same is true with technology. Unlike physical goods information and technology – use values of knowledge is non-rival – not destroyed in consumption. Its value in consumption can be enjoyed again and again. Hence, social return on investment in its generation can be multiplied through its diffusion. One other important trait of knowledge is that it posses the property of positive inbreeding. More significant quality seems to be extended and wider application. Invention of processes and materials in space research has wider application in various other spheres.

Knowledge now a days is not a free good and not freely exchanged, Once knowledge is discovered and made public, there is essentially zero marginal cost to adding more users. Knowledge does not wear out and people can duplicate it practically without cost, it is a source of super value and super productivity. Knowledge alone can add value to an otherwise closed, zero-sum system of value. It can increase value without diminishing it somewhere else.

Ideas and innovations have extensive externalities, their benefits typically extending well beyond those who first put them forward; and it can be difficult to exclude other potential users of knowledge through intellectual property rights. What is more, there is an inherent ‘unknowability’ in knowledge: it is like an experience good, which consumers find hard to value unless they have used it.

We can readily understand the crucial implications in conceptualizing knowledge economy.

Knowledge puts humans rather than land or machines at the centre of economic progress. Knowledge is privately produced food and, at the purely physical level, it resides mostly in the human brain. The most interesting and innovative knowledge originates from human brains. Although much knowledge resides in physical and electronic media, such as books and CD-ROMs, the ability to create new knowledge and adapt or cross-fertilize across different areas resides in humans.

Capital and machines are crucial in the industrial society. But the main scarce factor of production is no longer capital. Knowledge and ideas are more important today and more scarce than capital. Who owns the capital is no longer the main issue. Ownership of ideas is becoming more critical. The ownership of `intellectual capital' is key. This type of capital is different in a number of ways from standard capital, and markets which trade property rights on knowledge, or `intellectual capital' behave quite differently from our classical markets.

### Knowledge influencing production frontier

Traditional *"production functions"* focus on labour, capital, materials and energy; knowledge and technology are external influences on production. Now analytical approaches are being developed so that knowledge can be included more directly in production functions. Investments in knowledge can increase the productive capacity of the other factors of production as well as transform them into new products and processes. And since these knowledge investments are characterised by increasing (rather than decreasing) returns, they are the key to long-term economic growth.

It is not a new idea that knowledge plays an important role in the economy. Adam Smith referred to new layers of specialists who are men of speculation and who make important contributions to the production of economically useful knowledge. Friedrich List emphasised the infrastructure and institutions which contribute to the development of productive forces through the creation and distribution of knowledge. The Schumpeterian idea of innovation as a major force of economic dynamics has been followed up by modern Schumpeterian scholars such as Galbraith, Goodwin and

Hirschman. Economists such as Romer and Grossman have developed new growth theories to explain the forces which drive long-term economic growth.

According to the **neo-classical production function**, returns diminish as more capital is added to the economy, an effect which may be offset, however, by the flow of new technology. Although technological progress is considered an engine of growth, there is no definition or explanation of technological processes. In new growth theory, knowledge can raise the returns on investment, which can in turn contribute to the accumulation of knowledge. It does this by stimulating more efficient methods of production organisation as well as new and improved products and services. There is thus the possibility of sustained increases in investment which can lead to continuous rises in a country's growth rate. Knowledge can also spill over from one firm or industry to another, with new ideas used repeatedly at little extra cost. Such spillovers can ease the constraints placed on growth by scarcity of capital.

**Technological change** raises the relative marginal productivity of capital through education and training of the labour force, investments in research and development and the creation of new managerial structures and work organisation. Analytical work on long-term economic growth shows that in the 20th century the factor of production growing most rapidly has been human capital, but there are no signs that this has reduced the rate of return to investment in education and training (Abramowitz, 1989). Investments in knowledge and capabilities are characterised by increasing (rather than decreasing) returns. These findings argue for modification of neo-classical equilibrium models – which were designed to deal with the production, exchange and use of commodities – in order to analyse the production, exchange and use of knowledge.

## 3.6: Incorporating Knowledge in Production Function

Incorporating knowledge into standard economic production functions is not an easy task, as this factor defies some fundamental economic principles, such as that of scarcity. Knowledge and information tend to be abundant; what is scarce is the capacity to use them in meaningful ways. Nor is knowledge easily transformed into the object of standard economic transactions. To buy knowledge and information is difficult because by definition information about the characteristics of what is sold is

asymmetrically distributed between the seller and the buyer. Some kinds of knowledge can be easily reproduced and distributed at low cost to a broad set of users, which tends to undermine private ownership. Other kinds of knowledge cannot be transferred from one organisation to another or between individuals without establishing intricate linkages in terms of network and apprenticeship relationships or investing substantial resources in the codification and transformation into information.

## Knowledge codification

Knowledge is a much broader concept than information, which is generally the "*know-what*" and "*know-why*" components of knowledge. These are also the types of knowledge which come closest to being market commodities or economic resources to be fitted into economic production functions. Other types of knowledge – particularly know-how and know-who – are more "*tacit knowledge*" and are more difficult to codify and measure (Lundvall and Johnson, 1994).

Increasingly the traditional factors of production – land, labor and capital – have become less important when compared with technology; the economists have termed this as the 'expansion of the production frontier'. The source of technology is in science that is rooted in knowledge. It is easy to visualize that tomorrow's industries will be knowledge industries. The emphasis will not be on physical or tangible assets, but on intangible knowledge assets. The value of intellectual capital of an industry will determine its rank and competitiveness. In such industries, there will be a major shift from people, who handled information and did routine and unthinking work, to those who will use knowledge at every stage. For knowledge workers, information and knowledge will be both the raw material of their labor as well as its product.

World's major growth industries – such as microelectronics, biotechnology, designer-made materials, and telecommunications – are already brainpower industries. These knowledge industries stimulate other industries, in turn, to become knowledge based. Consider the oil industry. The issue of "bottom of the barrel" is driving the economics of these industries. New knowledge embedded in three-dimensional acoustical sounding, horizontal drilling and deep offshore drilling is turning oil business into a knowledge industry(economics of knowledge).

*We may thus surmise that Knowledge Economy or Knowledge Based Economy is "… one in which the generation and exploitation of knowledge has come to play the predominant part in the creation of wealth. It is not simply about pushing back the frontiers of knowledge; it is also about the most effective use and exploitation of all types of knowledge in all manner of economic activity"* (DTI Competitiveness White Paper 1998).

*Thus the* ***"the idea of the knowledge driven economy is not just a description of high tech industries. It describes a set of new sources of competitive advantage which can apply to all sectors, all companies and all regions, from agriculture and retailing to software and biotechnology*** (*New measures for the New Economy*, report by Charles Leadbeater, June 1999). The term "knowledge economy" may be used to describe this emerging economic structure.

It may be stated without further elaboration that '*economic success is increasingly based on upon the effective utilisation of intangible assets such as knowledge, skills and innovative potential as the key resource for competitive advantage."* (ESRC, 2005).. In the subsequent chapters investigation is made about the contribution of knowledge in different spheres of Indian economy.

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# Chapter-IV

## India as the Knowledge Economy

### 4.1: Introduction

For the last two decades India has been trying to improve its social and economic development. This has in fact been reflected in the faster growth of the economy. The growth rate of the economy, for example was only 3.5 percent for the three decades since 1950s. It started improving during 1980s and reached to 5.5 percent at the end of this decade. 1992-1996 was the period when India's growth rate was very high i.e. 6.7 percent. This was because of the fact that India initiated its new economic policy and the impact of such a policy was witnessed on the overall growth of the economy. But the growth slowed down during 1997-2001 and 2002-2003 when it fell to 5.5 percent and 4.4 percent respectively due to bad harvest in agriculture i.e., there was poor rainfall. The 2003-2004 was the good year for India when there was a tremendous agricultural output and due to which India experienced a huge growth rate of 8.2 percent. This chapter highlights some of socio-economic performances of the Indian economy during the reformed regime. It explores the importance of Knowledge in the context of global competitiveness. What is more, it investigates the opportunities and challenges India currently faces.

### 4.2: Performances of the Indian Economy

India for more than three decades has been trying to increase its income and standard of living of its population. To understand this we need to analyze India's performances in the growth of income and also the living conditions of the population with the help of supportive quantitative data. First of all we will present here the income scenario during the 1990s and 2000s

India took up new economic policy during 1990s and as a result of which a lot of changes took place in the spheres such as opening up sectors to private investment, encouraging foreign direct investment, reducing red tape, further liberalizing trade policy and exchange rate regime and reforming capital markets leading to an

improved investment climate. As central controls have receded states have also acquired more freedom to maneuver and some states such as Andhra Pradesh, Karnataka and Maharashtra have shown tremendous progress in encouraging private investment.

Every country in the world today is touched by the forces of globalization and the rise of the knowledge economy. Well-equipped countries are able to take the fullest advantage of these forces for the creations of wealth and the well-being of the people. But for the less equipped developing countries, globalization and the knowledge economy may lead to poverty, unemployment, inequality and marginalization. The biggest challenge before most of the developing countries (including India) is to channelize the forces of globalization and the knowledge economy for the alleviation of poverty and the empowerment of people to lead a decent standard of living.

In an agrarian economy as we have in most of the Asiatic countries land is the most critical factor of all factors of production. Similarly, in an industrially advanced country natural resources such as coal and iron ore are the main resources for its productive activities. Similarly in knowledge economy 'knowledge' itself is the key resource. A knowledge economy is one in which all the sectors of the economy such as agriculture, industry and services amply use knowledge in their productive activities. It is at all not a new concept. In every sphere of life knowledge is used and the use of knowledge has been increasing especially since the industrial and agricultural revolution. The whole world has seen an explosion in the application of information and communication technologies in all areas of production, marketing and community life especially since the onslaught of globalization in early 1980's. Knowledge economy does have effect on each and every aspect of the economy, on goods and services and on every aspect of business chain from research and development (R&D) to production, marketing and distribution channels. The marginal knowledge or information is virtually Zero. Naturally knowledge is being greatly intensified in all sorts of economic activities.

India is one of the world's largest economies which have made tremendous efforts in the growth of its economy and society in the past three decades. Growing at about 3.5 percent from the 1950s to 1970s, India achieved a growth rate of about 5.5

percent during 1980s. It achieved an annual growth rate of 6.7 percent during 1992-93 and 1996-97. This was possible only because of adopting new economic policy in 1991 through which the economy was mere open to the global competition. The growth of the economy went downed drastically during 1997-98 to 2001-2001 to 5.5 percent and further to 4.4 percent in 2002-2003. This was mainly due to poor rain and its impact on agricultural output. But due to huge rain and good weather for agricultural output the growth of the economy was 8.2 percent during 2003-2004.

India undertake a series of reforms during 1990's majority of which are opening up more sectors to private investment, encouraging FDI, reducing red tape, further liberalizing trade policy and the exchange rate regime and reforming capital markets. As central cannot have receded states have acquired more freedom to progress their respective economies. In this way same states such as Andhra Pradesh, Karnataka and Maharashtra have made tremendous progress in encouraging private investment.

India is now poised to realize even faster growth. It is thus an opportune moment for India to make further progress towards a knowledge economy one that creates, disseminates and uses knowledge to enhance its growth and development. The knowledge economy is often taken to mean only high-technology industries or information and communication technologies (ICT's). The concept may broadly be used to improve the productivity of agriculture, industry and services and increase overall welfare. Great potential exist in India for increasing productivity by shifting from low productivity and subsistence activities in agriculture, informal industry, informal service activities to more productive modern sectors as well as to new knowledge –based activities and in so doing , to reduce poverty and touch every member of society. India has potential to become a leader in knowledge creation and use.

India has many of the key in gradients for making this transition. It has a critical mass of skilled, English–speaking knowledge workers, especially in sciences. It has a well functioning democracy. Its domestic market is one of the world's largest. It has a large and impressive Diaspora, creating valuable knowledge linkages and networks. This list goes on: Macro Economic stability, a dynamic private sector, institution of a free market economy a well-development financial sectors and a broad

and diversified science and technology (S&T) infrastructure. In addition the development of ICT sector in recent years has been remarkable. With this India has become a global provider of software services. India's gross domestic product (GDP) by sectors 1997 to 2003 has been shown in the table-4.1 below.

**Table-4.1: India's GDP by sector, 1987-2003 (percentage of total)**

| Sectors | 1997-1998 | 1998-1999 | 1999-2000 | 2000-2001 | 2001-2002 | 2002-2003 |
|---|---|---|---|---|---|---|
| **Agriculture** | 26.5 | 26.4 | 25.0 | 23.8 | 23.9 | 22.0 |
| **Industry** | | | | | | |
| **a) Mining** | 2.5 | 2.4 | 2.4 | 2.3 | 2.2 | 2.4 |
| **b) Construction** | 5.0 | 5.0 | 5.1 | 5.2 | 5.1 | 5.3 |
| **c) Electricity, Gas or Water** | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.4 |
| **d) Manufacturing** | 17.7 | 17.0 | 16.7 | 17.2 | 16.8 | 17.2 |
| **Services** | 45.8 | 46.6 | 48.3 | 48.9 | 49.5 | 50.8 |

Source: Planning Commission of India, Government of India, 2004.

We can understand some interesting changes in the structural composition of the Indian economy. We see that agriculture's contribution has been declining from 26.5 percent in 1997-98 to 22.0 percent in 2002-03. Also we notice a decline in the manufacturing sector from 17.7 percent to 1997-98 to 17.2 percent in 2002-03. But those have been a significant improvement in the service sector.

**Table-4.2: Sector-wise GDP growth rates in India (%), 2008**

| Sectors | 2002-2003 | 2003-2004 | 2004-2005 | 2005-2006 | 2006-2007 | 2007-2008 |
|---|---|---|---|---|---|---|
| **Agriculture *** | -7.24 | 9.96 | -0.05 | 5.92 | 3.76 | 4.55 |
| **Industry** | 6.79 | 6.00 | 8.51 | 8.02 | 10.63 | 8.09 |
| **a) Manufacturing** | 6.81 | 6.63 | 8.65 | 8.98 | 12.00 | 8.78 |
| **b) Mining/quarrying** | 8.84 | 3.09 | 8.15 | 4.87 | 5.70 | 4.75 |
| **c) electricity** | 4.75 | 4.77 | 7.90 | 4.68 | 5.98 | 6.27 |
| **Services** | 7.52 | 8.84 | 9.87 | 11.01 | 11.18 | 10.66 |
| **a) Construction** | 7.95 | 11.98 | 16.14 | 16.46 | 11.98 | 9.81 |
| **b) Trade, hotels **** | 9.44 | 12.01 | 10.69 | 11.51 | 11.82 | 12.02 |
| **a) Finance/Insurance +** | 7.98 | 5.58 | 8.69 | 11.41 | 13.92 | 11.79 |
| **b) Community ++** | 3.93 | 5.41 | 6.85 | 7.21 | 6.89 | 7.25 |
| **GDP at factor cost** | 3.84 | 8.52 | 7.49 | 9.40 | 9.62 | 9.03 |

*Includes Forestry & Fishing
** Includes transport and communication
+ Includes real estate & business services
++ Includes social & Personal services.
Source: Planning Commission of India, Government of India,2009.

In 1997-98 service sectors sectoral contribution was 45.8 percent. It increased to 46.6 (nearly one percent within a year in 1998-99. This again rose to 48.3percent in 199-2000. There was a continuous increase in the GDP growth of this sector in 2001-2002 and 2002-2003. In 2001-2002 Indian service sector's sectoral contribution to GDP was 49.5 percent which again rose to 50.8 percent in 2002-2003.

The table4.2 shows India's sector-wise growth rate in percentage trends during 2002-2007.

Table-4.2 shows that India witnessed negative growth rate twice in agriculture sector one in 2002-2003 (-7.24 percent) and the other is 2004-2005 (-0.05 percent). This was due to bad harvest (bad monsoon). It was spectacular during 2003-2004 (9.96) due to good monsoon. The growth rates were more or less within the range 4 to 6 percentages during 2005-2006, 2006-2007 and 2007-2008. Industry showed a moderate growth rate during 2002-2007 within 6 to 10.5 percentage points. Service sectors growth rates were high if compared with agriculture and industry. Service sector growth rates were 7.52 percent in 2002-2003. This rose to 8.84 percent in 2003-04 and in 2004-05 it increased to 9.87 percent. During 2005-2006 and 2006-2007 it touched 11.01 percent and 11.18 percent respectively. This slightly came down in 2007-2008 to 9.81 percent. GDP at factor cost showed a remarkable upward trend from 3.84 percent in 2002-03 to 9.03 in 2007-08.

The gross Domestic Product (GDP) in India expanded 5.3 percent in the first quarter of 2012 over the same quarter of the previous year. Historically from 2000 until 2012, India GDP Growth Rate averaged 7.37 percent reaching an all time high of 11.80 percent in December 2003 and a record low of 1.60 percent in December 2002. The GDP growth rate provides an aggregated measure of changes in value of the goods and services produces by an economy. India's diverse economy encompasses traditional village farming modern agriculture handicrafts a wide range of modern industries and a multitude of services. Services are the major source of economic growth accounting for more than half of India's output with less than one third of its labor force. The economy has pointed an average growth rate of more than 7 percent in the decade since 1997 reducing poverty by about 10 percentage points.

## 4.3: Knowledge Economy and its Global Competitiveness

Today the whole globe is under a deep recession of uncertain length. It has, in fact, reduced the overall growth of the economies of the world irrespective of their economic structures (more advanced, advanced and developing) contracting their growth increase in poverty, helplessness and uncertainty. The impact of recession on the economy can be accessed through different perspective such as a fall in employment in technology and knowledge based industries, decline in investment in intangible asset and a decline of the financial services industry. In the case of international trade there has also been a decline in overseas market for the exports of knowledge services. Since the late 1970s countries like the UK have given too much attention to the knowledge- based industries i.e., knowledge services (e.g. Financial sectors). Naturally a huge investment has been made on this sector. This in fact has showed down the expansion of the more traditional sector like the manufacturing sector. Thus the expansion of knowledge services is at the exposure manufacturing sector. But it is a fact that there has been a tremendous expansion of knowledge base industrial sector during the globalised regime especially across the industrialized world.

Data on the UK economy (collected Office for National Statistics, UK for 1970-2008) show that between 1970 and 2008 consumer spending on knowledge economy services such as business, high tech, financial, telecom, health and education services has grown much faster than consumer spending on other services (spending on knowledge services went up by 3.1 times while spending on other services went up 1.7times). One important thing that has been observed (Report on: Enterprise and the Knowledge Economy – Brinkley, 2008 – SEEDA –South East England Agency Development).

From Brinkley report is that the increase in employment in SMEs in the UK over the part decade is very strongly associated with the knowledge based industries.

The critical area for the knowledge economy (and the wider economy) will be what happens to 'knowledge based' intangibles which include R & D, design, software, brand equity, and human and organizational capital. Intangibles investment increased substantially from 1980 onwards driven by rising investment in head

technologies and firm specific human and organizational capital. In 2004 investment in intangible assets exceeded in physical assets by 40% across the British economy as a whole and income sectors such as manufacturing it was as twice as high (HMT October, 2007 BERR Manufacturing Review 2008). Research has such similar results for the US, Finland and the Netherlands, major exception has been Japan. Japan did not experience the rapid increase in intangibles investment in the 1990s that took place elsewhere. However the ratio between tangible and intangible assets in Japan is exceptionally land. Intangible assets were worth only 30 percent of investment in tangible assets compared between 100 and 120 percent in other economics studied. (OECD 2008, Intellectual Assets and Value Creation). The UK data for 1970-2004 show that intangibles have been less affected by recession than physical assets.

## 4.4: Education and Human Resource Development

Knowledge economy is basically relied on education- formal and informal education. Educated and skilled persons can well create, share, disseminate and use knowledge properly and justifiably, 'Hard' and 'Soft' skills are the key to the successful operation and execution of the knowledge economy 'Hard skills' traditionally denotes literacy and recently it also includes ICT competencies. 'Soft skills' is an important element denoting communicating skills, problem-solving skills, creativity and teamwork. Previously 'Soft skills' are very much required and used by the managers of large business houses. But now-a-days this is equally used by all workers in the emerging knowledge economy.

Theoretical knowledge and learning are the two important components in a knowledge economy. Peter Drucker (2001, "The Next Society" – in The Economist, November 1) clearly mention that doctors, lawyers, teachers, accountants, and engineers are the true knowledge workers who, in fact, do possess both the 'theoretical' as well as 'learning' knowledge, Apart from this, Peter Drucker gives emphasis on the role of knowledge technologists. 'Knowledge technologists', according to him, are the computer technicians, software designers, analysts in technical labs, manufacturing technologists, and paralegals.

Knowledge economy calls for a dynamic education system starting from primary level to secondary and tertiary levels. All the three levels of education system

need to be developed in such a manner that not only provide the foundation of learning but also develop technical knowledge, skills and encourage creative and critical thinking. This are essentially required to solve all sorts of problems and are key to innovation and extended into a system of lifelong learning. Learning starts learning from the childhood and extends up to retirement. It thus covers both the formal and informal trainings. Formal training, we all know, is acquired learning from schools, college, universities and all other educational institutions and informal training is acquired from on-the-job training, and the knowledge or training learned from family members or people in the community.

A large number of highly qualified and technically efficient people in India are contributing to the growth process efficiently domestically and internationally. But in terms of total Indian population their proportion is quite negligible. What India requires is a very large pool of human capital base capable of creating huge number of knowledge workers who can create competitiveness in the global economy.

We will now discuss India's educational and human resource advancements with the help of World Bank data, 2005. World Bank data show that India has made marginal improvement during 2000-2005.

India, as the World Bank data show, leads South Asia and Africa regions, but lags behind Poland, Russia and Korea. India is successful in the progress of literacy but its average years of schoolings 5.06 years [(larger than Brazil (4.88) but less than China (6.35), Poland (9.84), Russia (10.03) and Korea (10.84)]. In case of secondary and tertiary education also India is far lagging behind).

World Economic Forum (WEF) made a qualitative rankings and this shows that India is ahead of many of the above countries in terms of science and math education, internet access in schools and management education. India's position in human resource development compared with China, Russia and Poland. One that disturbs India is its huge migration of skilled human resources to abroad.

In the following section we will analyse in detail India's trends in educational and human resource development:

First, India has been trying with its not most sincerity to improve its literacy. As a result there has been a considerable enhancement in literacy rate. The literacy rate rose from 52.2 percent in 1991 to 65.4 percent in 2001 which again rose to 74.04 in 2011. The literacy during different census as recorded has been exhibited in table-4.3 below.

**Table -4.3: Literacy Rates in India 1951-2011**

| Year | Male literacy | Female literacy | Total | Male-Female Gap in Literacy Rate |
|---|---|---|---|---|
| **1951** | 27.16 | 8.86 | 18.33 | 18.30 |
| **1961** | 40.40 | 15.35 | 28.30 | 25.05 |
| **1971** | 45.96 | 21.97 | 34.45 | 23.98 |
| **1981** | 56.38 | 29.76 | 43.57 | 26.62 |
| **1991** | 64.13 | 39.29 | 52.21 | 24.84 |
| **2001** | 75.85 | 54.16 | 65.38 | 21.59 |
| **2011** | 82.14 | 65.46 | 74.04 | 16.68 |

*Source: Census of India (Different Issues), Government of India*

Note: 1.Literacy rate for 1951, 1961 and 1971 Censuses relate to the population aged seven years and above

2.The 1981 Literacy rate exclude Assam where the 1981 Census could not be conducted due to disturbed conditions.

3.The 2001 Census, literacy rates exclude entire Kachehh distrist, Morvi, Maliya Miyana and Wankaner talukas of Rajkot district of Gujarat state entire Kinnaur district of Himachal Pradesh where population enumeration of Census of India, 2001, could not be conducted due to natural calamities.

**Figure 1: Literacy Rates in India 1951-2011**

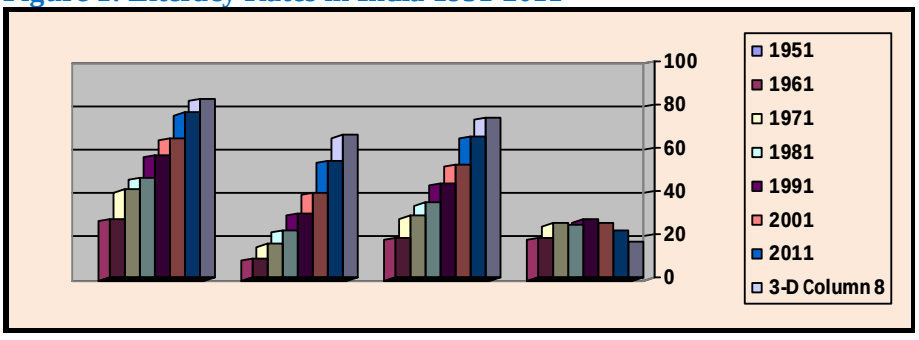
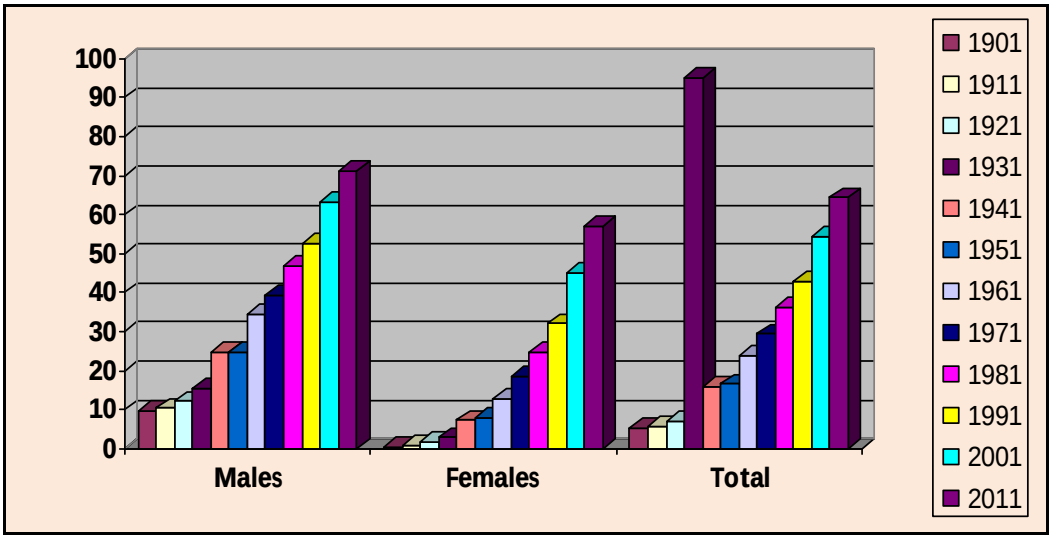


**Table-4.4: Crude Literacy in India by Sex: 1901 to 2011**

| Census Year | Crude Literacy Rate | | | Change in Percentage Points | | |
|---|---|---|---|---|---|---|
| | Males | Females | Total | Males | Females | Total |
| **1901** | 9.83 | 0.60 | 5.35 | | | - |
| **1911** | 10.56 | 1.05 | 5.92 | | | 0.57 |
| **1921** | 12.21 | 1.81 | 7.16 | | | 1.24 |
| **1931** | 15.59 | 2.93 | 95 | | | 2.34 |
| **1941** | 24.9 | 7.30 | 16.1 | | | 6.68 |
| **1951** | 24.95 | 7.93 | 16.67 | | | 0.57 |
| **1961** | 34.44 | 12.95 | 24.02 | | | 7.35 |
| **1971** | 39.45 | 18.69 | 29.45 | | | 5.43 |
| **1981** | 46.89 | 24.82 | 36.23 | | | 6.78 |
| **1991** | 52.74 | 32.17 | 42.84 | | | 6.61 |
| **2001** | 63.24 | 45.15 | 54.51 | | | 11.67 |
| **2011** | 71.22 | 56.99 | 64.32 | | | 9.81 |

Source: Census of India (Different Issues), Government of India.




The improvement in crude literacy rate in phenomenal in post independent India which is 48.22 percentage points. The increase is 49.69 percent for females and 46.32 percent for males.

Many steps have been taken by the government to reduce illiteracy. But there are several problems in reducing illiteracy. The first hindrance is the size and the diversity of Indian population. Secondly, the conventional methods to teach on adult person to read and write take relatively longer time. Thirdly, in spite of adopting various governmental measures dropout rates are very high. This is due mainly to poverty, parents' illiteracy, lack of awareness of the poverty etc. Fourthly, the infrastructures are very poor in the schools. Many of India's primary and upper

primary schools do not have a classroom for a class of students. Toilets for boys and girls are not found in many of the schools.

Also there is a problem of pure drinking water in most of the schools. Finally, lack of trained teachers also is a constraint in the path to reducing illiteracy in India.

Second, for creating as efficient human resource lease in order to enhance the level of productivity and efficiency in every sphere of Indian economy it is of paramount importance to creating a sound basic education system and for that matter a huge investment is needed in this system. Along with this emphasis on secondary and tertiary education is strongly demanded. The table-4.5 shows students enrolment in primary, upper primary, secondary and tertiary stages in India.

**Table-4.5: Enrollment in India, 1990-91 and 2001-02 (Millions)**

| Stages | 1990-91 | 2001-02 |
|---|---|---|
| **Primary (grades 1-5)** | 97.4 | 113.9 |
| **Upper primary (grades 6-8)** | 34.0 | 44.8 |
| **Secondary (grades 9-12)** | 19.1 | 30.5 |
| **Tertiary** | n.a. | 9.2* |

* Includes more than one million students enrolled in open Universities.
n.a. = not available

*Source: Education Statistics, Deptt. of Education, Government of India. (www.education.nic.in)*
*Tertiary education figures are taken from the UGC.*

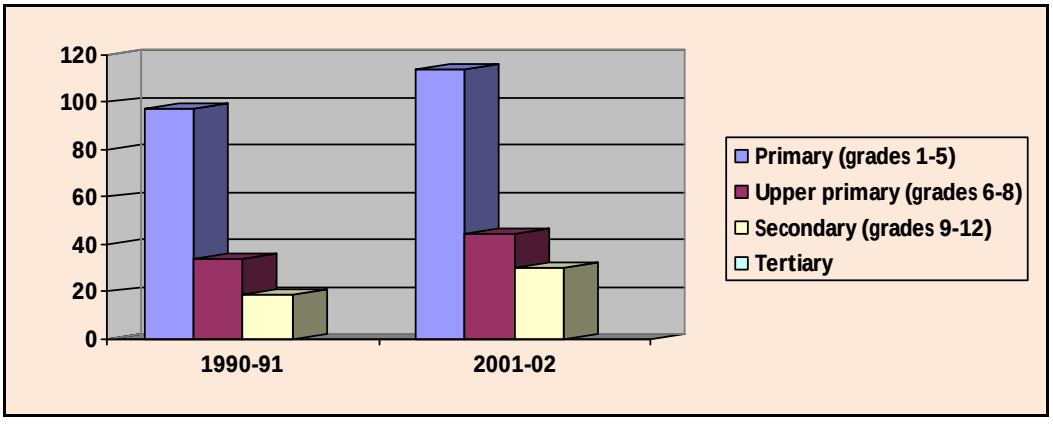



Table-4.5 shows that there has been a substantial expansion in primary, upper primary, secondary and tertiary education in India during 1990-91, 2001-02 and 2011-12 in terms of expansion of enrollment students at different stages. We will now look at the primary and secondary school education in India under different types of management. This is shown in table-4.6 below.

**Table-4.6: Schools under Different Types of Management in India (%)**

| Category of Schedule | Years | Types of Schools | | | | |
|---|---|---|---|---|---|---|
| | | Government Local | Local Body | Government & Local Bodies | Private Aided | Private unaided |
| Primary Schools (Grades 1-5) | 1973-74 | 50.88 | 42.47 | 93.35 | 5.01 | 1.64 |
| | 1986-87 | 41.37 | 51.71 | 93.08 | 4.34 | 2.57 |
| | 1996-97 | 47.78 | 43.88 | 91.66 | 3.34 | 5.00 |
| | 2001-02 | 47.45 | 43.47 | 90.92 | 3.07 | 6.01 |
| Upper Primary Schools (Grades 6-8) | 1973-74 | 50.71 | 26.86 | 77.57 | 17.75 | 4.67 |
| | 1986-87 | 42.79 | 32.33 | 75.12 | 16.30 | 8.58 |
| | 1996-97 | 46.41 | 29.13 | 75.54 | 10.25 | 14.20 |
| | 2001-02 | 47.36 | 29.05 | 76.41 | 7.81 | 15.77 |
| Secondary Schools (Grade 9-12) | 1973-74 | 26.54 | 10.85 | 37.39 | 57.02 | 5.59 |
| | 1986-87 | 37.49 | 7.73 | 45.22 | 44.79 | 9.99 |
| | 1996-97 | 38.96 | 6.74 | 45.70 | 36.20 | 18.10 |
| | 2001-02 | 36.16 | 6.29 | 42.45 | 33.99 | 23.56 |

*Source: Education Statistics, Department of Education, Government of India, 2002.*

**Fig : Schools under Primary Schools (Grades 1-5) of Management in India (%)**

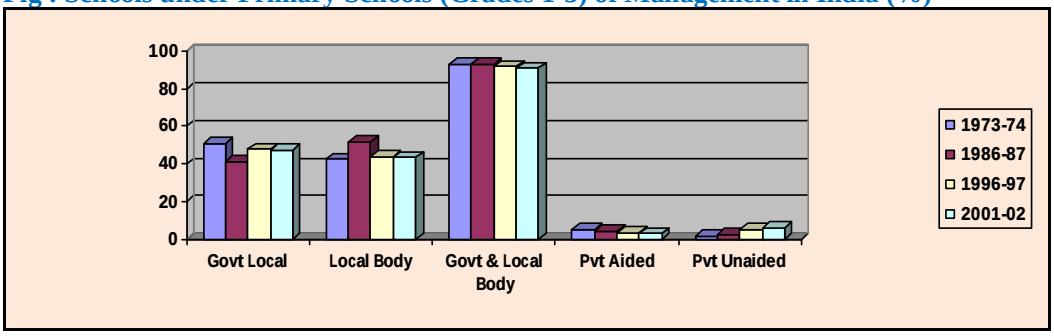



**Fig : Schools under Upper Primary Schools (Grades 6-8) of Management in India (%)**

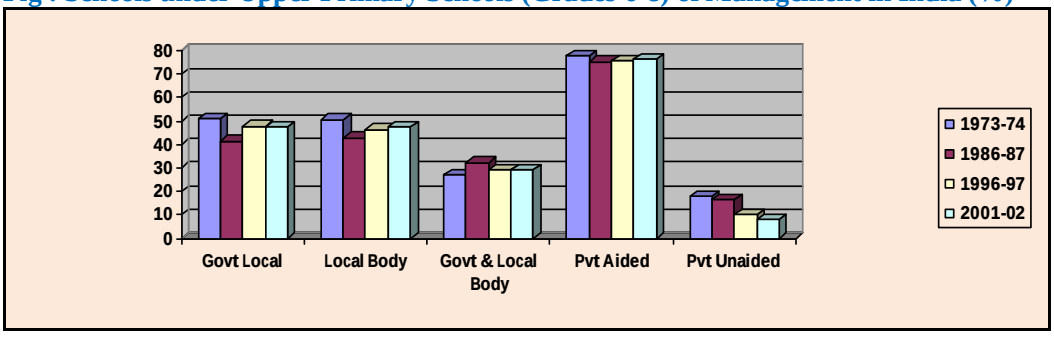
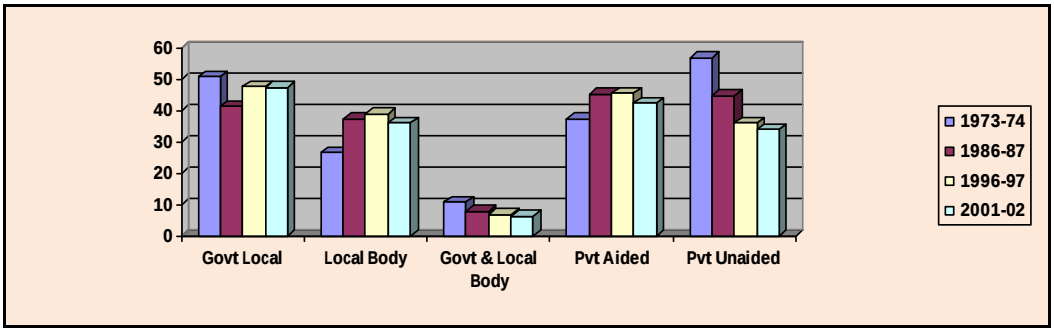


**Fig : Schools under Secondary Schools (Grade 9-12) of Management in India (%)**




According to the education statistics provided by the Government of India we notice that there are four types of schools – schools run by the government (Central, state or local government), schools run by the local bodies, schools run by the local management but largely funded by the government grants-in-aid and known as the aided schools and the schools run purely by private management and also funded privately and known as "private unaided". The date presented in the above table show that among different categories of schools majority of schools especially the primary schools are run by the government (central, state and local level governments). But the management under this category has been going down. For example it was 93.35 percent in 1973-74. It came down to 9092 in 2001-02. On the other hand, the number of schools under 'Private aided' and 'Private unaided' categories has been rising although their number together remains within the range 6-9 percent. In the upper primary category, the number of school ranges between 75 percent and 77 percent and in the case of private aided and private unaided together it ranges between 22 percent and 25 percent. The number of secondary schools ranges between 37 percent and 46 percent during the same period of time. But the number of private aided secondary schools has been slightly going down. It was 57 percent in 1973-74 and it came down to 34 percent in 2001-2002. The complete different picture is noticed in the case of private unaided secondary schools. This shows an upward trend. It was only 4.67 percent in 1973-74 and their came up 15.77 percent in 2001-2002.

## 4.5: Literacy Rate in EAG States

Table-4.7 shows the effective literacy rate for eight Empowered Action Group (EAG) states and non-EAGs states Data show that literacy rates for all the three categories i.e. person, male and female is higher in non-EAG states compared to EAG states during 1991, 2001 & 2011. But the literacy rate in EAG States is higher for

these categories during 2001-2011 if compared with non – EAG states in percentage points. Hence the EAG states are catching up with non-EAG states.

**Table-4.7: Effective Literacy Rate in EAG and Non EAG states**

| Indian States/ India | 1991 | | | 2001 | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | M | F | P | M | F | P | M | F |
| **India** | 52.21 | 64.13 | 39.29 | 64.83 | 75.26 | 53.67 | 74.04 | 82.14 | 65.4 |
| **Non EAG States** | 60.09 | 70.34 | 49.2 | 70.64 | 79.25 | 61.53 | 78.24 | 84.76 | 71.4 |
| **EAG States** | 41.65 | 56 | 25.56 | 57.22 | 70.09 | 43.21 | 68.86 | 78.96 | 57.9 |

Source: Census of India, 1991, 2001, 2011

Notes

1. Figures for 1991 census do not include Jammu & Kashmir, as no census was held in the State.
2. See notes behind 'Figures at a Glance'

Table 4.8 indicates the male-female gap in effective literacy rate for EAG and non EAG States for Censuses of 1991, 2001 and 2011. The male female gap in literacy is declining at faster pace in EAG States. The decline is 5.92 percent in EAG States as compared to 4.38 percent in case of non-EAG States during 2001-2011.

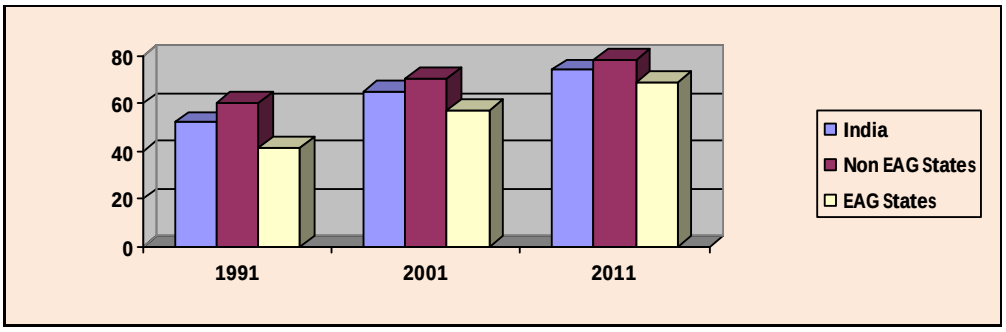



**Table 4.8: Male –Female Gap in Effective Literacy Rate**

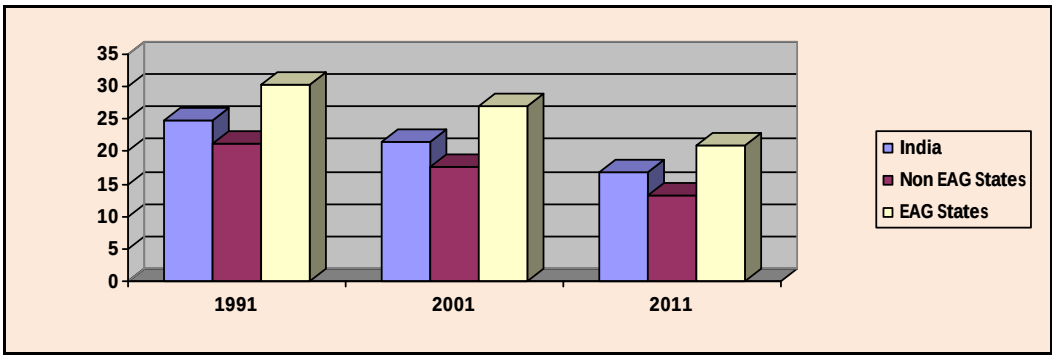
| Indian States/ India | 1991 | 2001 | 2011 |
|---|---|---|---|
| **India** | 24.85 | 21.59 | 16.68 |
| **Non EAG States** | 21.14 | 17.72 | 13.34 |
| **EAG States** | 30.32 | 26.89 | 20.97 |

Source: Censuses of India, 1991, 2001 and 2011

Notes

Figures for 1991 census do not include Jammu & Kashmir, as no census was held in the State.

See notes behind 'Figures at a Glance'



The increase in the number of literates in all the EAG States is encouraging. Bihar (74.83 percent) tops the list followed by Jharkhand; (54.24 percent) ; and Uttar Pradesh (56.40 percent), Rajasthan (40.68 percent) and Chhattisgarh (39.61 percent) are in the middle and the third category states are Madhya Pradesh (38.73 percent). Uttarakhand (37.05 percent) and Orissa (36.68 percent).The effective literacy trends have been depicted in table-4.9.

**Table-4.9: Effective Literacy Trends is EAG States, 2001-2011**

| Rank | India/ States Union Territories # | No of Literates in 2011 | No of Literates in 2001 | Absolute increase in the No. of Literates 2001-2011 |
|---|---|---|---|---|
| **1** | 2 | 3 | 4 | 5 |
| | INDIA | 77,84,54,120 | 56,07,53,179 | 21,77,00,941 |
| **1** | Bihar | 5,43,90,254 | 3,11,09,577 | 2,32,80,677 |
| **2** | Jharkhand | 1,87,53,660 | 1,17,77,201 | 69,76,459 |
| **3** | Uttar Pradesh | 11,84,23,805 | 7,57,19,284 | 4,27,04,521 |
| **4** | Rajasthan | 3,89,70,500 | 2,77,02,010 | 1,12,68,490 |
| **5** | Chhattisgarh | 1,55,98,314 | 1,11,73,149 | 44,25,165 |
| **6** | Madhya Pradesh | 4,38,27,193, | 3,15,92,563 | 1,22,34,630 |
| **7** | Uttarakhand | 69,97,433 | 51,05,782 | 18,91,651 |
| **8** | Orissa | 2,71,12,376 | 1,98,37,055 | 72,75,321 |

Source: Census of India, 2001, 2011

Notes

1. See notes behind 'Figures at a Glance'

Table-4.10 represents population aged seven and above, the absolute number of literates in 2011 and their decadal absolute and percentage difference between 2001-2011. Data show that majority of children who attained the age of seven are literate.

Kerala, Mizoram, Lakshadweep and Tripura have indeed shown a consistent improvement in effective literary rate for both the census of 2001 and 2011 census. Improvement in ranks was more than 5 points in 2011 census over 2001 in states like Tripura and Dadra and Nagar Haveli. States like Punjab, Chhattisgarh, Sikkim, Madhya Pradesh and Rajasthan have shown a decrease in rank by more than 4 points from 2001 census.

**Table-4.10: Population aged 7 and above, literates in 2011 and their decadal difference and percentage decadal difference during 2001-2011**

| State/ UT Code | India/State/ Union Territory | Population aged 7 and above in 2011 | Decadal difference in population aged 7 and above during 2001-2011 | percentage decadal difference during 2001-2011 |
|---|---|---|---|---|
| | India | 1,05,14,04,135 | 18,65,04,094 | 2 |
| **01** | Jammu & Kashmir | 1,05,40,284 | 18,82,387 | 2 |
| **02** | Himachal Pradesh | 60,92,645 | 8,07,882 | 1 |
| **03** | Punjab | 2,47,62,666 | 35,75,496 | 1 |
| **04** | Chandigarh | 9,36,733 | 1,51,711 | 1 |
| **05** | Uttarakhand | 87,87,908 | 16,58,591 | 2 |
| **06** | Haryana | 2,20,55,357 | 42,46,330 | 2 |
| **07** | NCT of Delhi | 1,47,82,725 | 29,49,067 | 2 |
| **08** | Rajasthan | 5,81,16,096 | 1,22,59,910 | 2 |
| **09** | Uttar Pradesh | 16,98,53,242 | 3,52,79,949 | 2 |
| **10** | Bihar | 8,52,22,408 | 1,90,29,962 | 2 |
| **11** | Sikkim | 5,46,611 | 83,955 | 1 |
| **12** | Arunachal Pradesh | 11,79,852 | 2,87,755 | 3 |
| **13** | Nagaland | 16,94,621 | 5,737 | - |
| **14** | Manipur | 23,68,519 | 4,00,989 | 2 |
| **15** | Mizoram | 9,25,478 | 1,80,639 | 2 |
| **16** | Tripura | 32,26,977 | 4,64,220 | 1 |
| **17** | Meghalaya | 24,08,185 | 5,57,342 | 3 |
| **18** | Assam | 2,66,57,965 | 45,00,512 | 2 |
| **19** | West Bengal | 8,12,35,137 | 1,24,73,162 | 1 |
| **20** | Jharkhand | 2,77,28,656 | 57,39,654 | 2 |
| **21** | Orissa | 3,69,11,708 | 54,65,858 | 1 |
| **22** | Chhattisgarh | 2,19,56,168 | 46,77,281 | 2 |
| **23** | Madhya Pradesh | 6,20,49,270 | 1,24,83,461 | 2 |
| **24** | Gujarat | 5,28,89,452 | 97,50,839 | 2 |
| **25** | Daman & Diu | 2,17,031 | 79,405 | 5 |
| **26** | Dadra & Nagar Haveli | 2,93,657 | 1,13,366 | 6 |
| **27** | Maharashtra | 9,95,24,597 | 1,63,17,096 | 1 |
| **28** | Andhra Pradesh | 7,60,22,847 | 99,84,697 | 1 |
| **29** | Karnataka | 5,42,74,903 | 86,06,441 | 1 |
| **30** | Goa | 13,18,228 | 1,16,528 | - |
| **31** | Lakshadweep | 57,341 | 5,782 | 1 |
| **32** | Kerala | 3,00,65,430 | 20,17,202 | - |
| **33** | Tamil Nadu | 6,52,44,137 | 1,00,73,618 | 1 |
| **34** | Pondicherry | 11,16,854 | 2,59,668 | 3 |
| **35** | Andaman & Nicobar Islands | 3,40,447 | 29,076 | - |

Source: Census of India, 2001 and 2011, Government of India

**Table- 4.11: Ranking of States and Union Territories by Literary Rate 2011**

| Rank | Persons | | Males | | Rank |
|---|---|---|---|---|---|
| | India/State/union Territory | Literacy rate | India/State/union Territory | Literacy rate | |
| 1 | 2 | 3 | 4 | 5 | 1 |
| 1 | Kerala | 93.91 | Lakshadweep | 96.11 | 1 |
| 2 | Lakshadweep | 92.28 | Kerala | 96.02 | 2 |
| 3 | Mizoram | 91.58 | Mizoram | 93.72 | 3 |
| 4 | Tripura | 87.75 | Goa | 92.81 | 4 |
| 5 | Goa | 87.40 | Tripura | 92.18 | 5 |
| 6 | Daman & Diu | 87.07 | Puducherry | 92.12 | 6 |
| 7 | Puducherry | 86.55 | Daman & Diu | 91.48 | 7 |
| 8 | Chandigarh | 86.43 | NCT of Delhi | 91.03 | 8 |
| 9 | NCT of Delhi | 86.34 | Himachal Pradesh | 90.83 | 9 |
| 10 | Andaman&Nicobar Island | 8627 | Chandigarh | 90.54 | 10 |
| 11 | Himachal Pradesh | 83.78 | Andaman&Nicobar Island | 90.11 | 11 |
| 12 | Maharashtra | 82.91 | Maharashtra | 89.82 | 12 |
| 13 | Sikkim | 82.20 | Uttarakhand | 88.33 | 13 |
| 14 | Tamil Nadu | 80.33 | Sikkim | 87.29 | 14 |
| 15 | Nagaland | 80.11 | Gujarat | 87.23 | 15 |
| 16 | Manipur | 79.85 | Tamil Nadu | 86.81 | 16 |
| 17 | Uttarakhand | 79.63 | Manipur | 86.49 | 17 |
| 18 | Gujarat | 79.31 | Dadra & Nagar Haveli | 86.46 | 18 |
| 19 | Dadra & Nagar Haveli | 77.65 | Haryana | 85.38 | 19 |
| 20 | West Bengal | 77.08 | Nagaland | 83.29 | 20 |
| 21 | Punjab | 76.68 | Karnataka | 82.85 | 21 |
| 22 | Haryana | 76.64 | West Bengal | 82.67 | 22 |
| 23 | Karnataka | 75.60 | Orissa | 82.40 | 23 |
| 24 | Meghalaya | 75.48 | Punjab | 81.48 | 24 |
| 25 | Orissa | 73.45 | Chhattisgarh | 81.45 | 25 |
| 26 | Assam | 73.18 | Madhya Pradesh | 8053 | 26 |
| 27 | Chhattisgarh | 71.04 | Rajasthan | 80.51 | 27 |
| 28 | Madhya Pradesh | 70.63 | Uttar Pradesh | 79.24 | 28 |
| 29 | Uttar Pradesh | 69.72 | Assam | 78.81 | 29 |
| 30 | Jammu & Kashmir | 68.74 | Jharkhand | 78.45 | 30 |
| 31 | Andhra Pradesh | 67.66 | Jammu & Kashmir | 78.26 | 31 |
| 32 | Jharkhand | 67.63 | Meghalaya | 77.17 | 32 |
| 33 | Rajasthan | 67.06 | Andhra Pradesh | 75.56 | 33 |
| 34 | Arunachal Pradesh | 66.95 | Arunachal Pradesh | 73.69 | 34 |
| 35 | Bihar | 63.82 | Bihar | 73.39 | 35 |

*Source: Census of India, 2011, Government of India*

**Table-4.12: Ranking of States and Union Territories by Literary Rate, 2001- 2011**

| State/ UTcode | India/State/Union Territory | Literacy rate | | Rank | | Decadal difference in literacy rate |
|---|---|---|---|---|---|---|
| | | 2001 | 2011 | 2001 | 2011 | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | **India** | **64.83** | **74.04** | **-** | **-** | **9.21** |
| **1** | Jammu & Kashmir | 55.52 | 68.74 | 32 | 30 | 13.22 |
| **2** | Himachal Pradesh | 76.48 | 83.78 | 11 | 11 | 7.30 |
| **3** | Punjab | 69.65 | 76.68 | 15 | 21 | 7.03 |
| **4** | Chandigarh | 81.94 | 86.43 | 5 | 8 | 4.49 |
| **5** | Uttarakhand | 71.62 | 79.63 | 14 | 17 | 8.01 |
| **6** | Haryana | 67.91 | 76.64 | 19 | 22 | 8.73 |
| **7** | NCT Delhi | 81.67 | 86.34 | 6 | 9 | 4.67 |
| **8** | Rajasthan | 60.41 | 67.06 | 29 | 33 | 6.65 |
| **9** | Uttar Pradesh | 56.27 | 69.72 | 31 | 29 | 13.45 |
| **10** | Bihar | 47.00 | 63.82 | 35 | 35 | 16.82 |
| **11** | Sikkim | 68.81 | 82.20 | 17 | 13 | 13.39 |
| **12** | Arunachal Pradesh | 57.34 | 66.95 | 33 | 34 | 12.61 |
| **13** | Nagaland | 66.59 | 80.11 | 20 | 15 | 13.52 |
| **14** | Manipur | 69.93 | 79.85 | 22 | 16 | 9.92 |
| **15** | Mizoram | 88.80 | 91.58 | 2 | 3 | 2.78 |
| **16** | Tripura | 73.19 | 87.75 | 13 | 4 | 14.56 |
| **17** | Meghalaya | 62.56 | 75.48 | 27 | 24 | 12.92 |
| **18** | Assam | 63.25 | 73.18 | 25 | 26 | 9.93 |
| **19** | West Bengal | 68.64 | 77.08 | 18 | 20 | 8.44 |
| **20** | Jharkhand | 53.56 | 67.63 | 34 | 32 | 14.07 |
| **21** | Orissa | 63.08 | 73.45 | 26 | 25 | 10.37 |
| **22** | Chhattisgarh | 64.66 | 71.04 | 23 | 27 | 6.38 |
| **23** | Madhya Pradesh | 63.74 | 70.63 | 24 | 28 | 6.89 |
| **24** | Gujarat | 69.14 | 79.31 | 16 | 18 | 10.17 |
| **25** | Damn & Diu | 78.18 | 87.07 | 9 | 6 | 8.89 |
| **26** | Dadra&Nagar Haveli | 57.63 | 77.65 | 30 | 19 | 20.02 |
| **27** | Maharashtra | 76.88 | 82.91 | 10 | 12 | 6.03 |
| **28** | Andhra Pradesh | 66.64 | 75.60 | 21 | 23 | 8.96 |
| **29** | Karnataka | 60.47 | 67.66 | 28 | 31 | 7.19 |
| **30** | Goa | 82.01 | 87.40 | 4 | 5 | 5.39 |
| **31** | Lakshadweep | 86.66 | 92.28 | 3 | 2 | 5.62 |
| **32** | Kerala | 90.86 | 93.91 | 1 | 1 | 3.05 |
| **33** | Tamil Nadu | 73.45 | 80.33 | 14 | 14 | 6.88 |
| **34** | Puducherry | 81.24 | 86.55 | 7 | 7 | 5.31 |

Source: Census of India, 2001, 2011

## 4.6: Literary Rates by Gender

According to Census of India, 2011, Kerala has a literary rate of 93.91 percent (highest in India) followed by Lakshadweep (92.28 percent) and Mizoram (91.58 percent). Bihar's position is the last which has literary rate of 63.82 percent preceded by Arunachal Pradesh (66.95 percent) and Rajasthan (67.06 percent). Maharashtra ranks 2nd (82.91) among the major states followed by Tamil Nadu (74.04 percent). Jammu and Kashmir, Rajasthan, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Bihar, Jharkhand, Orissa and Arunachal Pradesh and Assam have literary below the national average of 74.04 percent.

In terms of female literary Kerala ranks the first position. Rajasthan's female literary is the lowest that is 52.66 percent preceded by Bihar which is 53.33percent. Male literary is highest in Lakshadweep (96.11percent). Kerala ranks second in terms of male literary which is 96.02 percent. Male literary is the lowest in Bihar (73.39 percent) preceded by Arunachal Pradesh (73.69 percent).

## 4.7: Effective Literary Rate: Gender Gap

The gender gap during 2011 census was recorded at 16.68 which were 21.59 during 2001 census. The decadal difference in literary rates for males and females stand at 6.88 and 11.79 percentage points respectively. This indicates a substantial improvement in literary among the females. The gender gap was higher than the national average in 12 states and Union Territories in Census 2001. It was below the national average for 23 states and Union Territories during the same period. During 2011, the gender gap in 11 states is higher than the national average. For 24 states the gender gap is below the same period. Meghalaya and Mizoram (North-Eastern states) and Kerala (Southern State) have shown a minimum gender gap both during 2001 and 2011. Gender differential in literary both at 2001 and 2011 censuses are huge in Rajasthan, Jharkhand, Chhattisgarh, Madhya Pradesh and Jammu & Kashmir. These states are in fact at the bottom in terms of achieving effective literary rate.

## 4.8: A Comparison of Effective Literary Rate with NSSO Data (64th Round)

During 2011 census the effective literacy stands at 74.04 percent. The NSSO (64th Round) reports this at 71.70 percent. The NSSO conducted its 64th Round Survey in 2007-08. The Male literacy gap between the census 2011 and NSSO survey (64th Round) is 1.64 percent i.e., the NSSO reports it at 82.14 percent. The female literacy gap is 3.16 percent i.e., NSSO reports it at 62.30 percent and the census 2011 at 65.46 percent. All the states/Union Territories have shown increases in literacy rate in the Census 2011 as compared to NSSO. The exceptions are the North Eastern States of Assam, Nagaland, Manipur, Mizoram, Meghalaya, Arunachal Pradesh and Sikkim. Daman and Diu also shows a lower literacy rate during 2011 census. The comparison of literacy rates of 2011 census with NSSO survey (64th Round) is shown below in table -4.13.

**Table-4.13: Comparison of Literacy Rates of Census 2011 with NSSO survey (64th Round) by gender:**

| Sl. No | India/States/Union Territory | Literacy rate | | | Literacy rate | |
|---|---|---|---|---|---|---|
| | | 2011 Census | | | National sample (64th Round) | |
| | | Persons | Males | Females | Persons | males |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | **India** | **74.04** | **82.14** | **65.46** | **71.70** | |
| **1** | Jammu & Kashmir | 68.74 | 78.26 | 58.01 | 67.70 | |
| **2** | Himachal Pradesh | 83.78 | 90.83 | 76.60 | 80.40 | |
| **3** | Punjab | 76.68 | 81.48 | 71.34 | 76.10 | |
| **4** | Chandigarh | 86.43 | 90.54 | 81.38 | 82.80 | |
| **5** | Uttarakhand | 79.63 | 88.33 | 70.70 | 76.00 | |
| **6** | Haryana | 76.64 | 85.38 | 66.77 | 73.50 | |
| **7** | NCT Delhi | 86.34 | 91.03 | 80.93 | 85.20 | |
| **8** | Rajasthan | 67.06 | 80.51 | 52.66 | 61.70 | |
| **9** | Uttar Pradesh | 69.72 | 79.24 | 59.26 | 66.20 | |
| **10** | Bihar | 63.82 | 73.39 | 53.33 | 58.10 | |
| **11** | Sikkim | 82.20 | 87.29 | 76.43 | 83.90 | |
| **12** | Arunachal Pradesh | 66.95 | 73.69 | 59.57 | 70.50 | |
| **13** | Nagaland | 80.11 | 83.29 | 76.69 | 91.60 | |
| **14** | Manipur | 79.85 | 86.49 | 73.17 | 83.00 | |
| **15** | Mizoram | 91.58 | 93.72 | 89.40 | 95.90 | |
| **16** | Tripura | 87.75 | 92.18 | 83.15 | 78.40 | |
| **17** | Meghalaya | 75.48 | 77.17 | 73.78 | 92.60 | |

| | | | | | |
|---|---|---|---|---|---|
| **18** | Assam | 73.18 | 78.81 | 67.27 | 83.80 |
| **19** | West Bengal | 77.08 | 82.67 | 71.16 | 75.60 |
| **20** | Jharkhand | 67.63 | 78.45 | 56.21 | 64.60 |
| **21** | Orissa | 73.45 | 82.40 | 64.36 | 68.30 |
| **22** | Chhattisgarh | 71.04 | 81.45 | 60.59 | 71.00 |
| **23** | Madhya Pradesh | 70.63 | 80.53 | 60.02 | 70.40 |
| **24** | Gujarat | 79.31 | 87.23 | 70.73 | 74.90 |
| **25** | Damn & Diu | 87.07 | 91.48 | 79.59 | 93.00 |
| **26** | Dadra & Nagar Haveli | 77.65 | 86.46 | 65.93 | 72.50 |
| **27** | Maharashtra | 82.91 | 89.82 | 75.48 | 80.90 |
| **28** | Andhra Pradesh | 67.66 | 75.56 | 59.74 | 63.50 |
| **29** | Karnataka | 75.60 | 82.85 | 68.13 | 71.20 |
| **30** | Goa | 87.40 | 92.81 | 81.84 | 82.40 |
| **31** | Lakshadweep | 92.28 | 96.11 | 88.25 | 91.20 |
| **32** | Kerala | 93.91 | 96.02 | 91.98 | 93.90 |
| **33** | Tamil Nadu | 80.33 | 86.81 | 73.86 | 80.00 |
| **34** | Puducherry | 86.55 | 92.12 | 81.22 | 86.00 |
| **35** | Andaman & Nicobar Island | 86.27 | 90.11 | 81.84 | 85.90 |

Sources: Census of India, 2011 & NSSO (64th Round, 2007-08), Government of India

## 4.9: A Note on India's Traditional Knowledge

Traditional knowledge (TK) includes knowledge about traditional technologies of subsistence like tools and implements used previously or at present for hunting or agriculture by the indigenous or local communities. In most cases, there has not been documentation of traditional knowledge and it has been orally passed from person to person from time immemorial. In most cases traditional knowledge has come to us through stories, legends, folklore, rituals, songs and laws (Traditional Knowledge, Wikipedia). Traditional knowledge plays an important part in the daily lives of people of developing countries in matters of food security and health. Many international organizations such as world Intellectual Property Organisation (WIPO), International Labour Organisation (ILO), United Nations Educational, Scientific and Cultural Organisation (UNESCO), Food and Agriculture Organisation (FAO), and World Health Organisation (WHO) and conventions such as Convention on Biological Diversity (CBD), the United Nations Conference on Trade and Development (UNCTAD) have come up with the issue of protection of traditional knowledge, bio-piracy and fair and equitable sharing of benefits arising out of utilization of traditional knowledge.

International community such as WIPO and UNESSO in 1981 sought to recognize and protect traditional knowledge through the adoption of a model law on folklore and in 1989 the FAO introduced the concept of Farmers' Rights into its International Undertaking on Plant Genetic Resources. The CBD also in 1992 emphasised the necessity of promoting and preserving traditional knowledge.

India, being a bio-diversity rich country has taken steps along with other countries for the protection and preservation of traditional knowledge at the national and international levels. In 1992 also the Convention on Biological Diversity (CBD), emphasized the importance of promoting and preserving traditional knowledge. Thus many developing countries who are the holders of traditional knowledge and international organizations campaigning for protecting TK are continuously pressing for the creation of an international organization which ultimately led to the setting up of an Intergovernmental Committee on Intellectual Property and Genetic Resources Traditional Knowledge and Folklore in WIPO.

The preservation, protection and promotion of traditional knowledge and practices of local communities are extremely important for developing countries which play a critical role in their health care food security, culture, religion, identity, environment and ultimately in improving their trade and commerce. But it is a matter of great concern that this knowledge is largely used and patented by third parties without prior consent of traditional knowledge holders. It is seen that few of such benefits are being shared by the people of such local communities in which this knowledge originated and exists.

India has a rich traditional knowledge of ways and means practiced to treat diseases afflicting people. A part of this traditional knowledge has been found in ancient classical and other literature. But this is not easily accessible to the general public. Documentation of this knowledge was felt very urgent in order to protect it from being misappropriated in the form of patents on non-original innovations. In 1999, the Department of Ayurveda, Yoga & Naturopathy, Unani, Sidha and Homeopathy (AYUSH) constituted a Task Force for establishing a Traditional Knowledge Digital Library (TKDL). The TKDL project was initiated in 2001. The purpose of TKDL is to provide information on traditional knowledge existing in the country, in languages and format understandable by patent examiners at International

Patent Offices (IPOs). It is a collaboration project between Council of Scientific and Industrial Research (CSIR), Ministry of Science, AYUSH and Ministry of Health and Family Welfare, Government of India. TKDL involves documentation of traditional knowledge available in public domain from the exiting literature related to Ayurveds, Unani, and Siddha in digitized format. This documentation is done in English, French, German, Spanish and Japanese languages. It includes about 2.12 lakh medicinal formulations from 148 books and the database exists in 34 million A4 size papers. The government of India, on June 29, 2006, approved to provide the access of TKDL database to International Patent Offices, under Non-disclosure Agreement between CSIR and respective International Patent Offices.

The TKDL Access Agreements gave long-term implications on the protection and preservation of traditional knowledge and global intellectual property systems. This has also enhanced negotiating strengths of India and the developing countries at the international fore. The European patent office also appreciated the usefulness of this database. Many developing countries and international organizations such as South Africa, African Regional Industrial Property Organisation (ARIPO), Mongolia, Nigeria, Thailand, and Malaysia have come forward for creating their own TKDL-type database to protect their own traditional knowledge.

## 4.10: Conclusion

We have seen that every country in the world today is influenced by the forces of globalization and the rise of the knowledge economy. Developed economies have been able to take the fullest advantage of these forces for the creations of wealth and the well-being of people. For the less equipped developing economies, globalization and the knowledge economy may lead to poverty, unemployment, inequality and marginalization. The challenge before these economies, including India, is to channelize the forces of globalization and the knowledge economy for the alleviation of poverty and the empowerment of people to lead a decent standard of living. This calls for educational attainment of every citizen and human resource development through quality training and education.

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# Chapter-V

## Information Technology and Knowledge Economy: Role of Service Sector in India

### 5.1: Introduction

Indian economy is one of the world's largest economies. India has made substantial economic and social development during the recent past. It has been observed earlier that Indian economy is yet to overcome climatic shock. In what follows growth performance of Indian economy has considerably improved after globalization move .The nation could push forward her GDP growth rate – not infrequently around 8 percent which is in conformity with an average of 8 percent growth projections (India, Planning Commission, 2002a). In the social front Indian performance is not satisfactory. Sustained acceleration in economic growth is needed to provide an opportunity for India's growing population and its even faster-growing workforce. Jobless growth is general resolution. Hopefully we shall be able to overcome the problem of employment generation. No less significant is increasing regional disparity which has made finance commission even more significant to address the problem of regional asymmetry. At this juncture we may recall the political maturity of Indian constitution formulator – socio political knowledge of our predecessors.

Intellectual ability of Indian or political wisdom has not always translated into action and consequent changes in development. In what follows, present time is favourable for India to push forward her knowledge economy for improving human face. The nation has already experienced soft transition to the knowledge economy—an economy that creates, disseminates, and uses knowledge to enhance its capability of growth and human development. The knowledge economy is often taken to mean only high-technology industries or information and communication technologies (ICTs). It would be more appropriate, however, to use the concept more broadly to cover how any economy harnesses and uses new and existing knowledge to improve

the productivity of agriculture, industry, and services and increase quality of human life.

India has the potentiality for increasing productivity by shifting labor from low productivity and subsistence activities in agriculture, informal industry, and informal service activities to more productive modern sectors, as well as to new knowledge-based activities—and in so doing, to reduce poverty and touch every member of society. India should continue to leverage its strengths to become a leader in knowledge creation and use. To get the greatest benefits from the knowledge revolution, the country needs to press on with the economic reform agenda that it put into motion more than a decade ago and continue to implement the various policy and institutional changes required to accelerate growth.

India has many of the key ingredients for making this transition. It has a critical mass of skilled, English-speaking knowledge workers, especially in the sciences. It has a well-functioning democracy(!). Irony is that, in India – as a nation being respected across the globe for her intellectual and human resource quality is suffering from dynastic syndrome. In breeding of politician has become a regular phenomenon even in political parties not in opposition. It is obviously undesirable manifestation of globally acclaimed knowledge society of India. In what follows, despite the negative externalities of our knowledge society. India economic possibility is enviable to many nations in the present world.

Domestic market of India is one of the world's largest and expanding in every direction. The economy has a large and impressive Diaspora, creating valuable knowledge linkages and networks. The list goes on: macroeconomic stability, a dynamic private sector, institutions of a free market economy, a well-developed financial sector, and a broad and diversified science and technology (S&T) infrastructure. In addition, the development of the ICT sector in recent years has been remarkable. India has created profitable niches in information technology (IT) and is becoming a global provider of software services. Building on these strengths, India can harness the benefits of the knowledge revolution to improve its economic performance and boost the welfare of its people.

India's readiness to speed up the knowledge economy crucially depends on constraints and emerging possibilities confronting India on four critical pillars of the knowledge economy:

- Strengthening the economic and institutional regime
- Developing educated and skilled workers
- Creating an efficient innovation system
- Building a dynamic information infrastructure.

The above understanding or resolution is most conventional which ignores the sociopolitical environment of corruption. In our estimation / opinion nepotism, corruption and inadequacy of judiciary and human rights in short social sector is the fifth pillar of knowledge economy . Glass ceiling – gender discrimination at professional hierarchy and self annihilation or abandoning scientific research by Indian scientists is colossal wastage of knowledge potential of India. The story of Dr Subhas Chakroborty the inventor of artificial fertilization or test tube bay is well known. India lost the patent right and opportunity to earn foreign currency.

We however restrain and abide by the conventional path. To create and sustain an effective knowledge economy, India must undertake systemic integration of reforms in the four domains to strengthen its competitive advantage.

India should continue to focus its efforts on further reforming its overall economic and institutional environment and improve its overall trade and investment climate. Addressing all these issues is urgently required to improve performance across the economy. Further India has to initiate steps to leverage its strengths and opportunities on a global scale; it needs to undertake significant reforms and investments in building education and skills, strengthening its innovation system, and immediate concentrated effort for bolstering its information infrastructure. The following are some of the key issues that India needs to address in each of the four pillars to spur growth and innovation to augment economic and social welfare. We have here also concentrated on participation of elderly person in the society. In the new age, chronological constraint is much diluted – due to growth of Internet. A comparative analysis is therefore is worthy to investigate participation of elderly between India and USA.

## 5.2: Developing Educated and Skilled Workers

Education is the fundamental enabler of the knowledge economy. Well-educated and skilled people are essential for creating, sharing, disseminating, and using knowledge effectively. The knowledge economy of the twenty-first century demands a set of new competencies, which includes not only ICT skills, but also such soft skills as problem solving, analytical skills, group learning, working in a team-based environment, and effective communication. Once required only of managers, these skills are now important for all workers. Fostering such skills requires an education system that is flexible (discussed earlier in Chapter 4 and is further elaborated in Chapter 9 on Human resource).

## 5.3: Knowledge Economy and Indian Business Sector

Today the economy of every country is highly information technology driven. Information technology has become the backbone of infrastructure of all big and medium sized industries of our country. The following sectors like manufacturing, service, construction, healthcare, engineering, retail, aviation, railway, media etc are highly depended on information and communication technology.

Information and Communication Technology (ICT) encompasses systems and services to all such industries that gather, store, recover, maintain, manage, transmit, process, interpret, present and protect (in house and in transit) information which are very essential for their sustainability. ICT is embodied in large-scale and complex systems such as telecommunications networks and the World Wide Web, in devices such as mobile telephones and PCs, and in services such as banking, digital television and e-Government. It provides necessary tools and infrastructures for many branches of science and design including environmental science, bioscience and automotive design. ICT is the backbone of the digital economy. It drives forward productivity across all economic sectors and enables business transformation.

## 5.4: Automated Machines Controlled by Computers

Computer Numerical control (CNC) refers to the automation of machine tools that are operated by abstractly programmed commands encoded on a storage medium, as opposed to controlled manually via hand wheels or levers, or mechanically

automated via cams alone. These machines are nothing but robots. The first CNC machines were built in the 1940s and 1950s, based on existing tools that were modified with motors that moved the controls to follow points fed into the system on punched tape. These early servomechanisms were rapidly augmented with analog and digital computers that have revolutionized the machining processes.

In modern CNC systems, end-to-end component design is highly automated using computer-aided design (CAD) and computer-aided manufacturing (CAM) programs. The programs produce a computer file that is interpreted to extract the commands needed to operate a particular machine via a postprocessor, and then loaded into the CNC machines for production. Since any particular component might require the use of a number of different tools—drills, saws, etc., modern machines often combine multiple tools into a single "cell". In other cases, a number of different machines are used with an external controller and human or robotic operators that move the component from machine to machine. In either case, the complex series of steps needed to produce any part is highly automated and produces a part that closely matches the original CAD design. Today's manufacturing and engineering operations are fully run by CNC machines. Experience of corporate houses in India is favourable in adopting the modern tools. If we take the examples of TATA Motors for automobile manufacturing or we consider the company like Boeing for manufacturing airplanes or we take the example of SAIL for producing steels ,for each case CNC is essential now a days.

ICT creates wealth by allowing firms to:

a. Extend their reach and capacity

b. Reduce costs by streamlining their processes

c. Increase sales by offering higher quality and more competitive products and services.

d. Save processing time as well as cycle time.

Information technology can help organizations reduce the cost of products and services and, if designed correctly, assist with differentiation and focus strategies, too. For example, Corporate houses are using IT for overall cost leadership strategies. Information technologies can help bottom-line and top-line strategies. The focus of a

bottom-line strategy is to improve efficiency by reducing overall costs. A top-line strategy focuses on generating new revenues by offering new products and services to customers or increasing revenues by selling existing products and services to new customers. For example, e-commerce businesses are adapting business models to reduce distribution costs significantly.

Many organizations use enterprise systems, such as supply chain management, customer relationship management, enterprise resource planning, and collaboration software, to reduce costs and improve customer service.

## 5.5: Information and Communication Technology (ICT) in India

The rapid emergence of the Information and Communication Technology (ICT) sector has placed India on the global stage during the last one and a half decades. The sector has acted as a catalyst for growth across the Indian economy, including areas such as real estate, automobiles, travel and tourism, railway and mortgage banking industries. Employing over 2.5 million people directly, and over eight million indirectly through the sector, the ICT industry is rapidly expanding across all domains, primarily driven by software services.

With more attractive and investor-friendly Foreign Direct Investment (FDI) policies, India has become one of the favourite destinations for ICT investment portfolios. The introduction of liberalized foreign direct investment policies by the Indian government allows 100 per cent investment in the Indian ICT sector. The Government has initiated numerous measures to facilitate licensing, thereby making investment procedures easier.

The revenue aggregate of Indian IT-BPO industry is expected to cross US$ 100 billion during FY2012, according to NASSCOM. Aggregate IT software and services revenue (excluding hardware) is estimated to reach US$ 88 billion during the same period.

Further, export revenues (including Hardware) estimated to reach US$ 69.1 billion in FY2012 growing by over 16 per cent, while domestic revenues (including Hardware) to reach at about US$ 31.7 billion, growing by over 9 per cent. As a

proportion of national Gross Domestic Product (GDP), the sector revenues have increased from 1.2 per cent in FY1998 to an estimated 7.5 per cent in FY2012.

### Diversified field of utilization of IT

In modern times service sector plays an important role in the development of the nation IT is the backbone of service providing industries – transport and banking and fiancé along with health are three prominent once.

Information Technology is used in every sphere of Indian economy. The scope is widening with the development of IT infrastructure – both physical and human. IT sector has already penetrated even in the rural agriculture economy of the country. Significant role that IT plays in the external sector is discussed in the subsequent chapter – chapter 6. Application of IT in rural economy of India and Industrial sector are taken up in Chapters 7 and 8 respectively. Utilization of modern computer facility in service sector has special significance. It itself is an integral component of service sector. It is pertinent to mention at this juncture that modern health care system is extensively utilizing computer technology to influence the health status of our country.

### Banking and Financial Services

The BFSI segment accounts for the largest share of the domestic IT market. The major areas in which banks have undertaken IT related investments include computerization of branches, VSAT based networking among branches, installation of ATM networks, systems related to handling of credit/debit cards and facilities for Internet banking. An interesting trend, which we are beginning to witness, is the implementation of technology for improved customer service and thereby greater customer satisfaction apart from other significant benefits in terms of increased productivity. Another sector that has seen high IT related investments has been insurance. The increase has been driven primarily by the increase in the number of players as a result of opening up of the sector.

## Usage of IT in Banking and Financial Sectors (BFSI)

The usage of information technology (IT), broadly referring to computers and peripheral equipment, has seen tremendous growth in service industries in the recent past. The most obvious example is perhaps the banking industry, where through the introduction of IT related products in internet banking, electronic payments, security investments, information exchanges (Berger, 2003), banks now can provide more diverse services to customers with less manpower. Seeing this pattern of growth, it seems obvious that IT can bring about equivalent contribution to profits.

Some research work says that IT can reduce banks' operational costs (the cost advantage). For example, internet helps banks to conduct standardized, low value-added transactions (e.g. bill payments, balance inquiries, account transfer) through the online channel, while focusing their resources into specialized, high-value added transactions (e.g. small business lending, personal trust services, investment banking) through branches. Second, IT can facilitate transactions among customers within the same network (the network effect) (Farrell and Saloner, 1985; Katz and Shapiro, 1985; Economides and Salop, 1992).

Let us consider the case of automated teller machines (ATMs) by banks. If ATMs are largely available over geographically dispersed areas, the benefit from using an ATM will increase since customers will be able to access their bank accounts from any geographic location they want. This would imply that the value of an ATM network increases with the number of available ATM locations, and the value of a bank's network to a customer will be determined in part by the final network size of the bank. Indeed, Saloner and Shepard (1995), using data for United States commercial banks for the period 1971-1979, showed that the concern of network effect is important in the ATM adoption of United States commercial banks . Milne (2006) has also focuses the similar view. .

In view of these two effects above, it should be surprising to know that the evidence, however, shows some inconsistency in concluding the contribution of IT to banks' profit. Indeed, compared to manufacturing industries or agriculture, banking industries present higher diversification in providing customer services. In this case, a differentiated model with network effects would probably describe the market better

than the production function approach, which describes each bank's profit (output) as a specific production function of inputs. Notice that most empirical studies have constructed their testing on productivity or growth. In addition, while most production approaches only present a mixture of IT influences on both demand and supply sides, a differentiated model can distinguish a network effect from the demand side (in banking services) from a cost reduction effect.

### Usage of IT in Telecom Sector

Deregulation, mergers and acquisitions, and intense competition have thrown up multi-faceted challenges for the Telecom & Internet Service Provider communities. To sustain themselves in the highly competitive market, the players need to invest in infrastructure, improve quality of service, network efficiency and billing solutions.

### ICT in RURAL TELECOM

Telecommunication has been one of the prime services which an economy needs for rapid growth, development and modernization of its various sectors. It has been observed that telecommunication infrastructure development and economic development of a nation often proceed together.

### Application of ICT in rural Telecom

- Data networking, electronic mail and Internet access.
  - The use of electronic mail and access to the Internet is now growing faster than the explosive growth of facsimile transmission in the past ten years
- Distance learning, telemedicine and videoconferencing.
  - Telemedicine can improve access to specialty care in some areas, particularly in rural areas which they lack consultants in other fields of medicine.

### Importance & Benefits of ICT in rural telecom

- Economic growth

- Market information for buying and selling.
- Transport efficiency and regional development.
- Coordination of international activity, business, tourism and international organization.

- Improved agriculture
  - Farmers obtaining market information from urban areas.
  - Knowing scientific methods of agriculture from researches centers.
- Stemming out-migration to urban areas
- Education
  - Growth of interactive applications, ranging from audio videoconferencing
- Health care
  - Consultation by giving advice to rural workers.
  - Data collection and record keeping.
  - Training of health care workers.

### Usage of IT in Health Care Sectors

Healthcare is one of the fastest-growing verticals in India. The Indian healthcare sector has started focusing on serving customers better, keeping in mind the need to balance a robust and profitable business operation and meeting broader social objectives. The main focus areas have been to improve service to the end-customer, the patient and to increase patient safety. IT has played an important role in providing better systems, thereby streamlining information processes of an organisation, ironing out inefficiencies that grow due to lack of information, increase the quality of healthcare delivery to patients and reduce costs.

### Usage of IT in Aviation Industry

Globalization of the social economy will further increase during the 21st century. The mission of international air transportation will become more important, and all airports around the world will have a significant role to play. Furthermore, it is

predicted that air transportation demand in the world will double over the next 15 years.

In the meantime, since the September 11, 2001 terrorist attacks on the United States, the environment surrounding the aviation industry has become very severe and has caused adverse impact to the entire aviation industry. Security at airports has been reinforced in all aspects, significantly deteriorated on-time performance, caused mass congestion at the airport, and caused a drastic increase in aviation management and operational costs.

Owing to these issues, the aviation industry in recent years has seen a need to improve both convenience to passengers and security measures, and at the same time improve on-time performance in the most economical manner.

In connection with this trend, the International Air Transport Association (IATA) has been promoting the Simplifying Passenger Travel project to facilitate the process of international travel for next-generation air transportation. Information and communication technologies (ICTs) have an especially significant role to play here, for it is only with the strategic, widespread, intensive, and innovative use of ICT in future airport development policies and programs that the ambitious agenda of passenger convenience and airport security becomes much more possible to achieve. But this involves the need not only to unleash the potential of ICT per se, but also the need to ensure that an enabling environment and capacities that can facilitate its aviation applications are in place.

## ICT applications in Aviation Industry

•Air Passenger Needs

1. Travel Planning

Through any 3G mobile phone, one can use the in-built videoconferencing facility with his business partners or friends to discuss a travel plan. Once an itinerary has been agreed, one can access the Web site of travel agents and ask for quotes from different airlines regarding routes and accommodation types. Through e-mail and/or short message service (SMS) messages from the travel agent, the traveler can use his

PC, mobile phone, or personal digital assistant (PDA) to find out a plan most suitable to him.

2. Commencement of Traveling

On the day before departure, the traveler may need to buy some gifts, and he can access one of the virtual shops at the airport and pick it up on the day of departure. Assume that a traveler wants to travel hands-free; a delivery company would be asked by the airline to contact him for the purpose of picking up his baggage for delivery to the airport. In order to check the airline and flight number from the e-ticket, the driver could check the traveler's mobile phone by means of his portable identity (ID) terminal. When the driver does this, the ID terminal automatically sends the baggage information to the airline's computer system. Upon arrival at the airport, the baggage will then be transferred to the baggage handling system for security inspection and subsequently delivered to the aircraft.

3. Departing for Airport and E-Check In

On the day of departure, when the traveler arrives at the rail station, he can pass through the rail ticket gates simply by holding his mobile phone in contact with the designated scanner so that the built-in IC chips could be scanned. When it is time for boarding, the group would expect to check in quickly through the automatic check-in kiosks, which are installed with one of the International Civil Aviation Organization (ICAO)-endorsed biometrics for passenger identification and passport control.

4. Arrival at the Destination Airport

When the destination airport is installed with an advance passenger information (API) system, the API data (collected from a passenger's machine-readable e-passport) will be sent by the airline to destination airport, enabling the customs/immigration officials at the airport to organize their clearance process in advance of the arrival of the flight.

With this system, the customs/ immigration officials at the destination airport are able to focus on previously selected passengers, significantly reducing the wait

time for the majority of passengers and enhancing the quality of the clearance process regarding the inspection of suspected aliens or illegal immigrants.

Upon arrival at the destination airport, one may want to learn about the tourist promotion programs; this can be obtained via the electronic translation facility provided at the airport.

- Aviation Security Needs

1. Identity Verification

2. In air travel there is an increasing need for accurate and efficient verification of passenger identity. Technologies which allow for stronger access control and strengthened document integrity will be welcome by most airports.

In recent years, there has been a steady increase in the testing and piloting of biometrics. Biometrics are unique, measurable characteristics or traits of a human being for automatically recognizing or verifying identity.

The stability and uniqueness of the fingerprint are well established and Facial recognition technology utilizes distinctive features of the human face in order to perform a biometrics match. Even though two individuals may look alike, the unique physiological patterns of their facial features will be different.

2. Better Resource Utilization

Some countries started implementing trusted passenger programs to expedite the security screening of passengers who participate in such programs, thereby allowing security screening personnel to focus on those passengers who should be subject to more extensive screening.

## Usage of IT in Retail Sector

The significant increase in activity in the retail sector has resulted in a growth in IT investments in this sector. Indian retailers have been spending more and more on setting up IT systems and, importantly, plan to hike up their investments in this area in the future. Retailers are also looking beyond basic expenses to higher levels of IT

functionalities. Applications that are very commonly used by retailers include SCM, CRM and e-business solutions.

Government spending on IT is expected to witness a significant increase, owing to initiatives by both the Central and State governments. The government will use web-enabling services, consulting for planning and implementation, apart from the hardware and software needed to build the e-governance platform.

### Domestic Outsourcing-The BPO sectors

Domestic business process outsourcing (BPO) industry is emerging to be very important. The ability to transform business and add value is likely to project this pre-nascent industry to success. While IT outsourcing is a starting point in the domestic BPO segment, there is large potential in other areas like finance and accounting as well as many other activities. Bharti's deal with IBM and the more recent managed networks deal with Nokia, the Bank of India-HP deal, the Dabur-Accenture deal etc, point that the Indian market has matured and domestic outsourcing provides a huge opportunity for vendors.

According to the National Association of Software and Services Companies ( NASSCOM) out of the total exports, outsourcing services such as software programs, billing, customer management and accounting, grew to $US5.2 billion or 44 per cent of the worldwide total .The outsourcing industry also crossed a milestone in employment. The industry scaled record levels of employment during the 2008 with the employee base crossing the one-million mark. Despite the anti-outsourcing laws planned in the US and other regions India attracts foreign companies. The strong growth validates the economics of offshore outsourcing. India's offshore value proposition remains the strongest. Positive market indications and strong records strongly support the optimism of the industry in achieving its aspired target of $60 billion in software and services exports and $73-75 billion in overall software and services revenue by fiscal 2010. Direct employment is expected to reach two million people in 2010.The 2010 target would mean an increasing contribution of the sector to the socio economic development of the country. According to NASSCOM ,IT-BPO will employ about 2.5 to three million professionals directly in the sector, account for direct investment of about $10 to 15 billion and contribute seven to eight per cent of the national GDP by 2010. The Software Industry, which is a main component of the

Information technology, has brought tremendous success for the emerging economy. India's young aged manpower is the key behind this success story.

## Usage of ICT in media

ICT has had several effects on journalism, with some of them seen as advantages while others as disadvantages. Computer and the modem, along with many other ICT hardware and soft ware innovations and services, have placed us at a high point of a very significant stage of development in the history of human communication, often called, 'the information society', and have transformed the way many men and women work in the media and entertainment industries". This points to the fact that ICT has brought about significant changes in the journalism.

ICT has led to the generation of more and well researched news. With the coming of mobile phones, you can call your news sources at anytime and get news and moreover well-balanced and researched news. When it comes to the Internet, news and program backgrounders are always available.

Think of any topic you are working, from health, education, lifestyle, to environment, you cannot fail to get information to help you enrich your story especially with those hard to get facts. The Internet has surely transformed the newsroom to greater heights. It is important to note that this comes as a result of globalization and it is also a cause of globalization in one way.

ICT has made reporters, editors and other news contributors closer. It has created a 'network 'that leaves reporters and editors in close contacts at any one time. The editor can at any one time call the reporter who is situated in any place, as long as there is telephone network there, and get a story from him/her. Likewise, reporters file stories at any given time via the Internet. Mobile and satellite telephones and general improvement of landlines, have made it possible for newspapers to get stories from a reporter stationed anywhere. No matter where a reporter is stationed, he/she is always connected and close to the newsroom.

This in turn is cheap because not much money is wasted on transportation fares of the reporter from the field and back to his duty station. Mwila in his interview with RAP 21, drives this point home when he states, "Once fully adopted and adapted, the ICT will transform the newsrooms into cabled and networked centres

with all journalists discharging stories on to a network, editors picking them before sending them to the page designers or casters in the case of electronic media."

ICT has made communication process participatory. It is no longer only the journalist who is involved in this field, but the audience too. The local people affected are also part and parcel of the communication process. With ICT, diffusion, two-step flow and extension approaches of communication no longer hold. Communication is bottom-up. Listeners are able to pick their phones and call in the radio stationers immediately and in form communicators about anything happening in their area. Reporters later investigate on such issues.

In other words, ICT has helped to bring closer communicators and receivers to the extent that feedback is swift. This in turn makes communication process participatory, useful and development focused as it centers on the audience. Servaes and Malikhao (2005;91), argue that, "Participatory, which necessitates reasoning and moreover trust will help reduce the social distance between communicators and receivers, between teachers and learners, between leaders and followers as well as facilitate a more equitable exchange of ideals" this draws attention to the fact that ICT has made exchange of ideas between communicators and receivers easy hence making the communication process people centered.

## 5.6: Aged People and the Usage of Internet

Demographic trend across the world is increasing share of elderly group in population cohort. Elderly groups are marginalized in every society. Computer technology – internet in particular is helping this section of people to improve their quality of life. In the knowledge society they are emerging as self help group to overcome the age inflicted problems and difficulty. Computer technology and the Internet have a tremendous potential to broaden the lives and increase the independence of aged people. Those who have difficulty leaving their homes can now log in and order groceries, shop for appliances, research health questions, participate in online discussions, catch up with friends, or make new ones.

Transnational variation is expected. However inadequacy of information has restricted our investigation. A comparative study between the developed USA and our country is made to understand the future trend.

## Variation in use: age intervening

Experience suggests that more than half of the American population goes online and the computers and technology are traditionally seen as the domain of the young. But is this true? Generally it has been seen that children go on line both for educational and entertainment purposes. But the people who have attained the age of sixty years use internet for multiple purposes. It has been seen worldwide that those who are 24 years of age and younger have very high percentages of their age groups in Internet on line. This age group does tend to be techno savvy and its members use the Internet for research, entertainment, and communicating with friends through different social networks through face book, orkut, and twitter etc. But those who are 25 years and more than that have the most dynamic growth rates in computer world.

The study conducted in USA focuses that the people who are 50 and older are the fastest growing segment in computer world. But what is the scenario in India? Are the Indian aged people surfing Internet and getting the advantages of Internet? Is there any organization to make the old people aware about Internet usage? The aged people can pass their time well in the Internet. It will also be productive. The exact scenario needs to be investigated.

## Internet Use and the Benefits

Like millions of people, the aged people throughout the world use internet intensely in sending and receiving e-mail, online banking, shopping, reading news and books, online publications, and blogs, preparing speeches, including power point presentations, checking financial investments, organizing photos, using social media, ordering prescription items, and preparing and submitting tax return using the online pay system of income tax Department. The farmers can gather weather update and agriculture data useful for predicting better production decision.

We begin our discussion with a set of questions related to the use of Internet by the aged people. Are the Indian old people surfing internet and getting the advantages of internet? Is there any organization to make the old people aware about internet usage? Can the aged people pass their time well in internet? It will be productive also. But the exact scenario needs to be found out.

These days – like millions of other people – the people who are old aged can use internet as sending and receiving e-mail; online banking; shopping; reading news,

online publication, and blogs; preparing speeches, including Power Point presentations; checking financial investments; organizing, photos, using social media, ordering prescription items; and preparing and submitting tax return using the online pay system of income tax dept. The farmers can get weather update and agriculture data which are very useful for the better production. So internet can be a very useful hand for the aged people. They can reduce their boredom. And the use of internet is very easy for everyone. Even an uneducated person can use internet just clicking the mouse on some objects.

### General Population vs. Internet Population –USA experience

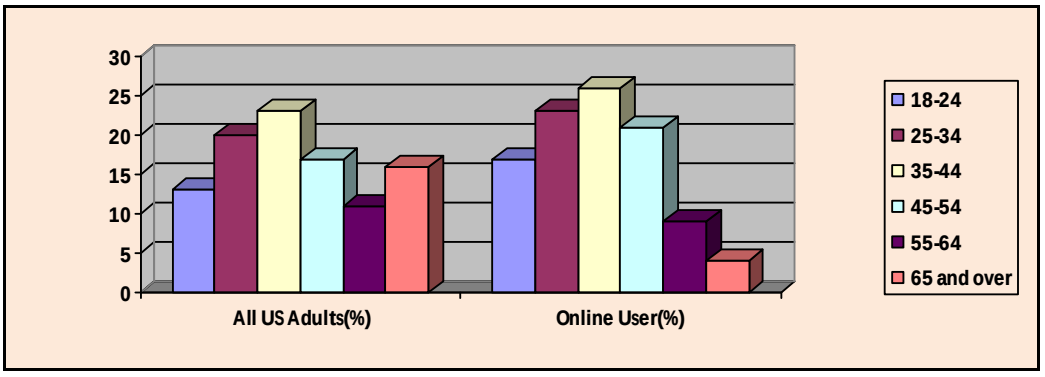
A study was done by the US Dept of Commerce regarding the age wise percentage of online users in USA and some interesting results were found out which is mentioned in table-5.1.

Table-5.1 shows that out of total 44 percent of aged population in USA 34 percent uses internet and it is a huge number.

**Table-5.1: A Comparative Study between General Population and Online Users**

| Age | All U.S. Adults (%) | Online User (%) |
|---|---|---|
| **18-24** | 13 | 17 |
| **25-34** | 20 | 23 |
| **35-44** | 23 | 26 |
| **45-54** | 17 | 21 |
| **55-64** | 11 | 9 |
| **65 and over** | 16 | 4 |
| **All** | 100 | 100 |

*Source: U.S. Department of Commerce, 2009.*




During the year of 1996 to 2000, the share of the online population whose age was 35 and above had increased from 52 per cent to 62 percent; the share for 18-34 year-olds has fallen from 48 percent to 38 percent. According to A Nation Online,

while 18-35 years olds tend to use the Web more for entertainment but those who are 35 and above have a different agenda. Online banking, shopping, and gathering health information all ranked high on the list of their frequent activities (and keeping in contact with loved ones through e-mail, of course – this is every group's favourite activity).

### Impact of Age on Internet Usage in USA

The age group between 18-30 are called 'Generation Y', the age group between 31-42 are called 'Generation X', the age group between 43-61 are called 'Baby Boomers', the age group between 62-71 are called 'Matures and above 71 are called After Work. A survey was done by University of Illinois, USA that a handsome number of aged people are highly depended on internet. From table-5.2, we can clearly understand the rate of internet usage by the aged and old people in USA. There is 79 percent 'Baby Boomers' whose age is in between 43-61 and 56 percent of the mature people whose age between 62 -71 uses internet. And it is very interesting.

**Table-5.2: Demographic Profile of US Adults Who Use the Internet, June September, 2007**

| Gender | Percent |
|---|---|
| **Male** | |
| **Female** | 78% |
| **Age** | 75% |
| **18-30 (GEN Y)** | 91 |
| **31-42 (GEN X)** | 90 |
| **43-61 (Baby boomers)** | 79 |
| **62-71 (Matures)** | 56 |
| **71+ (After work)** | 29 |
| **Family Annual Income** | |
| **<$40000** | 61 |
| **$40000+** | 91 |
| **Education** | |
| **Less than high school diploma** | 41 |
| **High School Diploma** | 69 |
| **College** | 86 |
| **Advanced College Degree** | 93 |
| **Geographic location** | |
| **Urban** | 76 |
| **Suburban** | 80 |
| **Rural** | 66 |

*Note: (Sample Size: 2796, English Speaking only)*
*Source: Graduate School of Library and Information Science, University of Illinois, 2007.*

India's internet community grew by a spectacular 42 percent in 2009 from a year ago, spurred by a rash of cheaper devices and affordable broadband plans that helped sidestep problems such as buttoned – up PC sales and a shrinking spread of cyber cafes. Available information suggests that by 2009, total number of internet users grew to 71 million in India. The exclusive and confidential annual survey by market research agency IMRB and Internet and Mobile Association of India, traced users who have used the internet at some point in time, give some indication of the number of Indians who have gone online at least once in their lifetime.

According to the survey four out of five computer users and English-speaking person in urban India are now hooked to the Web, The survey was conducted among 19,000 households, 68.000 individuals and 500 cyber cafes. The study says India's active user base – comprising people who access the internet at least once a month – grew by 18 percent to 51 million in 2009.

However, the survey also offers salient data that are a counter against getting carried away by the other glowing trends. The number of users who possess an internet connection remains remarkably low at 14.6 million. Also, internet penetration is still meager compared to that of countries such as the US. China has over 360 million internet users followed by US at 227 million and Japan at 95 million. Number of Internet users in Asia is 5, 29, 701, and 704. Though Asia has only 16 percent of populations of the world, 37.6 percent of total internet users are Asian which is great. Of them around 60 million are from India. India is 3rd in Asia (1st is China (220 million) and 2nd is Japan (87.5 million)) and 4th in world (1st is China (220 million), 2nd is USA (216 million) and 3rd is Japan (87.5 million)) as per as internet users are concerned.

**Table-5.3: Trend in Internet Usage in India, from 1998 to 2010**

| Year | Internet Users | Population | % over population |
|---|---|---|---|
| **1998** | 1,400,000 | 1,094,870,677 | 0.10 % |
| **1999** | 2,800,000 | 1,094,870,677 | 0.30 % |
| **2000** | 5,500,000 | 1,094,870,677 | 0.50 % |
| **2001** | 7,000,000 | 1,094,870,677 | 0.70 % |
| **2002** | 16,500,000 | 1,094,870,677 | 1.60 % |
| **2003** | 22,500,000 | 1,094,870,677 | 2.10 % |
| **2004** | 39,200,000 | 1,094,870,677 | 3.60 % |
| **2005** | 50,600,000 | 1,112,225,812 | 4.50 % |
| **2006** | 40,000,000 | 1,112,225,812 | 3.60 % |
| **2007** | 42,000,000 | 1,129,667,528 | 3.70 % |
| **2009** | 81,000,000 | 1,156,897,766 | 7.00 % |
| **2010** | 81,000,000 | 1,173,108,018 | 6.90 % |

Table-5.3 shows that a significant growth of internet users from 2007 to 2010. India has 13 percent of internet users in Asia and 7.36 percent that of the world. But the sorrowful fact is low 5.3 percent of people in India use internet. The reason of this is most of the people in India don't know computer. 70 percent of people who know computer have used internet which is a healthy sign.

We also observe some intercity variation in internet users. Mumbai has the maximum number of internet users (3.24 million) in India followed by Delhi (2.66 million). The top ten cities where people use internets are Mumbai Delhi, Bangalore, Kolkata, Chennai, Pune, Hydrabad, Ahmedabad, Surat and Nagpur in that order. The total number of internet users of those 10 cities are 37 percent of the total number of internet users in India.

### Site preference and browsing

Sites preference of users and browsing practice highlights some significant phenomenon. Most of the users use net for emailing (95 percent) which is obvious. Next is job searching (73 percent) showing crisis of getting job in India followed by chatting sites (62 percent), social networking sites (51 percent) and quite interesting mathematical sites (48 percent).

The top ten sites internet users browse in India are the following:

1. Yahoo
2. Google India
3. Google
4. Orkut
5. Rediff
6. You tube
7. Blogger.com
8. Windows Live
9. Rapid Share
10. Wikipedia

## Old Aged People and Internet Usage in India

Internet ownership has seen growth of 32 percent during the survey period. It is a delighting fact, there are some concerning factors too. Those are:

- Only 5.3 percent people use internet in India which is very low.
- Most of the users are male (85 percent). The female percentage should increase.
- Maximum number of users is from top 10 cities (37 percent). So the internet usage in urban areas is very less.
- And they very low rate (approximately 15 percent of the total internet users) of aged people who use internet unlike USA.

The low rate of internet usage among the aged people in India is not unexpected due to illiteracy and lack of access. Hopefully the situation will improve with greater penetration among the rural masses. Serious concern because if we need a developed India needs measures to improve internet awareness among old aged people.

The age group between 19-40 years is major section (85 percent) using internet in India. 85 percent of internet users in India are male which not a healthy picture. It is not surprising that among working women, only 11 percent use internet. The ratio is almost half (6 percent) in case of non-working women and even worst in case house-wives (2 percent). The scenario is much better in case of young men (33 percent). Also 15 percent older men, 14 percent school going kids and 21 percent college students use internet in India, 46 percent of net users are graduate, 26 percent are post-graduate. Among these, 2/3rd of user use internet 2-3 times a week. 62 percent uses internet from office as in most of the offices, it's free.

Age is very important factor and all older people want to make later life a more fulfilling and enjoyable experience. Therefore internet can help the ageing population very much.

There are many older people who are very interested in understanding and participating in new technologies such as the Internet, the web, email, Desk Top publishing etc.

Their motivations may be varied; it might be a feeling of needing to keep up with their grandchildren, to stay in touch with families and friends, to keep "grey cells" active, to take forward skills that have been picked up in earlier employment of just curiosity. Whatever the drivers, there are more and more older people who are signing onto internet.

The time has come in India that we need to activate older people – with a basic knowledge of computers and the internet and increase their confidence, offering them the change to move on if they wish, to more in depth, certificated training, and possibly, a return to paid employment of a greater involvement in voluntary or free time activity.

For more weak elderly people we need to enable them to take a much greater part in the life of their community. They will be encouraged to identify areas of particular interest to them so that appropriate web sites can be 'surfed' – which may be the desire to investigate a particular medical condition, find out more about a legal or historical matter, or simply to research their family history etc.

The old aged people can be more productive for a nation and be happy if they could start their new life with internet.

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# Chapter-VI

## Discourse on Knowledge Based International Trade- Pragmatic Analysis

### 6.1: Introduction

Production enterprises use inputs and convert them into output. In economic sense, inputs such as, capital, labour and other factors of production are being used as part of production process. Broadly speaking, inputs can be divided into labour, materials and capital which again might have different segmentations. Labour can be categorized into skilled labour and unskilled labour. Carpenters and engineers are examples of skilled labour and agricultural workers are known as unskilled labour. Steel, plastics, electricity, water and any other goods that the firms buy, transform into final products. Land, building, machine and other factors as well as inventories fall under the category of capital. Firms transform these inputs in various combinations into outputs.

Technology is the core of every production function. Firms while producing a good learn from doing. Same combinations of inputs can produce more and more output. Firms may be more productive reorganizing the input combinations (i.e., reorganizing the production process, changing the organizational structures, reducing lost time and material, improving maintenance procedure and so on. We can represent the net effect of technology change with the help of a production function for same good X that depends on two factors capital (K) and Labour (L) at some point in time t as follows.

$$X_t = A \times F(K_t, L_t)$$

The subscripts on X,K and L represent the time period (t) and the parameter A calibrates the value derived from F (K,L) into units of output. Technological change can augment the output that could be expected from any combination of capital and labour by g X 100 percent per year. The production function, then, would look like

$$X_t = [A (1+g)^t] F (K_t, L_t).$$

Here technological change will show changes in isoquant and the marginal end average production of all inputs would increase by ( gX 100 percent) per year. (Edwin Mansfield & Gary Yohe: Microeconomics, 2010). www. Newton & Company, Inc, NY.)

The shape of the production function of an economy can show the process of economic growth of that economy. In the real world, production takes place using many different inputs to production. This may in fact be summarized as – physical capital ($K_t$), Labour ($L_t$) and technology or knowledge ($T_t$). The production then can be expresses by

$$Y (t) = F [K (t), L (t), T (t)]$$

Where y (t) is the flow of output produced at time t.

In the modern world economy, knowledge is as important as other factors of production like land, labour and capital. This is truer especially in highly innovative/sophisticated industries where knowledge contributes as an input to augment production and productivity in larger quantity benefiting the producers, the consumers and the economy at large.

Companies acquire knowledge through technology. This new technology comes about due to spending on research and development (R&D) efforts. Companies also learn from competition by studying their products. Thus firms upgrade their know-how through R&D and through learning and doing. Thus apart from formal diffusion of knowledge a significant portion of knowledge diffusion takes place at a personal level and this kind of informal diffusion of knowledge takes place most effectively when an industry is concentrated in an area wherein employees of different firms/companies mix socially and exchange their views freely about technical issues relating to products.

This chapter deals with the impact of knowledge or research and development efforts as a key determinant of trade pattern in manufactured goods (Raymond Vernon, “International Investment and International Trade in the Product Life Cycle”, Quarterly Journal of Economics 80, 1966, pp. 190-207). It begins with the analysis of

new trade theories explaining the impact of R&D (knowledge) on international trade, ICT application in trade facilities, e-commerce and trade facilitation at global level.

## 6.2: New Trade Theories

In the discussion of international trade, we generally assume that the production possibilities for a country remain the same. But the fact is that changes in a country's production possibilities frontiers are continually taking place and are often fostered by the country's economic policies. Growth in output potential is represented by outward shifts in the production possibilities, which enables the country to reach to a higher level of real income and thus a higher level of well-being.

Trade theory developed by David Ricardo (1817) explains trade in terms of international differences in labour productivity and the alternative explanation offered by Eli. F. Heckscher and Bertil Ohlin (1933) links trade patterns to an interaction between the relative supplies of national resources such as land, labour and capital and the relative use of these factors in the production of different goods (Krugman, 2009). New trade theories developed after **Leontief Paradox (1953**) mainly focuses on the expansion of trade due to innovation. Almost all the newer trade theories developed especially since 1960s and later on, relax some of the assumptions such as market structure, production conditions, use of technology, etc. and explain the reasons for trade and the diverse effects of trade on the participating economies. We now examine the impact of R & D efforts to trade expansion and the changes in the pattern of trade with the help of some selected newer trade models.

**The Imitation Lag Hypothesis (1961)** introduced by Michael V. Posner contradicts the basic Heckscher-Ohlin model which states that for the production of a specific commodity the same technology is available everywhere. Posner categorically indicates that the same technology and know-how may not be always available in all the countries. This is because of delay in the transmission or diffusion of technology from one country to another. We consider a two-country world. We also suppose that a new product appears in the first country because of the successful efforts of research and development teams. The second country, according to this theory, will not be able to produce the same product at the same time. Incorporating a time dimension, the imitation lag is defined as the length of time that elapses between the new product's introduction in the first country and the appearance of the version

produced by the firms in the second country. The imitation lag includes a learning period during which the firms in the second country must learn the know-how to produce the new product. It also takes time to buy inputs (raw materials), install equipments, process the inputs, place the final good to market, and so on. This is the first lag. The second lag is the demand lag. This is the length of time between the product's appearance in the first country and its acceptance by the people in second country.

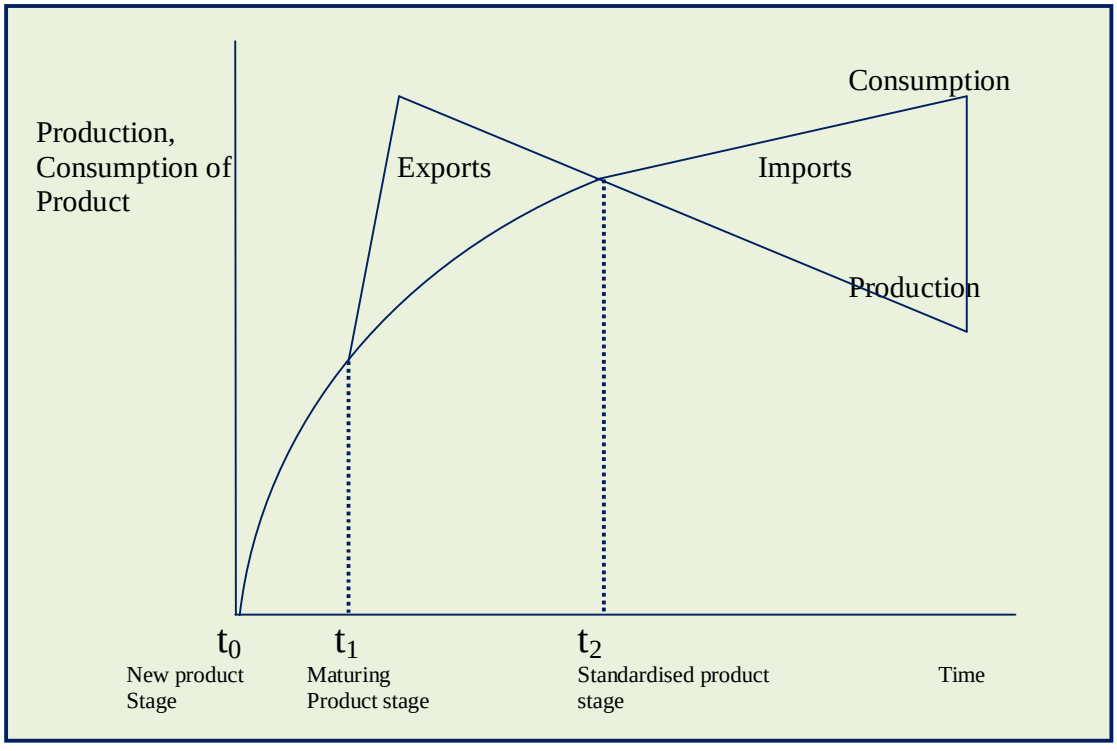
Another theory, **the Product Life Cycle Theory (1966)** developed by Raymond Vernon is concerned with the life cycle of a new product and its effects on trade. The new product (a manufactured good) caters to high-income demand and the good itself is labour-saving and capital – using in nature. This theory divides the life cycle of the new product into three stages – the new product stage, the maturing stage and standardized product stage. In the first stage, the product is produced and consumed only in the first manufacturing country. The producing firms stay close to the market place in order to quickly receive consumer response regarding the product. In the second stage, some general standards for the product and its characteristics begin to emerge and thus mass production techniques are adopted. In this stage, economies of scale are realized. In this stage, the first country also tries to assess the possibilities of producing abroad in addition to producing at home. If cost picture becomes favorable i.e. production abroad costs less than production at home plus the transportation cost. If this is done, then export displacement of the product occurs. As a result of this, other countries can be supplied from the new producing country selected by the first country as its production unit. Thus relocation of production aspect of this theory is a useful step because it recognizes that capital and management mobile internationally. In this stage, the product might now begin to flow from Western European nations to the US (for example). The final stage is the standardized product stage. In this stage ,product's life cycle, the characteristics of the product itself and of the production process are well known. The product is familiar to the consumers and the production process to the producers.

Vernon hypothesizes that production may shift to the developing countries. Labour costs again play a dominant part and the developed countries are busy introducing other products. Therefore, trade pattern shifts i.e. the first country

(obviously a developed country) instead of exporting the product imports it from the developing countries.

Figure-6.1 depicted below shows production, consumption and the pattern of trade of the typical 'new product'. Figure-6.1 tells us that from time $t_0$ until time $t_1$, the country (here USA) is producing the new product for the home market only and thus there is no trade. From time $t_1$ until time $t_{2,\ the}$ country exports the good to other developed countries (exports = production – consumption) and may even begin importing the good from those countries (imports = consumption – production). From time $t_2$ onward, imports arrive into the first country from other developed countries and increasingly, from developing countries. The product cycle theory postulates a dynamic comparative advantage because the country source of exports shifts throughout the life cycle of the product. Early on, the innovating country exports the good but then it is displaced by the other developed countries. For example, electronic products such as television receivers were for many years a prominent export of the United States, but Europe and especially Japan emerged as competitors, causing the U.S share of markets to diminish dramatically.

**Figure-6.1**




More recently, Japan has been threatened by South Korea, China and other Asian producers. The textile industry is another example where developing countries

especially China, Taiwan, South Korea, Singapore and recently Bangaladesh and India have become major supplier on the world market, displacing in particular the United States and Japan. Automobile production and export location also shifted from the United States and Europe to Japan and later on to South Korea and Malaysia. This dynamic comparative advantage, together with factor mobility and economies of scale, makes the product cycle theory an appealing alternative to the Heckscher-Ohlin model.

There is no single all-inclusive test to verify empirically the product cycle theory. Instead, researchers have examined particular features of the PCT to see if they are consistent with real- world experience. Economists hypothesise that, in the US manufacturing sector, there should be a positive correlation between R&D expenditures and successful export performance by industry. A number of tests indicated this result, including those by Donald Keesing (1967), William Gruber, Dileep Mehta and Vernon (1967), Kravis and Lipsey (1992) found that high R & D intensity was positively associated with the direct-investment and export-displacement features of the PCT.

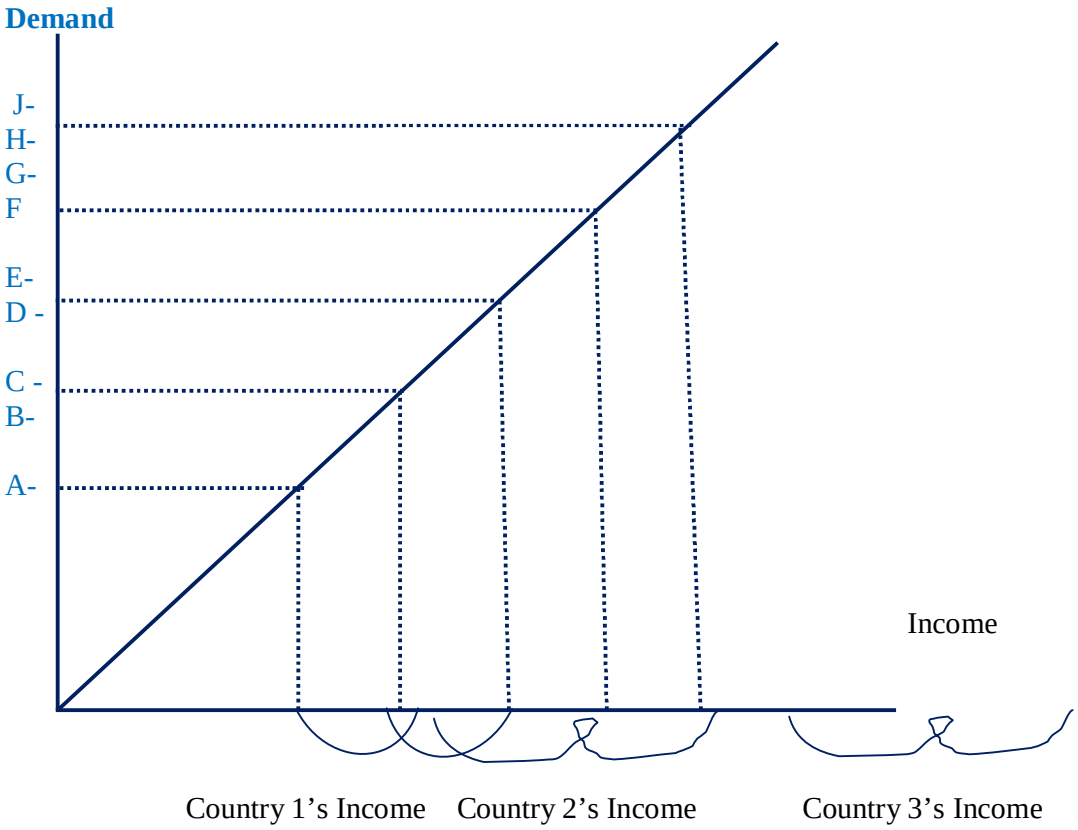
**The Linder Theory** is a dramatic departure from the Heckscher – Ohlin model because it is almost exclusively demand-oriented. The Heckscher-Ohlin approach was primarily supply-oriented because it focused on factor endowments and factor intensities. The Linder theory postulates that tastes of consumers are conditioned strongly by their income levels, the per capita income level of a country will yield a particular pattern of tastes. It is to note that Linder is concerned only with manufactured goods. He regards Heckscher-Ohlin as fully capable of explaining trade in primary products.

Now to illustrate the Linder theory we suppose that country 1 has a per capita income level that yields demands for goods A, B, C, D, and E. These goods are arrayed in ascending order of product quality or sophistication , with goods A and B , for example , being low – quality clothing while goods C,D and E are further up the quality scale. Now suppose that country 2 has a slightly higher per capita income. Because of its higher income , it may demand and therefore produce goods C,D,E,F and G. Goods F and G may be quality products (such as silk) not purchased by

country is therefore producing goods that cater to the demands and tastes of its own citizens.

Given these patterns of production, what happens if the two countries trade with each other? Which goods will be traded between them? Trade will occur in goods that have overlapping demand, meaning that consumers in both countries are demanding the particular items. In our example, goods, C, D, and E will be traded between countries 1 and 2. Suppose that we introduce country 3, which has an even higher per capita income than country 2. Country 3's consumer demand may be for E, F, G, H and J. which goods country 3 will trade with the other two countries? Country 3 will trade goods E, F and G with country 2, but it will trade only good E with country 1. The following fig (fig-7.2) portrays the income-trade relationships, recognizing that there is a representative range of individual incomes around each country's per capita income level.

**Figure-6.2**



Looking at the Linder model as a whole, the important implication is that international trade in manufactured goods will be more intense between countries with similar per capita income levels than countries with dissimilar per capita income levels. The Linder conclusion is consistent with aspects of the product cycle theory and fits with the observation that, most rapid growth in international trade in manufactured goods in the post-World War 2 period has been between developed countries.

The Linder theory is subject to a number of empirical tests. A common type of test is formulated as follows. Suppose that we have figures on the absolute value of the per capita income differences between a given country 1 and its trading partners. Then we get information on the intensity of trade between country 1 and each of its trading partners. The Linder theory would hypothesize that the relationship between these two series is negative, because the greater the difference between the per capita incomes of country 1 and a trading partner, the less intensity the two countries will trade with each other. Studies, such as that by Joel Sailors, Usman Qureshi, and Edward Cross (1973), have indeed found a negative correlation. However, a complication factor is that countries with similar per capita incomes often tend to be near one another geographically, so that the intense trade may also reflect low transportation costs and cultural similarity.

Nevertheless, after allowing for distance between countries and other determinants of trade, Jerry and Marie Thursby (1987, p. 493) found that support for Linder's hypothesis was overwhelming in their study of the manufactured goods trade of 13 European developed countries, Canada, Japan the United States, and South Africa. Only Canada and South Africa failed to have a significantly negative regression coefficient for per capita income differences with trading partner on the volume of trade with that given partner.

In our example of countries 1, 2, and 3 the theory identified the goods that would be traded between any pair of countries. However, the Linder theory did not identify the direction in which any given good would flow. When we said that countries 1 and 2 would trade in goods C, D, and E we did not say which good or goods would be exported by which country. This was not a slip in the model; Linder made it clear that a good might be sent in both directions – both exported and imported by the same country. This phenomenon was not possible in our previous

models of trade; because how could a country have a comparative advantage and a comparative disadvantage in the same good?

This type of trade could clearly occur, for example, because of product differentiation. This term refers to products that are seemingly the same good but which are perceived by the consumer to have real or imagined differences. Clearly two different makes of automobiles are not the same in the consumer's mind. Nor does the consumer regard as equivalent two different brands of beer, tennis rackets, or word processing programmes. Linder's theory can incorporate this notion of product differentiation, because country 2 might be exporting a brand of automobile to country 3 and country 3 again might be exporting another more sophisticated automobile to country 2.

Another probable cause of this two-way flow of a product is that producers in any one country are producing for the mass market of consumers in their country. Consumers at income levels well above or below the per capita income level of the country may find their wants unsatisfied by home producers and will import their desired varieties of goods. Thus low-income consumers in higher-income country 2 may purchase the good from country 1, which has a lower per capita income and high -income consumers in country 1 may purchase the good from country 2.

The Linder theory tells us that international trade in manufactured goods will be more intense between countries with similar per capita income levels than between countries with dissimilar per capita income levels. Linder conclusion is consistent with aspects of product cycle theory and fits with the observation that the most rapid growth in international trade in manufactured goods in the post – World War 2 period has been between developed countries.

A trade theory known as **Intra-Industry Trade Theory (** Bela Balassa,Grubel and Lloyd and many others)was developed in the early seventies of the last century. This tells us that more than one-fourth of world today follows intra-industry trade in which trading countries export and import items in the same product classification.Intra-industry trade occurs because of product differentiation, transport and geographical location, dynamic economies of scale or what is known as 'learning by doing', degree of product aggregation, differing income distributions in countries and so on.

**Krugman Model (1979)** is another extension of trade model beautifully explaining the pattern and the gains from trade with the help of economies of scale and monopolistic competition. It explains trade of goods which are similar but differentiated in character. All the models explain that the expansion of world trade is due to the effect of research and development efforts of the trading countries of the world.

## 6.3: E-Commerce and Trade facilitation

In the knowledge economy the generation and exploitation of knowledge has come to play the predominant role in the creation of wealth. Knowledge based economy makes more effective use of and exploitation of all types of knowledge in all the spheres of economic affairs (production and service activities). Modern business is characterized by more and more demand for goods and services, more and more competition at the international level and the steady growth of customers' expectations. In order to expand market access and overcome competition from all over the world, business organizations are in the full process of organizational and functional changes. E-commerce is a means that facilitates and supports all these changes globally. This process makes production and sales companies more efficient and also at the same time it becomes cost effective. E-commerce gives companies to be more flexible in their internal way of functioning. It also helps the production companies to work closer with their suppliers and to become more conscious about the choice of consumer. This scientific mechanism allows the companies to choose the best suppliers from any corner of the world at least possible cost. It narrows down the geographical obstacle and the companies are able to sell their products at the global market. E- Commerce along with the huge growth of information technology and the development of Internet place the companies in a better position to manage business activities than the competitors.

IT and the Internet transaction cost goes down abnormally which in turn eliminates the intermediaries in the business activities. E- Commerce becomes more effective in enhancing international trade and commerce if countries develop faster and bigger capacity of mobile and fixes communication such as phone, cable, radio and satellite network. Strong general as well as technical education base of a country widen the scope of E-Commerce. The assurance of education is thus a priority for the growth of learning and research process.

## 6.4: ICT Application in Trade Facilitation

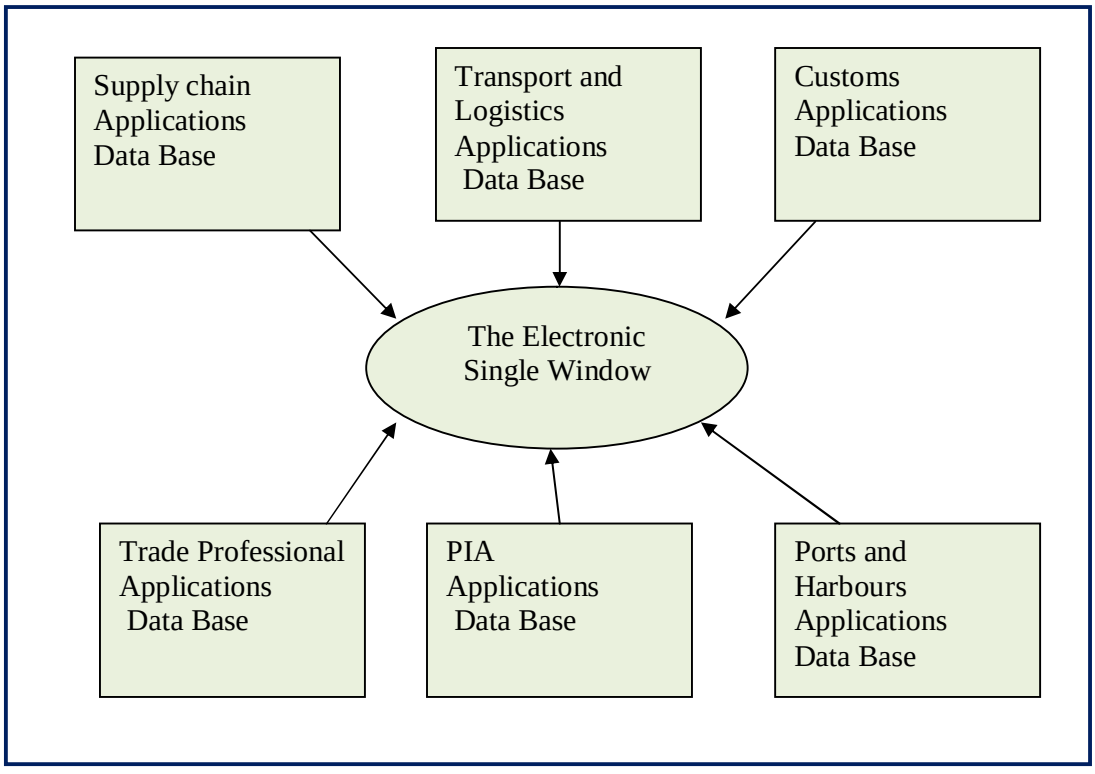
Information and communication technology (ICT) application in trade facilitate trade transaction in customs formalities, trade documentation flow and trade security. ICT facilitates timely exchange of information. This reduces physical impediments. The volume of international trade has been increasing globally and this has become possible due to more participation of countries (irrespective of their economic status) to international trade. A study ( SWEPRO, 2002) shows that world trade represents more than 30 percent of world GDP and it would grow to 50 percent by 2020. Under the circumstance, ICT-enabled trade facilitation can play a vital part in managing larger volume of trade transaction replacing paper-based trade facilitation system. Paper- based trade facilitation system is inefficient because this makes huge wastage of time. UNCTAD, 2006 mentions that saving a day through ICT-enabled trade facilitation is equivalent to ½ percent of trade tariff and 7 percent of value of international trade is the cost of administration of trade logistics. About 7 to 10 percent of value of international trade is spent on customs formalities (ESCAP, 2002). Huge wastage of time and money in paper-based trade facilitation increase government expenditure and this poses a burden to most of the developing countries. On the other hand ICT application in trade facilitation not only saves time and money but also these system changes the concept of trade-related government activities. ICT –enabled techniques and services make paper less trade documentation and real time information sharing among the trading countries. Three important factors, namely, technological advances, development of e-commerce and WTO accession and integration into the networked global economy, have in fact reduced cost and increased productivity.

International trade and commerce together involves a number of stakeholders and players such as exporters, importers, permit issuing authorities (PIAs), and also there are suppliers and intermediaries (including the transport or freight forwarders and shipping agents) this large number of stakeholders and players means that traders are to face with a huge number of regulations, and documental requirements.Moreover, trade transaction procedures are inadequate. Audit-based controls and risk-assessment techniques are also inadequate especially in the developing and the least developed countries. Unclear unspecified import and export

requirements are also a common phenomenon. Lack of coordination and cooperation among customs and other Government agencies disturbs the growth of trade flow.

Modern trading world is very much keen to achieve efficient trade facilitation. Single windows model facilitates trade in modern trading world benefiting both the producers and consumers of both the participating nations. Single windows create a single connection between all stakeholders in the trading community. It allows the stakeholders from a single point of entry to transmit and receive a specific data set, as well as in any data standard and format they need to fulfill requirements for export, import and transit regulations and clearance. Single windows, in short, expedite and simplify information flows between and the Government (United Nations, ESCAP, 2006).The entire single windows Trade facilitation system can be shown in figure-6.3 below.

**Figure-6.3:Single Windows Trade Facilitation System**




Source: Guidelines on ICT Application for Trade and Transport Facilitation in Landlocked Countries in Asian and Pacific Region, ESCAP, 2006.

It is possible to set up single window in the developing countries. It is as attempt to overhand the existing system into as integrated mechanism. Due to shortage of fund and lack of innovative technologies developing countries the set-up costs for implementing single window are higher than operating costs; but the long-term savings are larger than the operating cist if single window.

ICT application in trade facilitation reduces paper-based information and documentation. But the application of ICT or trade promotion largely depends on each country's ICT capacities and ICT infrastructure. The successful operation of the simple window system depends on many factors like assigning lead agency, mapping stakeholders, influences and potential part hers, assessment of stakeholders' ICT awareness level, simplification and standard desertion of documents and procedures, reviewing ICT – related legal and regulatory frameworks, mapping existing transaction process and documents , risk assessment and management , examining the system designing, adopting capacity building initiatives, building up monitoring mechanisms, creating seated cooperation and coordination with all interested parties.

The shifting two and single windows system of trade facilitation is a continuous system and it does not take place overnight. It takes longer period of time for shifting from one system to another. The evolution of trade facilitation systems are shown below in table-6.1.

**Table-6.1: Evolution of Trade Facilititation System**

| Stage | Geographic Scope | Cases |
|---|---|---|
| **Pre-single window Portals** | National | Eighty-five Plus Countries (World – wide) Have Adopted UNCTAD's ASYCUDA platform |
| **Single Window Portals** | National | Australia (Trade gate) Hang Kung, China (DTTN) Japan (NACCS), Republic of Korea (KTNet), Malaysis (Dagong Net) Singapore (Trade Net) Thailand (Trade Siam) |
| **Regional, Multinational Portals** | Multinational Regional | ASEAN Single Window Initiative |
| **Global Portal** | Global | Bolero.net (a precursor) |

*Source: The Electronic Journal on Information System in Developing Countries, 2006 vol. 26, issue 3, pages 1-27.*

The successful implementation of the ICT- enabled trade facilitation system (Single Windows System) depends on the political will and commitment of government. Gender and better coordination among different stakeholders such as Government capacities, private players in trade transactions and operations is also required. Trade procedures need to be more simplified. International conventions, standards, code and other instruments are also required. All the collaborations among various stakeholders should be transparent for better implementation of the single windows system. The existence of a basic ICT infrastructure and spending in R & D and adoption of legal and regulatory frame workers for electronic processing are also needed for successful operation of ICT – enabled trade facilitation.

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# Chapter-VII

## Impact of Knowledge Economy on Indian Agriculture

### 7.1: Introduction

This chapter has been subdivided into two segmentations-( i)knowledge economy in Indian agriculture,agribusiness and research and to assess the role of information technology in agricultural production ,marketing ,extension and management and(ii) agriculture marketing information system that provides information on global trends in agriculture and competitive prices of commodities, legislation that will improve agricultural production and marketing.

### Section-I: Knowledge Economy in Indian Agriculture

### 7.2: Objectives of the Study

The main objective of this section is to find out the role of IT in Indian agriculture, agribusiness and research, and also to assess the role of IT in agricultural production and marketing, and what is more to find out the role of IT in agricultural extension and management. We would also study the impact of internet on the farming community, and also to describe how farmers become successful in agriculture, agribusiness and marketing of their products using IT.

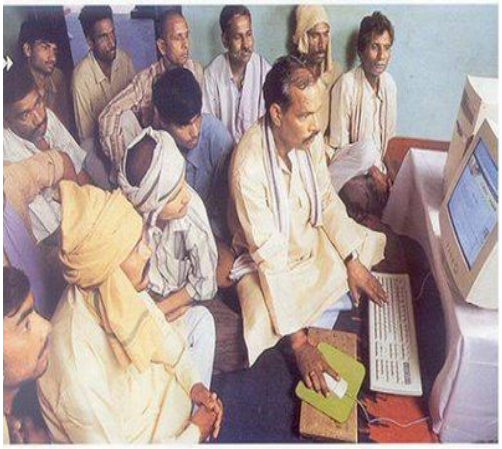
In everyday life we see that all the economic agents are not equally knowledgeable. If this is the case then a more informed party may exploit a less informed a less informed party. Such opportunistic behaviour due to knowledge gap leads to market failure and this feature, in effect, destroys many desirable properties of competitive markets. In a competitive market in which everyone has full information, consumers can buy whatever quality good they want at its marginal cost. In contrast, when firms have information that consumer do not, that is, when information is not equally available to all, there will be two sharp classes of economic agents-one the gainers(obviously the more informed)and the other the losers(less informed or ignorant).This does happen in Indian agriculture. In

agriculture the big or large farms are more informed and thus are capable of exploiting the other groups (especially the small and medium farmers)

## 7.3: Knowledge Economy and Agriculture

Information Technology has a tremendous role in Indian agriculture, agribusiness, agricultural research, education and it is improving the quality of life of the people living in rural areas especially the farmers and agricultural workers. The beauty of IT is that it helps an average Indian farmer to get relevant information regarding agro-inputs, crop production technologies, agro-processing, market support, agro-finance and management of agri-business. The information technology can furnish timely and proficient advice to the farmers to develop the productivity as well as the marketing of agri-products in a better way. The excellent scopes of Internet has broaden the opportunities for farmers for crop forecasting, input management, command area management, watershed management, land and water resources development , drinking water potential mapping precision management, natural disaster management, fishery management , hill area development and post harvest management and proper price of their produce. Due to the uncanny price fixation by the middleman and intermediaries the farmers do not get the proper price of their products. The crux of the problem is the selling of agricultural produces in an unregulated manner. Information technology can help the farmers to communicate with the company directly and get the best prices for their produces using web portals. We can have a look on a case study of ITC Ltd.

### e-Choupal: An ITC Initiative-A Case Study



**Farmers using e-choupal** (source: ITC)

ITC's Agri Business Division, one of India's largest exporters of agricultural commodities, has started e-Choupal in different villages of India. The system of e-Choupal is to link directly with rural farmers via the Internet for procurement of agricultural and aquaculture products like soybeans, wheat, coffee, and prawns. The main objective of e-Choupal was to tackle the challenges posed by the unique features of Indian agriculture, characterized by fragmented farms, weak infrastructure and the involvement of numerous intermediaries. Traditionally, commodities were procured in mandis (major agricultural marketing centres in rural areas of India), where the middlemen used to make most of the profit. These middlemen used unscientific and sometimes outright unfair means to judge the quality of the product to set the price. The difference in price between good quality and inferior quality was little, and therefore there was no incentive for the farmers to invest and produce good quality output. With e-Choupal, the farmers have a choice and the exploitative power of the middleman is neutralised. ITC Limited has provided computers and Internet access in rural areas across several agricultural regions of the country, where the farmers can directly negotiate the sale of their produce with ITC Limited. This online access enables farmers to obtain information on mandi prices, and good farming practices, and to place orders for agricultural inputs like seeds and fertilizers. This helps farmers improve the quality of their products, and helps in obtaining a better price. Each ITC Limited kiosk having Internet access is run by a sanchalak — a trained farmer. The computer is housed in the sanchalak's house and is linked to the Internet via phone lines or by a VSAT connection. Each installation serves an average of 600 farmers in the surrounding ten villages within 5 km radius. The sanchalak bears some operating cost but in return earns a service fee for the e-transactions done through his e-Choupal.

Real-time information and customised knowledge provided by 'e-Choupal' enhance the ability of farmers to take decisions and align their farm output with market demand and secure quality & productivity. The aggregation of the demand for farm inputs from individual farmers gives them access to high quality inputs from established and reputed manufacturers at fair prices. As a direct marketing channel, virtually linked to the 'mandi' system for price discovery, 'e-Choupal' eliminates wasteful intermediation and multiple handling. Thereby it significantly reduces transaction costs. Launched in June 2000, 'e-Choupal', has already become the largest

initiative among all Internet-based interventions in rural India. 'e-Choupal' services today reach out to over 4 million farmers growing a range of crops - soybeans, coffee, wheat, rice, pulses, shrimp - in over 40,000 villages through 6500 kiosks across ten states (Madhya Pradesh, Haryana, Uttarakhand, Karnataka, Andhra Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Kerela and Tamil Nadu).

### Success story of a farmer

Ashutosh Dixit is the ITC e-Choupal sanchalak in Ichhanapur Village, Hardoi District, Uttar Pradesh.

→ **Ashutosh Dixit**
**ITC-e-Choupal Sanchalak**
**Icchapur Village, Uttarpradesh**

(Source: ITC Ltd)

Ashutosh Dixit's evolution as an e-farmer has transformed the quality of his life. Like Ashutosh, 4 million e-farmers in 10 states across the country are raising a better crop and earning fair rewards. Thanks to ITC e-Choupal. This is just one of the many ways in which ITC expresses its belief that country must come before corporation.

The application of Information and Communication Technology (ICT) in agriculture is increasingly important.

E-Agriculture is an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. More specifically, e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (IT) in the rural domain, with a primary focus on

agriculture. E-Agriculture is a relatively new term and we fully expect its scope to change and evolve as our understanding of the area grows.

## 7.4: IT for Agricultural Production and Marketing

IT is playing an important and vital role in agricultural production and marketing. IT allows farmers to save time on order and delivery and getting feedback. In the existing competition, there is a need to rapidly attract new customers as well as retain existing customers. In order to take the real status of agricultural production and marketing, there is an urgent need to develop the following items:

1. Farmers' crop database must be managed. The database includes the kinds of crops, the size of cultivated area, time of harvest and yield. Farmers or the extension personnel transmit those data via the Internet to database server. Further, information provides the farmer with an important instrument for decision making and taking action.

2. Crops information service system should be created. This system analyzes the crop data to create some statistical tables. Farmers can access these statistical data by browsing the homepage and make their production plan. Changes within the structure of agriculture will probably have an impact on the selection and types of acquisition of software and other integrated systems made by the farmers.

3. Production techniques and information inquiry system should be created. This system integrates the production techniques and information, which are developed by experimental agricultural institutes and agricultural improvement stations. Farmers can find out relevant production information through this inquiry service system.

4. Production equipment's inquiry service system should be created. This system gathers information from the companies of seeds and crop production equipment to build the production equipment's inquiry service system. At the same time, allow relevant companies to access this system and enter their own data. Therefore, farmers can order the needed items through this system. Information is critical to the social and economic activities that comprise the development process. Development economy has witnessed for revolutions in agricultural (i.e. Green, white,

yellow and blue revolution), bio-technological, industrial and information technology. Good communication system and information system reinforce commitments to sustainable productivity. The Government of India is giving more thrust on agriculture, food and information technology sectors towards achievement of economic reforms to achieve high growth rate in production in the years to come.

## 7.5: Knowledge Management System and the Scope in Agriculture

The world is in midst of a knowledge revolution complemented by opening up to entirely new vistas in communication technologies. Knowledge has indeed turned out as a single most important area we need to concern with. If we mean development, we must deal with the issue of knowledge. It is not an overstatement at all when our ex-president of India A.P.J.Abdul Kalam pointed out that in the 21$^{st}$ century a new society is emerging where knowledge is the primary production resource instead of capital and labour. A new society is emerging and that society's primary source is knowledge. Today, agriculture has become an area where the role of IT has become huge important for knowledge sharing.

The main phases of the agriculture industry are: Crop cultivation, Water management, Fertilizer Application, Fertigation, Pest management, Harvesting, Post harvest handling, Transporting of agri products, Packaging, Food preservation, Food processing/value addition, Food quality management, Food safety, Food storage, and marketing of agro produce.

All stakeholders of agriculture, industry need information and knowledge about these phases to manage them efficiently. Any system applied for getting information and knowledge for making decisions in any industry should deliver accurate, complete, concise information in time or on time.

## 7.6: Agricultural Research and Information Technology

The major contribution of agricultural research in India has been reflected in various agricultural revolutions during the post independence period. The result of agricultural research boosted the food production and we could see the Green, White, Blue and Yellow revolutions in the fields of Cereal crops (wheat), Milk, Fisheries and the Oil Seeds witnessing the Golden Revolution of horticulture crop production.

However with the advent of new emerging agricultural technologies there was a change in focus from increased production to increased efficiency.

Today's agricultural research is based on demand-driven, not supply-driven .Sustainability in agriculture and food security has become much more important now a days. So here are the implications of IT we can observe. For this purpose, the findings of laboratory research have become much more important where the requirement of software has become immensely important. Dissemination of a careful documentation methodology and proper communication media play a significant role in agriculture. In this sphere, the Information Technology can be fully utilized for proper transfer of technology to the farming community and also those living in remote areas of villages.

For research documentation, experiments, and analysis of results presentations IT can be the best tool to identify the thrust areas of research in the changing scenario under Indian and global context. The skill to distinguish between what is urgent and what is important will hold key to the success in deciding priorities. Such skill can be acquired by IT.

**• IT for research documentations: Textual and Non textual documents**

Textual documents – To present information in the form of *Written text* e.g. books, periodicals, catalogues, statistical compendia, trade publications, patents, etc. and

*Non textual documents* - e.g. maps, plans, graphs, diagrams, posters, paintings, photographs, slides, sound tapes, films, videotapes, artistic monuments and magnetic documents for computer processing IT can be the best mean in agricultural research management.

• **IT in Research Communication:** The benefits of Internet connectivity can be utilized for better collaboration amongst scientists for exchange of their views.

## 7.7: IT in Agricultural Extension Management

The present age is called as an "information age". People want adequate and authentic information as early as possible. Farmers as human beings are also anxious

and become more intended with the advancement in science and technology to know what is happening in the field of agriculture. Farmers are enthusiastic to obtain knowledge, particularly in the field of modern agriculture to become psychologically strong and conducive with necessary capacities to adopt modern methods of agriculture. In India, it is very difficult to contact each and every farmer in limited time to communicate latest agricultural technology. To diminish this difficulty, various mass media have a tremendous role to convey information to the broad means of people, particularly to the huge illiterate segment of the farmers.

In India various media, radio, television, literature and newspapers are mostly utilized by the extension workers to transfer agricultural technology to the huge illiterate and literate segments of the rural. There is a great transformation in agricultural extension approach in dissemination of knowledge. The advancement made in information technology is so fast that every areas of livelihood have to be well organized to tie up such technology. It has been seen that generally the benefits of information technology have restricted primarily to the urban areas. This is only due to lack of understanding about the new Information Technology in rural areas. Now after the revolution of IT a new approach has come up which actually strengthening the communication and training centres like Agricultural Science Centres and Farmers Training Centres which have reinforced the overall agricultural scenario.

The Agricultural Extension System (AES) has five important prerequisites: Regular training and maintaining of extension workers and functionaries at various levels in the specific knowledge and skills, monitoring the AES and understanding the constraints, strong information, documentation and publication support, effective institutional network for synergetic support, develop national and international linkages. For this strong information, documentation and publication support are very pivotal. IT can play significant role in this.

• **IT's role for the linkage between Research and Extension:** The network between different agencies like Agricultural Science Centres (Known as Krushi Vigyan Kendra) ,Farmers Training Centres , Agricultural Technology Management Agency and Information Shops needs to be developed for useful linkage and proper utilization of available resources. The human resources will have to be trained in

usage of IT Tools and all infrastructure facilities required for strengthening the Agricultural extension System and Services.

## 7.8: IT in Agro-Based Rural Development

It is assumed that 60 to 8 percent of household consumption belongs to agricultural produces so agriculture plays an important role in industrial development, it provides raw materials to industries like cotton textiles, jute, sugar, tobacco, edible and non edible oils, leather, plantation industries etc. The food processing industries are also dependent on agriculture. Lots of agro-based materials are exported in European and Gulf countries by India. In all such agro-based industries, role of IT needs to be improved. IT Tools are very useful in creating effective linkages in agro based industry activities. These linkages are concerning dissemination of useful information. Linkages of the producers can be with State Federations, National Federation and Board, Finance Corporation etc. Advertisement is best way to add value of products. This market again can be very well established with available database of product wise information on products with comprising data of competing nations of the world. IT can help in this direction.

### Role of IT in agricultural production

The IT Approach for commercial crops, horticultural crops or floriculture have to focus on Integrated System may be for plant nutrition or plant protection. The well established Integrated Plant Nutrition Approach and Management and Integrated Pest Management (IPM) need to be strengthened with the help of IT Tools. The Post Production Technology (PPT) needs to be utilized properly. The end user, beneficiaries and all concerned especially with export of agricultural produces need to be trained to access the Internet facilities available as one of the most useful IT Tools of the computer era.

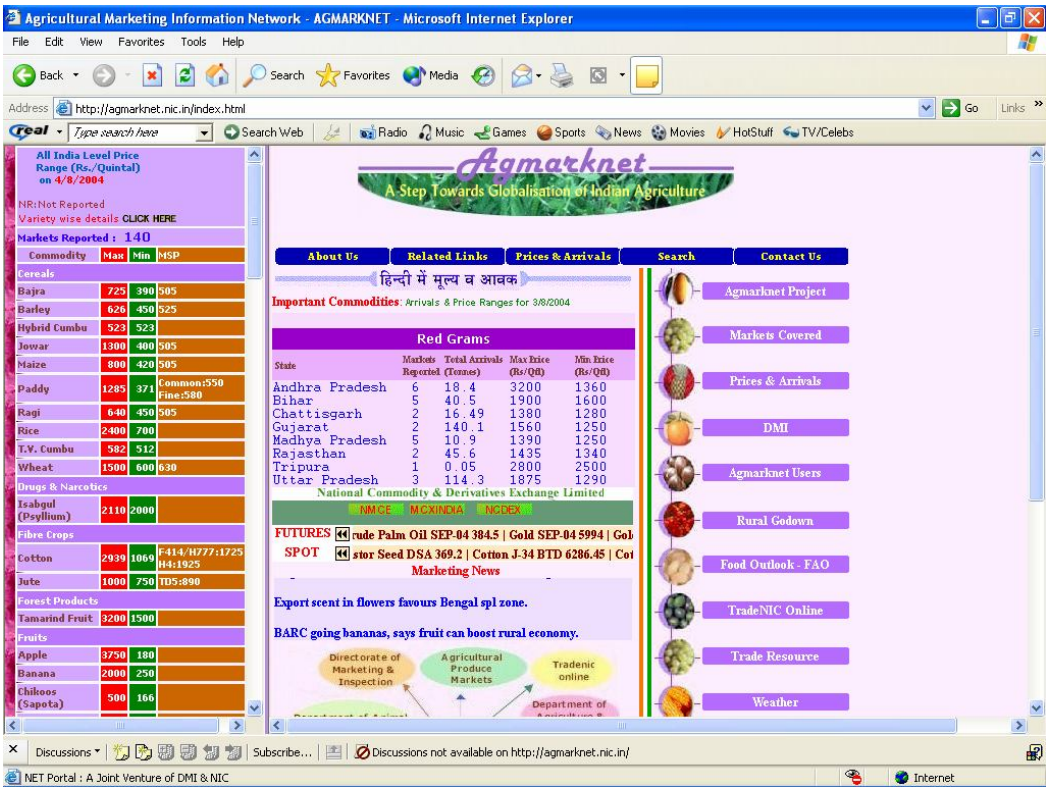
### Role of Geographical Information System (GIS) in agriculture

The use of IT through GIS is very encouraging in India. The important areas like Crop forecasting (procurement policy, crop insurance, relief measure) , Cropping System ( input management : fertilizer, Crop Diversification, intensification, degradation measures, sustainability measures), Command Area Management

,Watershed Management ,Land and Water Resources Development ,Drinking Water Potential Mapping Precision , Natural Disaster Management (flood, drought), Fishery (inland, Marine ), Hill Area Agriculture Development Management, Post Harvest Management and Precision Farming can be reinforced with the help of Information technology in India.

## Scope of rural Internet

Experiences of Rural Internet users of many developing and developed countries indicate that the Internet provides them with a very convenient method for quickly accessing a large volume of information without being hampered by geographic barriers in the form of new ideas, discussion, expert advice, continuing education resources, increased global understanding and cultural awareness, and information that helps to make them better and more informed citizens. In addition to this, social benefits including new opportunities to overcome geographic isolation, increased social interaction, opportunities to organize advocate for social change, equalization of urban/rural disparities and new links between urban and rural communities were also experienced. Agribusiness users emphasize the Internet's value in enabling them to expand their markets to global audiences and to establish national and global business networks and alliances that would otherwise be inaccessible. Residents as direct Internet users while in other areas the capacity of intermediary organizations (such as extension field officers, NGOs, rural schools, libraries, health clinics, government satellite offices) need to be built up, or assistance given in the establishment and promotion of community information centres linked to the Internet.




**A Web portal for Farmer** (source: www. Agmarket.nic.in)

## 7.9: Establishment of Information Centers in Villages

It is stressed that Internet initiatives for rural and agricultural development must consider the fact that different regions, organizations and communities have different applications and technical needs. In some areas it is possible to have farmers and rural residents as direct Internet users while in other areas the capacity of intermediary organizations (such as extension field officers, NGOs, rural schools, libraries, health clinics, government satellite offices) need to be built up, or assistance given in the establishment and promotion of community information centres linked to the Internet.

Successful rural and agricultural Internet communication and information systems have some common elements. Some of the elements include preliminary participatory assessment of communication and information needs with intended users. Awareness building, sensitizing decision makers; commitment to participatory rural and agricultural development; user participation in design, implementation and

management of information and communication services and commitment to manage and sustain these services; provision for technical training, user support and outreach within the user community.

In our country services provided by the Government are inadequate both in terms of infrastructure, technology and in empowering people with information. To provide information to local rural people through satellite based communication technology according to their needs and demands, Information centre at village level can be established by involving local people in choosing the actual location of centre, providing rent free space and electricity and recruiting volunteers.

This concept was first implemented in Sweden. Information centres in isolated rural communities with Pentium personal computers, printers, a modem, a fax machine, Internet and electronic networks, access to databases, libraries and a consultant can make information accessible to a wider audience. Such centers not only facilitate single-point access to external information services e.g. government marketing and price information or to global information through the WWW, but also help in organization of virtual village-to-village meetings and tele-training events thus facilitating local sharing of information.

Each centre should contain data on agriculture, health-related information especially for the rural farmers, women and children. A directory of government schemes should be made available to rural families on local prices of agricultural input or produce, cultural/public events in the locality, local transport/traffic details including timing, grain prices, general and crop insurance schemes, hospitals and medical practitioners, as well as information about integrated pest management in various crops. These databases should be in local languages.

## 7.10: Application of IT based agricultural communication in India

The global communication revolution has been an important part of our country and now India is opening up to the world economy. As result, the situation has changed dramatically. Like other people, farmers also want latest, newest, most modern, most up-to-date, up-to-the-minute and most recent information of any corner of the world at there door. A few years back it was difficult to get such information

for Indian farmers, but now many spectacular, wonderful, amazing, fantastic, excellent and fabulous satellite based communication facilities are available in the hand of Indian farmers.

There are cases of application of information and communication technologies in extension that have made a difference in the delivery of extension services in rural India. Some of these include the Warana Wired village Project in Maharashtra; Milk collection in dairy co-operatives (National dairy Development Board); Information Villages Project (MS Swaminathan Research Foundation-International Development Research Centre); Information Technology application for Indian Rural Postal System (CMC Limited, Hyderabad); Knowledge Network for grassroots innovations (IIM, Ahmedabad); Application of Satellite Communication for Training Field Workers and Extension Workers in Rural Areas( ISRO); Computerisation of Mandal Revenue Offices (MROs) and computer aided administration of revenue department in Andhra Pradesh .

## Warna Wired Village Project: A Case Study

Warna Nagar, a cluster of 70 villages in Maharashtra is a central eye of the "Wired Villages" project. In 1960, a visionary like Tahasaheb Kore propagated the idea of co-operatives in Warana Nagar, as a method of achieving socio-economic development. He showed how this could bring all the farmers together; to share information, increase productivity, and profits. Thus was born the "Warna Nagar Co-Operative Society". The society has a Chairman and a Board of Members and is free from political influence and society members are free to elect the board members. There are about eight sub co-operative bodies, working under this main society viz.; Warna Dairy Development Society, Warna Co-operative Bank, Warna Foods, Warna Women's Co-operative society etc. Sugarcane is major crop of this area and most of the sugar production of the two districts Kolhapur and Sangli is processed at this Society. From each village 200 - 300 farmers are registered as society members.

The "Wired Village" project was initiated by Mr. Vinay Kore, the son of Mr. Tahasaheb Kore and the present Chairman of the Warna Co-operative Society two years ago and actual implementation began in April 1998. The Project has been jointly implemented by GOI through National Informatics Centre (NIC), Government

of Maharashtra and Warna Co-operative Society with the share of financial support being in the ratio of 50:40:10. The manpower and maintenance cost is borne by the Warna Co-operative Society itself. The project area is a cluster of 70 villages consisting of 46 villages from Kolhapur and 24 villages from Sangli districts of Maharashtra. This project has been initiated to serve the information needs on different crop cultivation practices of major crops, sugarcane cultivation practices, pest and disease control, marketing information, dairy and sugarcane processing information etc. to the farmers, right up to their village level.

NIC, Pune was involved in setting-up the hardware and software and NIC, Delhi established connectivity of WAN links such as VSAT and dial-up connections. The software required for the system such as web page designing, database designing and client based applications used by the farmers such as dairy; sugarcane information systems had been developed by the NIC, Pune.

### Satellite Krushi Gosthi: A Case Study

Like all other State Agricultural Universities, Gujarat Agricultural University also performs triple functions of teaching, research and extension education. The research generates technologies, which can be utilized by farmers and rural people. The present system of the transfer of technology from Gujarat Agricultural University (GAU) to extension functionaries of the development of the State and in turn to the ultimate users consumes considerable time. Looking to this reality the GAU has prepared a major plan under the name of "GAU Satellite Krushi Gosthi" to apply modern tools like satellite linkage for agriculture sector. The GAU is the first in all SAUs, where such kind of facility has been installed. The GAU satellite Krushi Gosthi for transfer of technology can reduce the time lag to a considerable extent the system helps for large area coverage as well as noticeably reduces the distortion in message transfer. Such facility provides facility for two-way conversation. It helps farmers to get on the spot solutions of their questions and queries regarding the live programmes while watching it at the classroom end. This facility makes possible to keep a live contact between the scientists of the university and the farmers of the state.

### Features of the System

A satellite based distance interactive education system normally consists three elements, first TV studio from where scientists deliver the talk through live programme, second a number of remote classrooms or Direct Reception Centres (DRSs), with the facility of TV set and STD telephone, from where farmers can watch the live programme on TV sets and third satellite linkage to transmit live programme given by scientists from the TV studio to farmers at DRSs.

The Gujarat SATCOM Network has full capability for one-way video and two way audio. RESCO has established SATCOM Network consisting of TV studio at the capital city of Gujarat. The video and audio from TV studio are digitally transmitted to the classroom ends (DRSs). The return audio at classroom (DRSs) is available through STD lines. This facility is used to keep a live contact of the scientists of the university delivering a talk from the studio with those farmers who are watching live programme at the classroom ends. At present more than hundred Direct Reception Stations (DRSs) to receive transmission are already established throughout the state with the collaboration of different departments of Government and NGOs. GAUSATKRU has vital linkage with them. This system helps farmers to receive information regarding inputs as well as markets. This latest satellite based communication facility is also useful to the students of the university to interact with the dignitaries or experts of agriculture field. To reduce time lag to a considerable extent, such type facility can also be installed in other State Agricultural Universities. Such facility needs to be strengthened at village level with the collaboration of NGOs, schools, co-operatives and Government organizations.

## 7.11: Government of Andhra Pradesh's effort to apply IT in Agriculture

Satellite based Information and communication technologies are an important part of the Government of Andhra Pradesh's efforts to improve the efficiency of its administrative offices. AP is the first state in India to design a statewide computerization programme that will be used in rural areas, at the administrative unit above the village-level panchayat. There are 1124 mandals in the state. The first software application is the issuance of certificates pertaining to land holdings, caste,

nativity and income across a common counter, without the current delay of 15 to 20-days. The AP State Wide Area Network (APSWAN), aims to link the state government's Secretariat with 23 District Headquarters, serving as the backbone for "multi-services" (voice, video, and data) that would be used for improved co-ordination between state headquarters and district offices in managing various regulatory, developmental, and hazardous mitigation programmes of the state government. Mandals will be served by this two-way communication, and electronic commerce applications will be developed. The AP Value Added Network Services project hopes to deliver a variety of public services through a large network of information kiosks. The Computer-aided Administration of Registration Department (CARD), a project of A.P. aims to introduce a transparent system of property valuation, which is easily accessible to citizens.

### MANAGE's efforts to Apply IT in Agriculture

The National Institute of Agricultural Extension Management, MANAGE, Hyderabad, has taken-up a number of "Cyber Extension" initiatives, across the country. District level Web Sites are being hosted, Information Kiosks are being established at block/ Mandal and village levels and technical and other need based information is being collected, digitized and hosted on the Internet.

## 7.12: Conclusion

Information Technology is the buzz technology now-a-days. It is the technology that is helping to exchange the information in fast and easier way. Due to this technology the distance between or the difference between the nations is reduced and now world is becoming a global village. This technology provides an opportunity to the developing nations and under developed nations so that can build up their strategies and compete with the developed nations.

In any sector information is the key for its development. Agriculture is not exception to it. If the relevant and right information in right time is provided, it can help agriculture a lot. It helps to take timely action, prepare strategies for next season or year, speculate the market changes, and avoid unfavorable circumstances. So the development of agriculture may depend on how fast and relevant information is

provided to the end users. There are other traditional methods to provide the information to the end users. Mostly they are inoculated, untimed and also communication is one way only. It will take long time provide the information and get feedback from the end users.

So now it's time to look at the new technologies and methodologies, which will benefit developing nation like India, which can help it to become the super power. There are many ways in which Information Technology can be used to exchange the information rather effective communication like information kiosks which provide not only the basic services like email, helps in education, health services, Agriculture and Irrigation, online trading, community services etc., expert systems which helps in determining marketing alternatives and optimal strategies for producers, integrated crop management systems for different crops, Farm-level Intelligent Decision Support system developed to assist in determining optimal machinery management practices for farm-level system. Many organizations and Institutes are utilizing the information technology to provide solutions to the problems faced by the agriculture sector in a cost effective manner with proper business models.

So like other area without of Information Technology agriculture is nothing now-a- days.

## Section-II Information and Knowledge in Agricultural Marketing

### 7.13: Introduction

Information is significant to the social and economic activities that comprise the development process. Development economy has witnessed agricultural, industrial and information technology revolutions. Good communication system and information system reinforce commitments to sustainable productivity. Information system is a process that transforms data into information. When this information is further refined it acts as a basis for decision-making leading to the development of decision support system. Information and knowledge have the paramount importance to perform marketing functions systematically and continuously and making it available to market participants in a form relevant to their decision making. Information can enhance efficiency if it is used to aid decision making and

management of risk (King and Sonka, 1985). The purpose of such information is to continuously enhance market transparency through Creation of stimuli by indicating market opportunities and competition among suppliers and traders. Farm producers attempt to mitigate risk and uncertainty by utilizing accurate and reliable information (Jones et al. 1990).

Olukosi, Erhabor and Demiryurek identified the need for agricultural marketing information as a major tool for farmers to make economic decisions that would benefit them and thus enhance their market access. According to them, marketing has a connection to immediate income and is dependent on useful information and knowledge, which enables the farmer to make decisions on what to produce, where, when and the price to purchase inputs, as well as availability of transportation, and where and how to dispose of produce. In the initial stages of economic development agriculture marketing information may not available to stakeholders in all aspect. A need for an information service first appears with rising market production and a falling significance of subsistence production. Therefore its content and extent should be in relation to such development. Information plays a major role to marketing and distribution of commodity as well as in the overall farm enterprise in terms of income generation and sustainability. Farm producers often use information to minimize their risk exposure or increase their expected income (Bullock at al, 1982). Poor information dissemination process create sever limitation to the growth of the agricultural sector and a huge constraint in food and income chains of rural area.

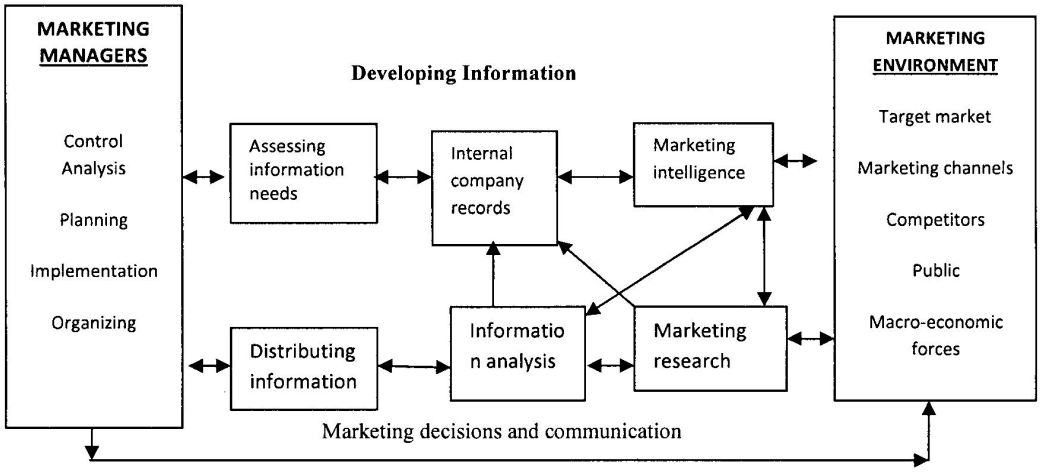
Agricultural sector has variety of information user community. According to Kaniki, (1995) and Adimorah (1995) agricultural information user populations are basically farmers, traders, researchers, extension workers, agribusiness personnel, bankers industrialists, economist and policy makers. All those uses have different types of information needs. The farmers need information to know the procedure of increasing output, the use of fertilizers, useful pesticides, high yielding seeds, testing needs of soils access to credit facilities, marketing of their products, etc. Traders need information of demand, supply and price of commodity. The extension workers scope of needing information is confined to serving the farming community and making them empower with latest information on improving the farm productivity. However,

information on variety of needs such as of resistant seedlings, control of major pests, credit sources etc. as well, as providing information on farmers' problems to the researchers. The agribusiness personnel are interested in product information that will increase farmers' output, current information on various agricultural products that will improve agricultural productivity. The academician, researchers and Scientists need information to make them aware of knowledge in their concerned subjects to keep them abreast of the latest development in agriculture so as to improve the quality of research work. The industrialists require information on export commodities, up-to-date world markets rates and prices of commodities. The bankers on the other hand, are interested in lending rates as it affects agriculture, current world markets and prices of commodities, feasibility studies on various aspects of agricultural production and loans and credits (Aina, 2008). Policy makers and economists require information on global trends in agriculture and competitive prices of commodities, legislation that will improve agricultural production and marketing. With such a wide spectrum of the various information needs of agricultural stakeholders, it is very clear that information professionals need to develop a strategy of information provision so as to satisfy the information needs of those information users in agriculture.

## 7.14: Agriculture Marketing Information System

A marketing information system (MIS) consists of people, equipment and procedures to gather, sort, analyze, evaluate and distribute neded, timely and accurate information to marketing decision makers (Kotler and Aamstrong, 2002). Figure 5.1 shows a typical marketing information system and how components of the system are interrelated. MIS distributes information to the concerned stakeholders in the right form at right time to help them make better decisions.

**Figure1.1: The Marketing Information System**




Source: Kotler and Armstrong (2002:110)

The key components of marketing information system include information collection, analysis, and dissemination. Most of the marketing information systems have established linkages with other organizations and have subscribed relevant published documents like journal, newspapers, and website to collect information. Most of the marketing information systems have used multiple sources of information, a range of analysis, and various media to deliver useful information to the target clients. The large scale marketing information systems have developed sophisticated database and have heavily used information communication technology to collect, analyze and disseminate the information. In general, there is a growing trend of using information communication technology to strengthen the marketing information systems**.** Most information is transmitted through radio, cell phones, newspapers, email or websites.

The main purpose of agricultural marketing information system is to disseminate accurate and timely marketing information so as to support in marketing decision making and marketing efforts of farmers, traders, government, development organizations, academicians, and researchers. Agricultural market information system helps in ensuring that produce goes to markets where there is a demand for it. It shortens marketing channels and cuts down on transport costs. It helps to ensure that in each marketing transaction all participants share the risks and benefits. However, this does not happen if marketing information is distributed unequally. Many small

and medium scale farmers in India are bearing the loss in their transaction with greater part of the risk, while the traders end up with the greater part of the profits. Farmers must be able to seek out and compare the information available for different outlets if they are to sell to best advantage. Price information is less useful if there is only a single market outlet, or if farmers are price takers rather than price seekers. There is a very wide gap between the farm gate price, wholesale markets price and retail markets price. Marketing information can help narrow the gap. Marketing information system helps to attain efficient or competitive markets through reduction of information asymmetries among the participants, which leads to reduction in costs and maximize profit sharing to the participants. It helps to increasing market transparency. MIS improves market efficiency in terms of helping to establish the law of one price, where there is reduction in price dispersion. Improved market information helps in the reduction and managing price risks and allows market participants to make better production, marketing and consumption decisions that result in efficient allocation of productive resources. Market information helps farmers and traders to identify new market opportunities and reliable trade partners.

## 7.15: Marketing Information System of Indian Tobacco Company (E-Choupals)

Over seventy percent of India's population lives in its 640,000 villages, for most of whom agriculture is the main source of livelihoods. The farmers are generally poor, and each of them generally owns just about a hectare of land. As they are situated in the remote places, they do not have updated information that impacts their agriculture practices and sales. They have very little bargaining power when they buy farm inputs or sell their products and the physical, social, and institutional infrastructure in rural India is generally weak (WB 2004).

Government interventions basically focus on dissemination of best farming practices and open auction system for better price discovery of farm produce. These supports mechanisms are helpful to improve production system and would be quite enough for a supply-driven business model. In the absence of any marketing information and support mechanism, the farmers have to sell their products to middlemen, who often offer them a complete package of solution- credit, inputs, and

market access. Thus, the middlemen, who can block the marketing information and create singles in their favor, enjoy a large chunk of profit from the trade of agricultural products (WB 2004). This situation in rural India was seen differently by Indian Tobacco Company (ITC). It was trying to diversify its business from the shrinking tobacco industry. It decided to establish a new business model by linking the rural communities with its marketing information and support system. Choupals, a meeting place in rural India, were targeted as the point of entry into the rural households for dealing in ITC products.

ITC targets the areas from where it has already been buying agriculture products for its MIS activities. The villages fairly accessible for market support and with population in between 1,000 to 5,000 are selected (Jain 2004). Farmers, who lacked marketing information about their products, were at disadvantaged situation and often reaped off by the middlemen. They needed not only the marketing information like price, demand, and quality, but also the alternative channel of marketing. Besides, the agricultural marketing system needed to address the problem of long marketing channels sapping the profit margins, fragmented and dispersed rural agriculture market, and weak infrastructure. To address this, e-Choupals system aggregates the supply and demand of the thousands of farmers; offers direct business links to ITC; provides marketing information about the products of farmers; and lets the farmers explore the competitive offers.

In the selected villages, ITC sets up internet kiosks and transforms them into e-Chouplals. For those places, which face shortage of phone lines and electricity, ITC provides VSAT satellite links and solar batteries. Selected farmers are trained on use of the system. Educated, entrepreneur type of local farmer or trader is carefully chosen to be an e-Choupal manger (called sanchalak). The e-Choupal is connected to the websites which ITC cautiously creates in local languages for the farmers targeted. A website for each of the crops, such as soya, wheat, coffee and aquaculture (shrimp) is setup. ITC updates the information and makes sure that the content is relevant. As for the input supply information, at least three input suppliers are enlisted for each category of inputs, such as seed, chemicals, and nutrients. Sanchalaks help the farmers access the different agricultural crop-specific websites. For their services, they earn commissions for the transactions facilitated by them through the system to ITC or the

third party affiliated to the system. With this, the farmers can gain market knowledge about their products as well as they can browse websites to know farming techniques, price trend, weather forecast, etc. For this, they do not have to pay anything, and they are also free to sell their products to any place they choose. The system links the farmers to the agricultural universities, newspapers, meteorological departments, banks, and technical analysts for the information. If they wish they can sell their product online, farmers can also order agricultural inputs online with the help of the sanchalak. The system helps achieve virtual aggregation of product supplies from the farmers, reducing costs of procurement to ITC. On the other hand, the farmers can also gain by aggregating their demands for inputs. Farmers even consult an agronomist by e-mail when they find some diseases or problems in crops. They can also seek for other services like sale and hire of tractors and harvesters, soil testing, and insurance (Jain 2004, WB 2004). A panel of specialists answers specific queries of individual farmers through email, and service providers extend their services to the farmers. e-Choupal thus links the Indian farmer with consumers in local and national markets, by leveraging ITC's proven competencies in marketing and distribution of agricultural commodities (WB 2004).

E-Choupal has empowered the farmers with information and helped improve their decision-making. Farmers do not have to pay for accessing the information, and they are free to decide whether to sell their produce to ITC or other buyers, or sell through the government auction center. Price is known in the villages before farmers incur any cost of transportation. As a result, farmers can choose the right place and time to sell, and they can avoid many overheads, such as multiple transportation, and handling. As it has created transparency in trading and market competition, farmers get benefits from more accurate weighing, faster processing time, and prompt payment. Farmers can earn higher incomes through increased prices, higher yields, better quality, and lower transaction costs. It is claimed that farmers selling directly to ITC through an e-Choupal realize at least 2.5 percent higher price for their crops than they would receive through the government auction system because of lower transaction costs. Farmers also benefit through lower prices for farm inputs. On the other hand, ITC benefits from decreased transportation and commission cost, which is reported to be 2.5 percent lower (WB 2004).

ITC also has more direct control over the quality of what it buys. The information provided directly to the farmers has resulted in improved planning and better relationships of ITC with the communities. ITC also earns by levying service charges to others participating companies, who find e-Choupal cost effective for distribution of their products to the villages. A number of companies market packaged consumer goods, personal care products, household appliances, and fuel through the e-Choupals. Sanchalaks also make money as they receive commissions from ITC and participating companies on all the purchase and sale transactions done through e-Choupals. As they have to compete with other marketing channels, entrepreneurial types of Sanchalaks try to meet the needs of farmers by customizing the offers.

In addition, villages have got free access to internet, which has opened up a window to the world. People also check local language news and entertainment sites. The possibility for e-Choupals is enormous, for example, government services can go online, micro-credit organizations can offer services in the small villages, and consumer goods firms can extend their networks into villages. As of March 31, 2004, it is reported that e-Choupal services reached to about 24,000 villages with 42,000 kiosks benefiting over 2 million rural farmers and expanding rapidly with seven kiosks added everyday (WB 2004). ITC intends to reach 10 million farmers in 100,000 villages by 2010. Recognizing its impacts, International Chamber of Commerce, United Nations Development Programme, and Prince of Wales's business forum jointly have honored ITC with Prince of Wales's business forum World Business Award.

The case shows that MIS system itself can be a core capability of a private enterprise when it supports to streamline the supply and distribution chain. Contrary to the common belief that the MIS system of private company is only tuned to their business strategic needs and profitability, the agri-enterprise MIS has shown that it is equally beneficial for the farmers. The perfect match between the need of the private company and those of the farmers has created win-win situation for both parties, and has increased the total economic gains in the agriculture business by reducing the inefficiency in the supply chain. However, this success owns much to the resourcefulness of the enterprise and their strategic choice to implement the MIS in a fashion contributing to the both parties and to the overall economy.

Furthermore, the market information system has increased its relevance to the farmers as it has incorporated the information, such as weather, best practices, input supplies, etc., which is relevant for the farmers. The strategic alliance among universities, other companies, and media houses to provide the content to the marketing system has made the system even more robust and cost effective in terms of information collection and management. Though initial invest is high, utilizing the information technologies appropriately, the system has been able to reduce the cost of market system operation per target farmer. And linking this system with e-commerce activities, the company has increased the credibility and usefulness of the system for the rural farmers. As the farmers and other actors are feeding data each time into the system, the capacity of system to generate even more useful analysis and information will certainly increase as the time progresses.

As the ITC's business model powered by e-Choupals increased market transparency and empowered the people with knowledge and information, the case shows that the farmers started to improve their agricultural practices and marketing decision making, and ultimately increased their incomes. On the other hand, it threatened the more traditional types of trading occupations (WB 2004). Traders could not compete with the system or their incomes from the agriculture trade declined. However, as the traders were more entrepreneurs, in some places they took the new role of Sanchalaks. As the changed business environment is creating difficulty for them to unreasonably gain, they are changing.

The private sector investment, strategically alignment with the business model of ITC, and warm welcome from the communities indicate that this marketing information system is a sustainable model. Although its replication in other areas and sectors seems difficult and demands careful planning, this model however shows a good learning points for developing agricultural marketing information system and marketing interventions.

## 7.16: Role of Knowledge and Information in Marketing of Agricultural Commodities

Market information plays a vital role in marketing of agricultural produce. If the information on commodity prices prevailing in various markets is made available,

the farmers would be able to get better price to their produce by moving their produce to the market which pays higher price. Market information expands knowledge among traders and producers, which reduce transaction costs, enable farmers to purchase inputs, and enhance farmers' ability to fine-tune production strategies to match the accelerating rates of change in consumer demand and marketing channels. Greater access to information seems to help farmers make better decisions around transportation and logistics, price and location, supply and demand, diversification of their product base, and access to inputs. Market information strengthens farmers' position in their day-to-day trading and, over time, market intelligence enables them to focus on satisfying consumers' and buyers' demands and on developing relationships with stakeholders in the next stage of the value chain. The key development challenge lies in assembling and disseminating this information in a timely manner, not just to traders or farmers but also to consumers.

The purpose of such information is to continuously enhance market transparency through Creation of stimuli by indicating market opportunities and competition among suppliers and traders. This also reduces of seasonal and erratic price variation and associated market risk. Relevant, meaningful and reliable information enhance the performance of agriculture marketing. It facilitates marketing decisions, regulates the competitive market process and simplifies marketing mechanisms. Market information is a means of increasing the efficiency of marketing system and promoting improved price formation. It is crucial to the farmers and traders to make informed decisions about what to grow, when to harvest, to which market produce should be sent and whether or not to store it. Improved information should enable traders to move produce profitably from a surplus to a deficit market and to make decisions about the viability of carrying out storage where technically possible. Most of the farmers today still lack a good understanding and capacity to use market information in guiding their production and marketing decisions. All the Indian states depend on interstate trade for major agricultural and horticultural commodities. Hence dissemination of market information (demand, production and prices) plays a vital role in the functioning of the whole market, by harmonizing the competitive marketing process. By helping ensure that produce goes to markets where there is a demand for it, it shortens marketing channels and cuts down on transport

costs. It helps to ensure that each marketing transaction is a fair one, and that all participants share the risks and benefits.

In fact, marketing information plays a vital role in the functioning of the whole market, by regulating the competitive marketing process. By helping ensure that produce goes to markets where there is a demand for it, it shortens marketing channels and cuts down on transport costs. It helps ensure that each marketing transaction is a fair one, and that all participants share the risks and benefits. However, this does not happen if marketing information is distributed unequally.

## 7.17: Agriculture Marketing Information Network Infrastructure

Market information is needed by farmers in planning production and marketing, and is equally required by other market participants in arriving at optimal trading decisions. The existence and dissemination of complete and accurate marketing information is the key to achieving both operational and pricing efficiency in the marketing system. A central sector marketing research and information network scheme was launched by the Department of Agriculture and Cooperation in March, 2000. The scheme aims at progressively linking important agricultural produce markets spread all over the country with State Agricultural Marketing Boards and Directorates and the Directorate of Marketing and Inspection (DMI) for the effective exchange of market information. The Agricultural Marketing Information Network (AGMARKNET) is being implemented jointly by the Directorate of Marketing and Inspection (DMI) and National Informatics Centre (NIC), using National Information Network (NICNET) facilities available throughout the country. The objective of the scheme is to facilitate the collection and dissemination of information for better price realisation by the farmers. The information covers market, price, infrastructure, and promotion related issues for efficient marketing. The markets report daily prices and arrival data using a comprehensive national level database at the AGMARKNET portal (http://agmarknet.nic.in). Wholesale prices and arrival information in respect of more than 300 commodities and 2,000 varieties are being disseminated through the portal on a daily basis. More than 3,000 markets have been linked to the Central AGMARKNET portal and more than 1,900 markets reported data during the month of January 2010 (Govt. of India, 2010).

The information of weekly and monthly prices movement and arrivals are also being disseminated by the AGMARKNET portal. Several other market related informations like standards and grades, physical infrastructure for storage and warehousing, marketing laws, fees payable, commodity profiles etc are provided by this portal. The portal provides information about schemes of the DMI, weather information, e-directories of markets, CODEX standards etc. It provides weekly trend analysis for important markets in respect of major commodities. Besides spot prices, the portal also provides access to future prices. Further, it is constantly being enriched with various informations. Prices and arrival information are being disseminated in nine languages. The portal also serves as a single window and has linkages with various organisations concerned with agricultural marketing.

This AGMARKNET project networked 735 Agricultural Produces Wholesale Markets (APWMs), during 2000-02. Again, during the tenth five-year plan (2002–2007), 2000 additional markets are being networked. To start with, 810 AGMARKNET nodes have been established in the country during ninth plan period. This includes 735 agriculture produce wholesale markets, State Marketing Boards/Directorates (48) and DMI offices (27) spread all over the Country (Govt. of India, 2007). Under this scheme at present about 3011 AGMARKNET nodes (table-1) have been promoted in the country so far. Out of these, 92 percent have been promoted in the agricultural markets whereas remaining are used for monitoring and follow up. The availability of AGMARKNET nodes per thousand Sq. Km of area is not even one. However their availability per thousand tones of produce is six. Intensive efforts are required to expand the AGMARKNET nodes in the states of Assam, Bihar, Jharkhand, Manipur, West Bengal, Orissa, Punjab, Uttar Pradesh and Uttaranchal.

The AGMARKNET project has led to a nation-wide information network for speedy collection and diffusion of market information, computerization of market related information ensuring regularity and reliability of data and increasing the efficiency in agricultural markets. AGMARKNET project has also been designated as one of the Mission Mode Projects of the Department of Information Technology (DIT), Government of India, and has won recognition nationally and internationally, for effectively fulfilling the objective of speedy collection and dissemination of

agricultural marketing information for better market access and price realisation by the farming community. It is hoped that in due course of time it would be an on-line marketing information service useful to all the stakeholders on agricultural marketing system of the country. It has an immense potential to service all the market participants to face the new challenges emerging out of liberalisation and globalization of agricultural sector.State-wise AGMARK Nodes in India have been shown in table-7.1.

**Table-7.1: State-wise AGMARK Nodes in India**

| States | Agmark Nodes | | |
|---|---|---|---|
| | Number (August 2010) | Per 1000 Sq.km | Per 1000 MT |
| **Andhra Pradesh** | 334 | 1.28 | 8.50 |
| **Arunachal Pradesh** | 15 | 0.18 | 29.74 |
| **Assam** | 23 | 0.29 | 1.93 |
| **Bihar** | 58 | 0.62 | 1.91 |
| **Chhattisgarh** | 73 | 0.54 | 7.18 |
| **Goa** | 10 | 2.70 | 31.37 |
| **Gujarat** | 319 | 1.63 | 13.00 |
| **Haryana** | 150 | 3.39 | 7.20 |
| **Himachal Pradesh** | 39 | 0.70 | 12.79 |
| **Jammu & Kashmir** | 41 | 0.18 | 8.75 |
| **Jharkhand** | 26 | 0.33 | 3.03 |
| **Karnataka** | 171 | 0.89 | 6.29 |
| **Kerala** | 92 | 2.37 | 13.80 |
| **Madhya Pradesh** | 267 | 0.87 | 9.40 |
| **Maharashtra** | 346 | 1.12 | 11.06 |
| **Manipur** | 5 | 0.22 | 5.37 |
| **Meghalaya** | 11 | 0.49 | 11.53 |
| **Mizoram** | 9 | 0.43 | 24.34 |
| **Nagaland** | 14 | 0.84 | 17.17 |
| **Orissa** | 91 | 0.58 | 4.99 |
| **Punjab** | 199 | 3.95 | 6.17 |
| **Rajasthan** | 166 | 0.49 | 6.89 |
| **Sikkim** | 7 | 0.99 | 27.82 |
| **Tamil Nadu** | 190 | 1.46 | 7.54 |
| **Tripura** | 21 | 2.00 | 14.90 |
| **Uttar Pradesh** | 257 | 1.08 | 3.51 |
| **Uttarakhand** | 21 | 0.39 | 5.84 |
| **West Bengal** | 56 | 0.63 | 1.34 |
| **All India** | 3011 | 0.92 | 6.40 |

Source: Compiled from the data obtained from Directorate of Marketing & Inspection, Ministry of Agriculture, Govt of India, Faridabad.

## 7.18: Finding a Suitable Channel for Agricultural Marketing: Role of Knowledge/ information

Efficient market information provides positive benefits to the farmers, traders and policy makers. Up-to-date market information enables farmers to negotiate with traders. Well analysed historical information helps farmers make decisions about new crops to grow and helps traders make decisions about the viability of inter seasonal storage. Market information can also be used by planners to help monitor food availability and to identify shortages. Market information enables farmers to make informed decisions about what to grow when to harvest, to which markets produce should be sent and whether or not to store products.

It has been observed that in the rural markets, the marketing activity is largely dominated by the private traders. Farmers are generally not aware of market information like supply, demand, prices prevailing in the market, market charges etc., which are crucial for proper decision making. There is no system of disseminate market information for the benefit of the producers and consumers. As such, the farmers who are in the villages have no chance to know the prevailing prices in the neighbouring markets at subdivision and district levels. They are never sure what price they will get until they reach the market. Prices fluctuate particularly in the peak season, when many farmers try to sell their production, under such circumstances the rural producers largely accept the price quoted by the traders. On the other side, due to various economic reasons like indebtedness, need for cash, insufficient storage, lack of adequate transportation and other infrastructure facilities farmers are also at a disadvantage in striking the bargain. As a result, they are forced to carry out distress sales.

Majority of the small farmers sell their produce to middlemen or in the nearest ‘mandis’ where the middlemen have a full control on deciding the price. The farmer does not have any interaction with the traders nor does he know the prices ruling at nearby markets. By making commodity prices and market information on real time basis available, the farming community can be provided with choices that they lack today. This will ensure better price realization and stimulate a drive towards better productivity. Farmers who grow cash crop can also be enormously benefited by

information and can forecast future prices of commodities. This will prevent the tendency of farmers to jump into a decision on the basis of ruling price levels and later on discover that the prices have crashed when they are ready to sell their produce at the end of the season.

Credible and timely information plays a crucial role in agricultural marketing, particularly for perishables. Due to lack of proper market information channel and interference of middle man, the farmers have been exploited often and forced to sell their produce at lower price in their nearby market. The harvested produce can be sold at a premium price information of the nearest alternative markets is disseminated to farmers on demand and daily basis. They can make better decision to harvest the produce at right time and send their consignment to particular market where the market price is higher for his/her produce.

In a study of jute marketing it has been observed farias, aratdars and balers are the dominant intermediaries in the marketing of raw jute by which jute reaches to ultimate consuming point at jute mills (Bhowmick, 2013). Though JCI (Jute Corporation of India) and co-operative societies are also one of the functionaries in the jute marketing process but no sample farmer sell their produce to JCI and co-operative societies in the study area and maximum number of sample farmers have not heard the name of any cooperative society and also no cooperative society really purchases jute from the farmers.

From the study of 260 farmers it is observed that marketing of jute from the producer to the consumer (Jute Mill) is done mainly through following four channels**.**

Channel I Farmer - Faria - Aratdar - Baler - Jute Mills

Channel II Farmer - Faria - Baler - Jute Mill

Channel III Farmer - Aratdar - Baler - Jute Mill

Channel IV Farmer - Baler - Jute Mill

The study revealed 71.72 percent of total farmers followed marketing channel-I. Channel-I is the commonest channel followed by farmers. Then 15.77 percent farmers followed marketing channel-II, 6.54 percent farmers followed marketing channel-IV and remaining 5.77 percent farmers followed marketing channel-III. The

study also revealed that 67.78 percent of total produce of the sample farmers was sold through channel-1 followed by channel-II (13.97 percent), channel-III (9.25percent) and channel-IV (9.00 percent). It is clear that channel-I is most important channel through which major portion of raw jute is being marketed by maximum no of farmers. In channel-I farmers sold their produce in the village primary market where farias(middlemen) are the major intermediary. The reason is that most of the small and medium farmers have various constraints to access long distance secondary market. They cannot access information about price of the produce in the long distance secondary market. On the other side village market is easy to reachable where the farmers can access market information.

## 7.19: Conclusion

Agriculture is a prime sector for development in an agrarian economy. The rural livelihood primarily depends upon the agricultural development. Among other instruments of development of agriculture the provision of right information to the agricultural stakeholders has yet to be designed. Access to right information and its proper utilisation for the farming community is utmost important. There is a need to develop a system of information utilizing the modern information communication techniques so that the farmers are provided with the required market information at the village itself so as to make appropriate decisions with respect to production and marketing plans including post harvest management storage, processing and sale of agriculture commodities. Government should make the provision of information to increase efficiency and improve the performance of the agricultural economy. There is a greater need of assessing the information needs of the agricultural stakeholders so as to know their information requirements.

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# Chapter-VIII

## Knowledge Influencing Industralisation in India

### 8.1: Introduction

Scientific knowledge influences industrialization. Prior to Industrial revolution, utilization and application of scientific knowledge in industrial development was moderate. Industrial revolution sped up the application of scientific discoveries and innovation. Technological research of the knowledgeable persons started gaining importance and sponsorship from the entrepreneur class. Technology was evolved to ease out the manufacturing process and large scale manufacturing process become a reality/ possibility ; we owe to discovery of electricity which substituted coal as the prime source of energy . Development of Technology in other field started widening. Apart from translation of scientific knowledge into application-technology, societal measures to improve the skill and quality of human resource also contributed. Scientific knowledge and its translation served as the basis of industrial revolution. Changes in cultural and political sphere helped industrial development. Both are product of human knowledge. Variation of industrial development across the globe is persisting apart from other reason, due to variation in the sphere of knowledge and its application.

The prime objective of the present chapter is to discuss the contribution of knowledge in Industrial economy or more precisely industrial economy of India. It is naïve to state that western industrial revolution influenced industrialization in India. Political sub-judication by industrially developed western world is equally significant. India experienced a discrete jerk from the western countries – Great Britain in particular, the economy most fortunate to harvest early gains from industrial revolution. Results of western influence is mixed – industrial economy of India was shattered and at the same time we owe much to west for large scale industrial operation and widening of industrial sector. Resource base of the country started improving but west harvested maximum benefit. We have subdivided the chapter in

to two sections. Section I briefly deliberates on industrialization in historical set up. In sectionII, Indian experience is discussed concluded.

## 8.2: Section I

### Knowledge Influencing Industrial Development: The Global Scenario

Without loss of much generality we may state that firms and Industries from early centuries relied more and more on this precious tool. It is a practice that has moved from the periphery of many corporate agendas right to the center of their strategies for growth and leadership later on. Most sectors and industries are currently experiencing what is called a "Schumpeterian renaissance": innovation is today the crucial source of effective competition, of economic development and the transformation of society.

Changes in human knowledge are a crucial ingredient in Industrial and economic growth seems obvious. Economists actually rarely have dealt with it explicitly. Even the “New Growth Theory,” which explicitly tries to incorporate technology as one of the variables driven by human and physical capital does not try to model the concept of knowledge and its change over time explicitly.

Technology is knowledge. The key to the Industrial Revolution was technology. It would therefore be proper to identify the timing of Industrial Revolution with positive intellectual developments on the one hand and on the other transformation of knowledge into technology

– industrial use presently. Thus true key to the timing of the Industrial Revolution has to be sought in the scientific revolution of the seventeenth century and the enlightenment movement of the eighteenth century.

Technology always plays a fundamental role in wealth creation, real economic growth, inducing transformation in any society and focused in the improvement of the quality of life. Dissemination and application of technology crucially depend on knowledge base of society and play the second and third fiddle in any society. Knowledge and or technology are primary requirement but maturity of society – cultural milieu is earnestly required. Many of the Asian countries – India and China

in particular - though was not industrially underdeveloped compared to global standard but failed to harvest instantaneously and directly from development in the western hemisphere during the period.

The United Kingdom and France harvested enormous benefits from the industrial revolution in the 19th century. United States is one other economy which emerged from an agrarian economy into an industrial superpower suppressing UK in the 20th century. Taiwan and Korea are later examples to become industrialized countries by exploiting advances in silicon microelectronics from the early 1960s. Most recently, China and India are fast emerging as industrial leaders in manufacturing and information technology, in that order. These countries invested substantially for skill development and factories, and their successes were based on carefully designed plans and strategies. Finally, by encouraging spending on science and technology they turned out to be globally competitive.

### *Industrialization: Impact of Science, Technology and Knowledge*

The Industrial Revolution was not the beginning of economic growth. Britain and other parts of Western Europe had gone through long periods of economic growth which can be attributed to the geographical discoveries after 1450 and improvements in shipping and navigational technology (a pure growth in knowledge) resulting in improved techniques and finally led to increased trade as well. Industrial Revolution constitutes a stage in which the weight of the knowledge-induced component of economic growth experienced a marked increase.

Industrial Revolution swept Britain changing the way in which production was carried out. Central to industrialization was the application of a string of technological inventions. New methods of spinning and weaving cotton, together with increasing specialization sharply increased productivity. That something remarkable happened to cotton textile manufacturing in the British Isles at the end of the eighteenth century is beyond doubt. India was exploited but in the long run derived benefits to emerge as global competitor in textile. This can be regarded as an example of diffusion of knowledge and technology.

In UK, cotton textiles production increased tenfold between 1770 and 1790 and tenfold again in the following decades. With rates of growth estimated at nine per

cent a year between 1770 and 1801 and six per cent in the following thirty years, British cotton textile manufacturing grew as fast as the Chinese and Indian economies of today. These performances have made cotton textiles manufacturing the most important sector in narratives of British and European industrialization. Key to the expansion of cotton textile manufacturing was a decrease in the cost of production. External market could be easily accessed for finished product. Supply of raw cotton from distant land also added to its glorious march.

General consensus is that economic growth as properly defined was very slow during the Industrial Revolution, and that living standards barely nudged upward until the mid 1840s (Mokyr, 1998c). There have even been some voices calling for abandoning the term altogether. Yet it is by now recognized that there are considerable time lag in the adoption and macroeconomic effects of major technological breakthrough and so-called General Purpose Technologies and that growth traditionally measured even during the difficult 1760-1815 years was, in fact, respectable once we take into account the negative political and demographic shocks of the period. In the longer run, the macroeconomic effects of the technological breakthroughs that constituted the Industrial Revolution have not seriously been questioned.

Experts largely view that (the growth of) *scientific* knowledge was a small subset of the accumulated knowledge of different sphere but a significant one. Disseminations and diffusion took place in informal manner- *'Most practical useful knowledge in the eighteenth century was not codified, unsystematic and informal, passed on from master to apprentice or horizontally between agents. Yet formal and informal knowledge were strict complements in the development of new techniques, and the technology of knowledge transmission itself played a major role.'(ref)*

### *Industrial revolution sailed: difference in quality and quantity*

The significant role played by *knowledge transmission* in Industrial revolution and carrying the momentum *beyond 1820 may* readily be *discovered* from the following. There had been macro inventions in the fifteenth century like the casting of iron, and advances in shipping and navigation technology, but these *mini-industrial revolutions* was only partially successful to gear up industrial growth process but

receded before their effects could launch the economies into sustainable economic growth.

The true question of the Industrial Revolution is not why it "took place" at all but why it was sustained beyond, says, 1820. Explanation lies in both quantitative and qualitative difference in Scientific Developments between the two eras. A discrete discontinuity may readily be observed. In the eighteenth century Scientific Revolution and the Enlightenment changed the structure of Science to the point where useful knowledge could increase abruptly by continuously feeding on itself. Without prejudice, previously not infrequently, scientific knowledge was suppressed by economic and social factors. Positive responses replaced the negative attitude of earlier periods and eventually became powerful to overcome the socio economic obstacles and resulted in self-sustaining. Such positive feedback effects between *knowledge and knowledge* resulted in a self-reinforcing spiral of knowledge augmentation that was mostly impossible in earlier days of engineering without mechanics, iron making without metallurgy, farming without organic chemistry, and medical practice without microbiology. "Growth" in scientific knowledge meant not only an increase in the *size* of it (through discovery) but also in its *density* (through diffusion). Indeed, the widening of the epistemic base of technology meant that the techniques that came into use after 1750 relied on a broader and broader base in scientific knowledge. This made a gradual stream of improvements and micro inventions possible. In short, the Industrial Revolution should be understood in the context of changes in useful knowledge and its applications.

The consensus is that techniques developed during the British Industrial Revolution owed little directly to "scientific knowledge" as we would define it today. Unlike the technologies that developed in Europe and the United States in the second half of the nineteenth century, science, by conventional wisdom, had little direct guidance to offer to the Industrial Revolution (Hall, 1974, p. 151). Gillispie (1957) points out that the majority of scientific endeavors of the time concerned subjects of limited technological use: astronomy, botany, crystallography and early exploration of magnetism, refraction of light, and combustion. Eventually many of those discoveries found economic applications, but these took place, with few exceptions, after 1830. If science played a role in the Industrial Revolution, it was first and foremost through

the incidental spillovers from the scientific endeavor on the properties of scientific knowledge. These spillovers affected the way in which *new* knowledge was generated, but equally important they affected the technology and culture of access to information. We may distinguish among three closely interrelated phenomena: scientific method, scientific mentality, and scientific culture. The penetration of scientific *method* into technological research meant accurate measurement, controlled experiment, and an insistence on reproducibility.

## 8.3: Early Beneficiaries: Great Britain and Cotton Textile

The Industrial Revolution of the late 18th and early 19th centuries was revolutionary because it changed -- revolutionized -- the productive capacity of England, Europe and United States. But the revolution was something more than just new machines, smoke-belching factories, increased productivity and an increased standard of living. The Industrial Revolution serves as a key to the origins of modern Western society. As Harold Perkin has observed, "the Industrial Revolution was no mere sequence of changes in industrial techniques and production, but a social revolution with social causes as well as profound social effects" [*The Origins of Modern English Society, 1780-1880* (1969)].

There is no denying the fact that the Industrial Revolution began in England sometime after the middle of the 18th century. England was the "First Industrial Nation." As one economic historian commented in the 1960s, it was England which first executed "the takeoff into self-sustained growth." And by 1850, England had become an economic titan. Its goal was to supply two-thirds of the globe with cotton spun, dyed, and woven in the industrial centers of northern England. England proudly proclaimed itself to be the "Workshop of the World," a position that country held until the end of the 19th century when Germany, Japan and United States overtook it.

### Socio political factors contributing

More than the greatest gains of the Renaissance, the Reformation, Scientific Revolution or Enlightenment, the Industrial Revolution implied that man now had not only the opportunity and the knowledge but the physical means to completely subdue nature. No other revolution in modern times can be said to have accomplished so

much in so little time. The Industrial Revolution attempted to effect man's mastery over nature. This was an old vision, a vision with a history. In the 17th century, the English statesman and "Father of Modern Science, Francis Bacon (1561-1626), believed that natural philosophy (what we call science) could be applied to the solution of practical problems, and so, the idea of modern technology was born. For Bacon, the problem was this: how could man enjoy perfect freedom if he had to constantly labor to supply the necessities of existence? His answer was clear -- machines. These labour saving devices would liberate mankind; they would save labour which then could be utilized elsewhere. "Knowledge is power," said Bacon, and scientific knowledge reveals power over nature.

What is even more remarkable, when viewed from a long-term perspective, is how suddenly, even seemingly exponentially, both population and per capita incomes began to rise from the 1800s onward. This tremendous growth was in large part led by the development of the steam engine, whereby mankind was first able to harness fossil fuel energy for productive tasks. This augmentation of power enabled the industrial revolution with the corresponding proliferation of productive activity and expansion in the range of products and services brought to market.

As a compounding factor, further improvements in agriculture released a stream of labour into the recently arisen and relatively more productive industrial sectors. Simultaneous with these demographic changes and enhanced production technology, railroads and steamships supported scale economies and provided new opportunities for specialization and exchange. In the early nineteenth century, this broad social and economic transformation set the course toward the advanced standard of living which is today the hallmark of developed countries.

These first basic transformations were followed by successive radical inventions and corresponding institutional restructurings. Consider, for example, the advent of electricity. More or less suddenly, power could be distributed in discrete units including into the home for powering numerous labour saving devices. This technological change gradually released women

into the workforce and increased output. Other examples include the following: gas and then electric lighting increased the length of the working day; the

development of the gasoline engine unthreaded power from grids and led to more flexible transportation; the telegraph, and then the telephone reduced distance by making it possible to communicate and coordinate activities across space, enlarging markets and furthering opportunities for specialization and exchange. Eventually, the development of the semiconductor spawned the current information technology revolution which ought to be viewed as one more epochal innovation wave that transforms the organization of economic and social activity. Consequently we observe, across the economies , development strategy today is based upon the evolving productive and developmental logic of information technology and knowledge economics.

From the 1700s onward, per capita incomes diverged across countries and regions. The benefits of increased per capita income concentrated first in England which generated the industrial revolution, then spread to Western Europe, and soon thereafter to the United States (US). By the end of the 1800s, the US began to overtake Europe in many areas of industrial production. The dazzling performance of the US has been attributed to qualitative changes in applied scientific research **.** Thomas Alva Edison created the first industrial research and development (R&D) laboratory. After Edison, the industrial R&D lab was quickly imitated by many large US companies. By 1900 there were more industrial research laboratories in the US than in Europe. Indeed **- 'US** *may be said to have invented the process of invention itself'***.**

## 8.4: Knowledge Revolution: Growth Pattern and Transnational Variation in Industrial Development

The knowledge base in the major economies has been growing at a fast pace. Investment in knowledge accounted for about 4.7 per cent of OECD-wide GDP and the high-knowledge-based economies invested between 5.2 to 6.5 per cent of GDP in knowledge development (OECD 2001). Developed and newly industrializing countries internationally trade goods and services which are knowledge-intensive. The industrial growth patterns and competitiveness of industries across countries and over time are closely related in the globalizing world. Two distinct patterns of industrial development are clearly noticeable: developed and newly industrializing countries

moved faster towards producing and exporting goods and services which are knowledge intensive; a large number of countries could not catch up and their position in the fast globalizing world is being marginalized. This pattern of industrial growth can be traced from the changing roles of innovative investment patterns in industry across countries and over time. The processes of globalization have affected different innovative activities differently and thus the rise/fall of innovative investment in some industries in some of the countries. Outsourcing of industrial R&D has shifted some of the innovative activities from developed to a few developing countries. The increasing role of foreign direct investment (FDI) and direct operation of multinational corporations in production of goods and services in the developing countries has significantly influenced development/under development of innovative capabilities. Developing countries under the new international economic order have substantially reduced the role of the state in innovative investment and have promoted the dependence on either private initiatives or on FDI. Therefore, it is legitimate to inquire the changes in the pattern of industrial innovative investment on trade and industrial development which are occurring across countries and over time.

## Asian Experience: Industrial Impetus

Asian countries (South East Asia, China and India) have shown dynamism, in terms of industrial development and contributing to global trade with high-tech exports, in the fast globalizing world. East Asian economies followed a standard pattern of economic transformation and achieved more than a 9 per cent growth rate during the decades of the 1980s and 1990s in the twentieth century. The industrial sector is truly the engine of growth of these economies contrary to the service sector-led economic growth in the case of other economies. The industrial growth experience of East Asia remained highly controversial on two counts. One, capital accumulation versus technical progress which of the factors that have allowed East Asia to achieve a faster rate of industrial growth. Two, the role of the state in enacting suitable policies for industrial development or the market forces which led the East Asia to succeed in economic transformation as well as in the international market. Thus Asian countries are most suitable to test new economic growth theory and draw lessons from successful public policy experience for other stagnant economies.

## European Union Presently: Forerunner in Knowledge

Industrial policy supporting innovation and external competitiveness can play a role to reverse the declining trend. The EU is a major producer of new knowledge in key enabling technologies. Its products based on industrial biotechnology or advanced materials have higher technology content than competing North American or East Asian products. Apart from advanced manufacturing technologies, EU products based on key enabling technologies are mature and need to compete on price. Adding more innovative and complex products to the product portfolio will help manufacturers move up the value chain.

A further evidence of the industrial strengths of the EU is the analysis of the sophistication (knowledge intensity) of EU exports of products with comparative advantages. This is an advanced indicator of non-cost competitiveness which shows that manufacturing industries in the EU have a higher degree of complexity. The report documents that EU exports have preserved their advantages thanks to developing sophisticated, knowledge-intensive products to address the cost advantages of emerging industrial powers. By gradually increasing the complexity of their products from 1995 to 2010, EU manufacturing industries managed to maintain their competitive position. By contrast, products from BRIC countries (Brazil, Russia, India, China) underwent major changes in the same period – goods produced by firms in wood industries, radio, TV and communication equipment industries, medical, precision and optical instruments industries, and furniture industries in BRIC countries have considerably improved in terms of their average complexity – but the majority of industries in BRIC countries still produce less complex products than EU industries. As a consequence, in 2010 the EU exported around 67 percent of products with revealed comparative advantage, while China had comparative advantage in 54 percent of its exports, the US in 43% of its products, and Japan in 24 percent.

What the study of the complexity of EU export products suggests is that targeting only high-tech sectors might be less rewarding than increasing the share of knowledge-intensive products in all tradable sectors, including medium-low tech sectors. Moreover, some of the labour-intensive sectors with lower knowledge intensities may be better positioned to tackle the EU's unemployment challenges than the high-tech sectors. About 40 percent of EU manufacturing employment is in low-

tech sectors. Therefore the policy priority attached to key enabling technologies which lead to new materials and products in all manufacturing sectors has a strong potential to upgrade EU competitiveness not only in the high-tech sectors but also in the traditional industries.

## 8.5: External Trade and Governance: Fillip to Industrial Economy

International trade is an important determinant of the development of sectoral shares in countries. The successful catch-up stories of Germany in 19th century, and Japan and South Korea in the 20th century, cannot be explained without taking into account international trade, comparative advantage in tradable goods and specific competencies and capabilities in the production of new and high-value added products. Here it is important to acknowledge that structural change that shapes economic development of countries is highly path-dependent and cumulative. Any change is rooted in present knowledge bases and constrained by existing specialisation patterns. Complementary capabilities need to be built up. Thus policies to support structural change should always start by taking into account the existing production structures of countries and regions, as well as the knowledge base of supporting institutions. Countries seeking to shift their industrial production up the technology ladder are required to increase and improve education and business services. Improved quality of human resource is essential.

The centrality of institutions and policies in the process of structural change leads to a view that the general quality of institutions is important to structural change. Policies that foster structural adjustments should therefore be conceived in a broad way and cover such different areas as education, research, technology and innovation policies, while also focusing on the general quality of governance and human capital .

## Section II

## 8.6: Industrial Experience of India: Knowledge, Technology and Polity

We can readily identify three distinct phases of Industrial growth in India with reference to knowledge base and technological change. Phasing is based on changes in external world environment in science and technology and in political ambiance in the country. Indigenous development prior to industrial revolution and external penetration namely British power , British colonial regime and industrial experience during the period of self governance starting with 1947.

India can boast of her ingenuity in fashioning Industrial development both in the past – pre industrial period and during the self governing period – the era of national administration. We obviously do not want to live in the past but preset is the culmination of past and more significant is that future originates from the present. Indeed the ongoing period is most important since India has already stepped into knowledge age .

### *British colonial regime: diversification of manufacturing activities*

Clive's victory in Plassey in 1757 introduced a new epoch in Indian subcontinent, it paved the way of British political power to penetrate Indian subcontinent. Inroad of British power via East India Company focuses inadequacy of knowledge base of Indian. Indian capability to restrict British and to protect the country was ineffective. The reason is more due to lack of political maturity rather than military and defense infrastructure. Indian arm sector was moderately developed and military power was not completely incapable to fight British solders mostly manned by Indian. However, we should not also ignore the pessimistic view of relating disintegration of the Mughal Empire during the time.

Earliest political movement in 1857 to resist the British resulted in British Crown rule. British overpowered the feudalistic movement; Lack of coordination among the feudal rulers is well focused but their failure to implant the significance of native feudal rule for sustainability and long term welfare and economic progress has

rarely been focused. Our rulers were immature politically British crown for optimizing exploitation of market and resources base of Indian subcontinent introduced the concept of India. However, British unification move was rewarding to the ruler but the concept of nation did not flourish. Missing link was tagged by Gandhi, Diplomacy of Gandhi was to utilize the British unification move elegantly to generate the concept of Indian nation. We are indeed, indebted to Gandhiji for national integration and more significantly for the birth of the national concept – Indian nation was born consequently love for freedom; Swaraj – complete administrative control over our resources – inert physical and human resources came in the forefront. Participation of people in the movement monotonically started improving. Gandhiji is more a socio political philosopher like Marx than a politician. In support we may observe that Gandhiji was side tracked by his political disciples during the negotiation of transfer of power after the Second World War. It is difficult to presume that Mahatma failed to analyze the consequence of two great wars – colonial system of exploiting resources and human manpower has started undergoing qualitative change to give birth of a new system . We owe to Lenin for the political terminology – imperialism.

National movement led by Gandhi resulted in transfer of power to national administration after the Second World War. Republic of India was born on 15th August 1947. Unfortunately India was partitioned and Pakistan was created with some absurdity. Genesis of third nation – Bangladesh was only latent at that time.

During the British colonial period manufacturing activities in the country underwent both quantitative and qualitative changes .The interplay between the British and Indian entrepreneurs dominated the industrial economy of the country. Indian traders experienced boom and a sizeable portion emerged as industry entrepreneur, Indian manufacturing class started growing with active complementary and supplementary participations of Britishers ; often they were competitive. Indian industry sector during the two Great War widened but lacked in many areas. Industrial atmosphere - entrepreneurship, knowledge and technology base of the country was substantially developed compared to other colonial regions. Knowledge and technological base of the country was moderate and was developing. During the two great wars Indian entrepreneur class made substantial inroad in the industrial sector in

British India. As a matter of fact, available information suggests dominance of Indian entrepreneurs (table-8.1).

**Table-8.1: Changes in the Distribution of Paid- up Capital and Asset Control: by community**

(Units in percentage)

| Community | Paid- up Capital | | | Asset Control | | |
|---|---|---|---|---|---|---|
| | 1912 | 1935 | 1948 | 1912 | 1932 | 1948 |
| **British** | 30.8 | 21.6 | 8.9 | 43.0 | 10.0 | 3.6 |
| **Parsis** | 40.7 | 47.6 | 36.0 | 31.4 | 41.3 | 46.5 |
| **Gujeraties** | 11.5 | 12.5 | 24.5 | 21.8 | 18.3 | 18.5 |
| **Marwaris** | 0.0 | 0.8 | 14.3 | 0.0 | 2.4 | 7.3 |
| **Others** | 8.0 | 17.2 | 16.3 | 3.8 | 27.9 | 24.6 |

**Source : compiled from Table 8, C. Myers – Labour Problems In The Industrilisation of India**

Agro based textile and food processing industry dominated, in the eastern India metal based industry– special mention may be mentioned of iron and steel – and engineering industry was considerably developed compared to other parts of India and other developing nation. Industrial infrastructure was praiseworthy. Plantation industry was developed but India had persistent problem in wage good front.

Transfer of power or gaining administrative power in 1947 was accompanied by a setback in Industrial economy of India - mainly due to partition. Dominant textile sector plagued with shortage of raw material and scarcity of skilled man power was in general experienced by many industries – noticeably in developed railway transport industry. Indian polity faced the challenge by formulating her inward oriented strategy. The main elements of that strategy were import substitution, a large public sector with central planning, Public – private collaboration was one of the major cornerstone of industrial reconstruction planning in India. Public investment was directed to capital and infrastructure sector; private entrepreneurship was encouraged in consumer goods producing industry. Small scale industrial sector was encouraged - reservation of 1,500 items for production by small-scale industry. Indian strategy was to regain her industrial strength and glory. Indian planning eventually emerged as the role model of developing world.

## 8.7: Oriental Manufacturing Knowledge: Influencing Western Industrial Technology

Let us not forget our heritage - knowledge base. Prior to industrial revolution in the west, India and China were the 'first industrial regions' providing manufactured export goods on a mass scale to markets throughout the world. They are now doing once again.

Civilization developed across the globe in isolation. Sharing of ideas and knowledge and exchange of goods and services started with expedition made. Historical evidence of Indian exploration is nearly absent while western world is famous for expedition. Indian historian not infrequently depends on explorer document to highlight the prevailing socio economic order and attainment of the region. In art and culture Indian supremacy is well known. Indians were striving to influence the knowledge base but translation process was not well attended. Indian industry was household oriented and person specific. Indian mostly ignored scientific process of mass Production. Export from India – namely knowledge based highly skill product – attracted the attention of western world.

West is the region of explorer. West can boast of her reception and accommodation quality of knowledge, which is still continuing in the field of phiotherapy – yoga and humanity – religion in particular. Inquisitive west developed the borrowed knowledge – they had the capability due to improved scientific base and quantity. West is efficient compiler and composer. Western expedition resulted in exploration of resource base and ultimately colonial exploitation.

Europeans of the seventeenth and eighteenth centuries sought out Asia's 'exotics', followed by its export-ware products. West also sought to understand manufacturing systems adept at providing the goods that people at a distance wanted to buy. Products and quality were as significant to this trade as were productivity growth. Industry of India and China ultimately stimulated the technological transformation in Europe. Contribution of China prior to industrial revolution in inventing and fashioning various industrial products is recognized. While India may boast of her quality of human resource and skill in many spheres, Chinese in the

orient apart from technological knowledge contributed in human resource management.

European manufacturers and inventors throughout the latter half of the eighteenth century tested their patents, projects, and products against the great achievements of transparent Chinese porcelain and Indian textiles in madder red and indigo dyes, in glorious prints, or in the textures of the finest muslins. Studies indicated many cases of medical, botanical, and chemical knowledge transported and 'translated' to European environments from India and South East Asia, Taiwan, and Japan via Dutch East India Company doctors, merchants, and local intermediaries.

Surat during this period of the later 1780s was place of vibrant and growing trade: 'it not only pays and defrays its own great expense, but likewise furnishes Bombay with three to four lacs of rupees per year'. A new shipbuilding industry was there, building ships from teak for use in private trade. The exports included fine cotton, indigo, Ahmedabad carpets, silks, kincobs, ilachu (satin), and cotton cloth; imports were of coffee, sugar, spices, iron, copper, and ivory. The weavers were operating in highly competitive markets, with access to Portuguese, Armenian, and Indian merchants, thereby frustrating any tight economic control by the East India Companies.

## 8.8: Industrialization since Independence:Predominance of Knowledge and Technology

From early 1950s the United States emerged as internationally pre-eminent in science and technology. Economic dominance of US was well focused.The country was without loss of generality , was the store house of scientific knowledge , US superseded almost all the knowledge based economies including Germany in knowledge creation and application The only country comparable to the US in terms of per capita innovative output during this time was Switzerland . Partial explanation to this unseemly phenomenon lies with the fact that much of any significant scientific and technological effort and achievement remained the exclusive preserve of a few advanced industrialized countries. In the last 30 years or so, however, the economic landscape has changed considerably and indeed continues to change with amazing rapidity.

Increasing globalisation has meant that several more nations have become important players on the world economic stage and the rules of the game have subsequently changed. In the area of science, technology and innovation, the supremacy of the United States and the few other monopoly powers are seriously challenged and partly eroded. Several developments have materialised.

Israel, Taiwan, Singapore, South Korea and, to a lesser extent, Ireland, have made substantial progress in upgrading their innovative capacity and, as a result, have become beneficiaries of foreign investments in science and technology ventures. Although countries such as India, China and Malaysia, have increased investments in areas related to science, technology and innovation at modest levels, there is little doubt that some of these, especially China and India, are potential scientific powerhouses.

### *Industrial development strategy : significance of scientific research*

Indian intelligentsias prior to gaining administrative control deliberated on industrial strategy . Three different plan model for industrialization was formulated- Bombay Plan emphasized industrialization but was not in favour of import substitution strategy – relatively more emphasis was attached to cosumer goods sector , capital and basic goods producing sector was given less attention and public sector as well . In Simla plan due to M N Roy emphasis was on maximizing utilization of human capital to expedite economic growth on the one hand and addressing the problem of employment as an inbuilt welfare measure. Now a days ensuring participation of people is upheld as endogenous growth model. Third but not so publicized planning model of VIsesharia emphasized more on knowledge creation and technology. Indian planners are fortunate. Indian plan model is an admixture of these three exercises. But that was rather influenced by planning strategy followed and devised by Soviet Planners.

Immediately after gaining political power in 1947, Indian polity committed to a policy of industrialization based on self-reliance. For almost four decades, India pursued import-substitution strategy across all its sectors. This produced large enterprises, many of them state-owned. The result was an economic growth around 3 to 4 percent per year (in contrast to rates of growth of 5 per cent to 10 per cent for

many other Asian economies) – what had become known as the "Hindu rate of growth".

Indian administration, under Jawaharlal Nehru set itself the task of socio-economic transformation of the country through a process of central planning. Science was given considerable importance in the development "Plans", as its significance in national development was recognised.

In Industrial Policy Resolution (IPR) the Focus was***, "The key to national prosperity, apart from the spirit of the people, lies in the modern age, in the effective combination of three factors, technology, raw materials and capital, of which the first is perhaps the most important, since the creation and adoption of new scientific techniques can, in fact, make up for a deficiency in natural resources and reduce the demand on capital. But technology can only grow out of the study of science and its application".***

Under Industrial Policy Resolution 1958, India pursued a policy of import-substitution and strategy and meticulously planned out a diversified industrial production base ranging from simple consumer items to sophisticated capital goods and heavy machinery. A faster growth rate in the productive capacity of capital goods industries was seen as vital to raising savings and investment rates, diversifying the industrial sector and promoting manufactured exports. FDI, technology licensing and financial and technical collaborations were allowed over a wide range of industries.

### *Policy Experience: changes in favourable direction*

In this liberal atmosphere, industrial boom in India started to take off in the late 1950s. The policy of import-substitution created and sustained demand for foreign technologies. Foreign collaborations increased six-fold between 1948/55 and 1964/70. The FDI stock more than doubled to Rs 5660 million between 1948 and 1964. Technology-related royalty payments jumped sixteen-fold between 1956/7 and 1967/8. While industrialization proceeded on back of foreign technologies, "R&D promotion policies focused on creating a scientific and research base". This stance led to substantial investments in the establishment of science-based educational and R&D infrastructure. There was also a rapid expansion of agencies like the Council for

Scientific and Industrial Research (CSIR), the Department of Atomic Energy and the Defense Research and Development Organization.

In late 1960s, foreign exchange crisis induced the government to pursue a policy of "self-reliance". Besides, the Monopolistic and Restrictive Trade Practices (MRTP) Act ushered in a period of regulation in which the expansion of large firms was regulated, a reservation policy to protect the small-scale sector was introduced and banks and financial institutions were nationalized to ensure the flow of credit to designated sectors. The result of this policy change for science and technology was that technological self-reliance also became important. The basic stance was that technology should not be imported to the detriment of local development effort and that R&D structures created earlier should be used to meet the industrial demand for technologies. To generate demand for domestic technologies, the earlier policies on technology acquisition were reversed and the emphasis was shifted from “science and scientific development” to “technology and technological development”. Foreign collaborations were severely restricted and FDI was allowed only in core industries where no alternative local technologies were available. To deal with the situation arising from the restrictions on technology acquisition, a Department of Science and Technology (DST) was set up. S&T planning was made part of the overall planning process in the Fifth Plan (1974-1979).

The impact of these policies is well documented. Technology transfers declined drastically between 1968 and 1980. FDI inflows declined and in the late 1970s there was a net outflow. Growth of royalty payments slowed, from 22.3% annually between 1970-76 to 15.2% between 1977-85. Local R&D activities increased. R&D expenditures in private companies increased more than eight-fold to Rs 1207 million between 1970/71 and 1980/81. The number of registered units in the private sector rose from 156 in 1969 to 516 in 1979. R&D expenditures in the CSIR rose from Rs215 million in 1970/71 to Rs690 million in 1980/81. This led to near self-sufficiency in standard technologies and India indeed began to export technology.

In the 1980s, in view of declining exports, worsening balance of payments and stagnating industrial growth spanning over a decade, the Government of India decided to re-orientate industrial and trade policies. The Sixth Plan (1979-84) laid emphasis on "growth with efficiency". With shifts in priorities, technology acquired a stronger

focus. Restrictions on technology imports and foreign equity participation were relaxed. Up to 51% foreign equity was permitted in many sectors, except in those reserved for the public sector. In areas of sophisticated technology and/or export-oriented ventures, up to 100 percent equity was allowed. The Technology Policy statement of 1983, for the first time, recognized the need for establishing linkages between scientific, technological and financial institutions to promote effective transfer of technology from institutions to industry - technology policy was "the development of indigenous technology and efficient absorption and adaptation of imported technology appropriate to national priorities and resources". A fully-fledged Ministry of Science and Technology was created in 1985. A quality system management (SM) scheme to strengthen in-house R&D and provide quality assurance of same was set up to grant recognition to scientific and industrial research organizations (SIROs) in the private sector.

Prior to the 1990s, the main thrust of the R&D incentives was to generate indigenous technologies primarily in the institutional sector (public funded R&D institutions) and facilitate effective commercialisation, transfer and absorption of such technologies in the industrial sector. There were very few incentives at the firm level with the explicit aim of augmenting technology-creating capabilities. In-house R&D was encouraged only to facilitate acquisition of technological capabilities of absorption, adaptation and assimilation. Special incentives were given to firms using indigenous technologies developed by R&D institutions.

However, it was in July 1991 that India undertook sweeping reforms to open the country to foreign investment and deregulate most of Indian industry. More than 80 percent of Indian Industry was de-licensed, the number of industries reserved for the public sector was reduced from seventeen in 1990 to six, and plans were put forward for the divestment/privatization of public sector undertakings. Besides fostering domestic competition, the economy was opened to external/foreign competition. Tariffs were reduced progressively from a maximum of 300 percent in 1991 to 65 percent in 1994/95 and to about 20 percent currently.

In this progressive environment, the promotion of R&D has re-established its importance, not only for the exploitation of inward technology but also to improve the efficiency of technology transfer. The technology policy also had to be moderated, and

attuned to meet the new challenges of global competition. In fact, the *Science and Technology Policy 2003* states that, *"It is recognised that these objectives* (of S&T policy 2003) *will be best realised by a dynamic and flexible Science and Technology Policy, which can readily adapt to the rapidly changing world order. This policy, reiterates India's commitment to participate as an equal and vigorous global player…."*. The policy placed emphasis on the strengthening of linkages between industry, R&D institutions and financial institutions for encouraging commercial exploitation of technologies developed in laboratories. It recommended a consortium approach to R&D and technology development involving academic institutions, national research laboratories and user industries for goal-oriented programmes and new product development.

A major initiative has been the restructuring of public institutions and the strengthening of India's role in international organisations. The CSIR has taken on a more commercial orientation. In addition, India plans to play an active role in the work of the WTO in all areas of international relations, including the thorny issue of trade-related intellectual property rights (TRIPS). Collaboration between Indian firms and foreign suppliers of technology has been the major channel through which the manufacturing base in the country has been diversified.

The Industrial Policy Statement of 1991 had, among its objectives, the aim of "injecting the desired level of technological dynamism into Indian Industry" and "the development of indigenous competence for the efficient absorption of foreign technology". It also expressed the hope "that greater competitive pressure will induce our industry to invest much more in research and development than they have been doing in the past". The intention was to create a national innovation system (NIS). The national innovation system is the set of institutions, policies and organisations and the interactions between them that determine the level of innovation arising from that country. While the increase in globalisation has resulted in some dilution of the importance of the boundaries of the nation-state from an economic perspective, the NIS continues to be an important determinant of a nation's economic performance.

The impact of this liberalization on the economy and on science and technology policy was significant. The average rate of growth for the economy jumped to 6.0 per cent during 1990-2000. Firms woke up to the need to improve their

products and services and to reduce their costs. Some parts of the public research infrastructure responded to the change in the overall incentive regime. The impact of growing competitive pressure was also reflected in an increase in the number of private firms doing R&D and in the increase in their R&D relative to sales.

As part of the conditions for joining the WTO in 1995, India agreed to bring its intellectual property legislation into conformity with developed country standards. This was done through a series of amendments in 1999 and 2005. The opening up of foreign investment also brought stronger competitors into the domestic market.

Since 2000, India is showing greater participation in the global arena. Propelled by a boom in services, and with a healthy growth rate in manufacturing, the Indian economy has maintained a growth rate in excess of 6% since economic liberalization began. Since 2003 it has actually been growing at 8 per cent. India's engineering talent began to be recognized globally. This launched its expansion into software services and business process outsourcing (BPO) globally. In addition, an increasing number of MNCs were not only producing in India, but setting up their own R&D centres in the country, attracted largely by the relatively low cost and high level of human capital available locally, as well as the possibility of working round the clock with their other research centres thanks to digital networks.

## 6.9: Outsourcing: Impetus to Information Technology

Perhaps the most creditable achievement of India had been the creation and growth of an export-oriented software industry. Indian information technology and software exports grew from US $ 3.4 billion in 1999-2000 to US $ 12.2 billion in 2004-05 and in the process became the largest constituent of India's export basket. While the opportunity arose from the global trend towards outsourcing and the quest of large companies for cost efficiencies, Indian software companies built on a strong human resource base to create organizational processes to quickly absorb new technologies and ramp-up internal delivery capabilities in a short time to meet customer requirements, and at the same time ensure on-time delivery at an acceptable level of quality. Using cost arbitrage as an entry strategy in an emerging business, they opportunistically expanded their business, at the same time building more sophisticated organizational capabilities within.

The Indian pharmaceutical industry was another high performance industry. About one-third of its 2002 production of $5.2 billion was exported to other countries. Among the ten entities based in India with the largest number of US patents during 1996-2001 are three Indian pharmaceutical companies. These pharmaceutical companies are seeking to move from imitative research and reverse engineering to the discovery of new molecules and drug delivery systems and their R&D intensity is more than 5%. Joint R&D initiatives with multinational drug companies, licensing of new discoveries to MNCs, sponsored research projects at national laboratories with government support, and the creation of international marketing networks in the hope of future exploitation of such networks to sell newly developed novel drugs are some of the developments in this area.

India has several large business houses (like the Ambanis (Reliance), Tatas, the Birlas, and the Mahindras) who have multi-billion dollar business empires. Post-liberalization, new giants have emerged as companies like Infosys Technologies (computer software), Ranbaxy (pharmaceuticals), and Bharti (telecommunication services) have grown into billion dollar-plus businesses. All these businesses have grown substantially and profitably even though they compete with several of the world's largest multinational corporations. Several companies have demonstrated major increases in productivity, the ability to develop and successfully manufacture new products, and have been the winners of top quality awards like the Deming prize. The share of the Indian private sector in industrial R&D spending has been rising slowly but steadily.

## 8.10: Industrial R&D:Growing Trend and Achievement

In principle, the government recognized the importance of industrial research and development more than three decades ago. Even in the era of tight industrial regulation, companies could take a 100% write-off on R&D expenditure in the year the expenditure was incurred; a scheme of recognition of "in-house R&D units" allowed easy import procedures for equipment and consumables used in research and development; and the domestic patent law encouraged Indian firms to find new process routes for existing drugs. However, prior to 1991, there were no government schemes that provided financial support for R&D by private industry.

Since 1991, the government has created schemes for the financial support of local industrial research and development. A recent programme to support public-private partnerships is the New Millennium Indian Technology Leadership Initiative (NMITLI) of the CSIR that seeks to support joint work between Indian companies and the government laboratory network to create technology leadership positions in industries/technologies where India has a potential competitive advantage in global markets. Fiscal incentives for R&D include tax breaks for R&D expenditure and exemption from excise duty for products developed indigenously for which international patents have been obtained.

Perhaps the biggest source of strength of the Indian innovation system today is the confidence that has been generated by India's success in several industries such as software, pharmaceuticals, and automobile components. The diffidence of the past is slowly disappearing. If this confidence is channelized into addressing the weaknesses mentioned above, India may well have a world-beating innovation system.

### *Policy environment: growth promoting*

The Indian economy is firmly on the path of steady growth. Even during the last decade when other countries were in the grip of a massive slowdown, India continued to enjoy a comfortable economic position. This recent spurt in growth is propelled by radical reforms such as the removal of restrictions on foreign investment and industrial de-licensing. Tailoring the EXIM policy to promote exports and aligning the import duties to meet WTO commitments further contributed to this development. This trend is expected to continue over the next five years, driven by a favourable business in terms of tax cuts, broadening tax base, and reduced interest rates.

The liberalization of the economy has opened new windows of opportunity for manufacturing sector. Increasingly the success of manufacturing industries is dependent on innovations, research and development. It is critical not only to remain competitive but also, significant advantages can be gained by developing and commercializing new technologies.

### *Strengthening Innovation*

One of the fastest economic growths, India has achieved an average growth rate of 8.2 percent since 2003. It is also one of the world-class excellences in a number of science-intensive sectors such as nuclear power, satellite communications and defense as well as software. India is one of the world's larger and faster-growing research and development (R&D) performers. Nevertheless, India shows relatively low capacity in science, technology and innovation (STI), in comparison to advanced OECD countries and emerging economies like China.

The fast growth of India's R&D performance is the result of a strategic approach to promoting innovation that emphasises indigenous capacity development and inclusive innovation as well as focusing on spending efficiency. Benefiting from a pool of cost-competitive, English-speaking skilled labour force, India has emerged successfully as a global hub for outsourcing knowledge-intensive services. India has attracted massive inflows of foreign direct investment, and hosts several top corporate R&D investors in automotive, industrial machinery and IT industries. This has in turn contributed to India's integration in the global knowledge system. As an illustration, a quarter of Indian Patent Cooperation Treaty (PCT) patent applications between 2007 and 2009 were produced in international collaboration (Figure) and 19% of scientific articles were published with foreign co-authors.

India's gross expenditure on research and development (GERD) was however 0.8% of GDP in 2007 (compared to 1.4% in China), a figure essentially unchanged since 2000, although R&D expenditure grew in real terms by 6.5% a year during this same period. Government funding still accounted for two thirds of GERD in 2007, down from 82% in 2000, and the share of business R&D expenditure is considerably below the OECD median. Research outputs in terms of patents and non-technological innovation, as reflected in trademark counts, are still limited. Universities and Public Research Institutes (PRIs) strongly dominate India's R&D system and 73% of public research is funded by block grants - reflecting a lack of competition mechanisms in the public R&D system. India's world ranking however changed only moderately, from 12th in 1995 to 11th place in 2009. As per Global Innovation Index (2009), South Korea is ranked 1; USA 2; Japan-3; Sweden-4; and India 15.

Positive association between innovation and competitiveness in the world market is well known. Even though India is 15 in innovation index, our ranking in global competitiveness index is 49 in 2009-10. Position of India in the world can readily be understood from table- 8.2 below.

Table-8.2:Global Standing of India : some selected indicator

| Index \ Country | | Brazil | India | China | South Korea | South Africa | Iran |
|---|---|---|---|---|---|---|---|
| **GDP 2009(Million $)** | | 1,574.0 | 4,909.0 | 1,236.0 | **331,5** | 287.2 | 832.5 |
| **GDP growth** | 2007 | 6.1 | 9.6 | 14.2 | 5.1 | 5.5 | 7.8 |
| | 2008 | 5.1 | 5.1 | 9.6 | 2.3 | 3.7 | 2.3 |
| | 2009 | -0.2 | 7.7 | 9.1 | 0.2 | -1.8 | 1.8 |
| **FDI (2008)** | Inflow | 45 058 | 41 554 | 186 982 | 7 603 | 9 009 | 1 492 |
| | Outflow | 20 457 | 17 685 | 136 156 | 12 795 | - 3 533 | 380 |
| **Rank of Global Competitiveness Index** | 2009 | 58 | 51 | 27 | 22 | 54 | 69 |
| | Basic requirements | 86 | 81 | 30 | 23 | 79 | 63 |
| | Efficiency enhancers | 44 | 38 | 29 | 22 | 42 | 90 |
| | Innovation and sophistication factors | 38 | 42 | 31 | 18 | 43 | 82 |

Table 2. Comparison of selected countries by economic growth rate; FDI inflow & outflow and their rank of global competitiveness index ref: Global Competitiveness report (WEF, 2010)

Tables-8.4 and 8.5 demonstrate the contribution of industrialization & technological upgradation in the composition of Value Added and Employment by major sectors in BRICS. In comparison to 1980 China and India have experienced most structural change, as indicated by the average of absolute percentage changes, with large declines in the shares of agriculture and large increases in respectively manufacturing and services.

Qualitative structural change has taken place within manufacturing, away from labour intensive manufacturing towards more capital (and technological/skill) intensive production. Typically labour- and low-skill intensive sectors- such as food processing, textiles, leather and footwear and wood and wood products, tend to decline in importance. Value added shares have been increasing in more capital intensive sectors such as chemicals, machinery, electrical and optimal equipment and transport equipment.

Some country-specific features should not evade our attention. Observation indicate increase in value added share in the petroleum and chemicals sub-sectors in Brazil, India and South Africa, the transport equipment sector in China and Brazil, rubber and plastics in Russia. Remarkable feature is that the share of high-tech activities in electrical and optical equipment in China and India has been increasing.

**Table-8.3: Sectoral Shares of Value Added (at constant prices) BRICS, 1980-2008 (in%)**

| | Brazil | | Russia | | India | | China | | South Africa | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** |
| **Agriculture** | 4.9 | 6.4 | 7.2 | 4.2 | 37.4 | 16.3 | 29.9 | 9.2 | 3.5 | 2.6 |
| **Mining** | 0.5 | 1.0 | 6.3 | 5.0 | 1.9 | 1.8 | 4.5 | 3.3 | 13.8 | 6.1 |
| **Manufacturing** | 21.0 | 19.4 | 19.6 | 16.6 | 14.9 | 16.4 | 22.2 | 44.7 | 21.9 | 18.4 |
| **Utilities** | 1.4 | 2.5 | 4.2 | 2.5 | 1.8 | 2.2 | 2.6 | 2.7 | 1.8 | 2.1 |
| **Construction** | 7.6 | 4.8 | 6.6 | 7.2 | 5.8 | 6.3 | 6.4 | 5.0 | 4.1 | 3.3 |
| **Services** | 64.5 | 65.9 | 56.1 | 64.5 | 38.2 | 57.1 | 34.3 | 35.1 | 60.8 | 67.5 |
| **Total** | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Industrialization Lessons from BRICS: A Comparative Analysis , P11

**Table-8.4: Sectoral Shares of Employment. BRICS, 1980-2008 (in%)**

| | Brazil | | Russia | | India | | China | | South Africa | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** |
| **Agriculture** | 38.4 | 17.8 | 27.7 | 21.5 | 69.9 | 54.0 | 59.2 | 40.2 | 12.6 | 5.7 |
| **Mining** | 0.5 | 0.3 | 1.4 | 1.2 | 0.5 | 0.6 | 1.8 | 1.3 | 11.1 | 2.4 |
| **Manufacturing** | 12.8 | 13.0 | 17.3 | 13.7 | 10.3 | 12.3 | 16.0 | 18.5 | 15.0 | 14.3 |
| **Utilities** | 0.8 | 0.4 | 1.9 | 2.3 | 0.3 | 0.3 | 0.3 | 0.5 | 1.6 | 0.7 |
| **Construction** | 8.9 | 7.2 | 7.7 | 7.3 | 1.9 | 6.7 | 4.5 | 6.7 | 7.8 | 8.3 |
| **Services** | 38.6 | 61.3 | 44.0 | 54.0 | 17.1 | 26.0 | 18.3 | 32.8 | 51.8 | 68.6 |
| **Total** | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Industrialization Lessons from BRICS: A Comparative Analysis , P12

**Table-8.5: Composition of Industrial of Industrial Product in BRICS : Change during 1980 to 2008** (%)

| | Brazil | | Russia | | India | | Ch-ina | | South Africa | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** |
| **Food, beverages & tobacco** | 15.5 | 13.1 | 18.5 | 20.4 | 12.3 | 10.5 | 14.9 | 10.7 | 18.3 | 17.0 |
| **Textiles & Textile Products** | 12.2 | 7.9 | 2.7 | 1.6 | 22.2 | 15.1 | 14.3 | 8.4 | 5.8 | 3.4 |
| **Leather & Footwear** | 1.8 | 0.9 | 0.4 | 0.3 | - | - | 1.1 | 1.6 | 1.1 | 0.6 |
| **Wood & products of wood & Cork** | 2.6 | 1.5 | 2.9 | 2.7 | 8.5 | 1.4 | 1.3 | 2.5 | 2.2 | 1.9 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Pulp, paper, paper products & publishing** | 7.2 | 6.8 | 4.1 | 5.5 | 3.9 | 2.8 | 3.4 | 3.6 | 7.7 | 6.5 |
| **Coke, refined petroleum Products, nuclear fuel** | 3.8 | 5.5 | 6.0 | 5.6 | 1.2 | 3.3 | 6.5 | 1.3 | 6.0 | 10.5 |
| **Chemical &chemical products** | 11.8 | 16.0 | 6.7 | 6.6 | 8.3 | 15.9 | 12.2 | 10.1 | 2.9 | 8.3 |
| **rubber & plastics products** | 3.9 | 2.5 | 2.0 | 3.6 | 2.3 | 1.8 | 3.2 | 3.4 | 3.1 | 5.3 |
| **other non metallic mineral products** | 4.2 | 3.5 | 6.8 | 6.7 | 4.6 | 5.6 | 7.9 | 7.2 | 5.4 | 3.8 |
| **Basic metal & metal products** | 11.3 | 11.2 | 17.6 | 17.8 | 15.8 | 16.3 | 15.0 | 13.1 | 18.1 | 16.0 |
| **Machinery NEC** | 5.8 | 7.8 | 8.5 | 8.3 | 7.1 | 4.9 | 9.5 | 11.2 | 7.4 | 4.8 |
| **Electrical &Optical equipment** | 7.6 | 7.2 | 5.4 | 7.1 | 6.4 | 11.6 | 5.9 | 16.7 | 3.9 | 4.2 |
| **Transport Equipment** | 7.5 | 11.3 | 10.2 | 7.0 | 4.8 | 6.4 | 2.6 | 8.2 | 11.5 | 9.5 |
| **Furniture, manufacturing n.e.c & recycling** | 4.9 | 4.6 | 8.3 | 6.8 | 2.7 | 4.5 | 2.2 | 2.0 | 6.6 | 8.1 |
| **Total** | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

**Source: Industrialization Lessons from BRICS: A Comparative Analysis , P14**

**Table-8.6: Change in the Distribution of Employment in Manufacturing Sector in BRICS (during 1980-2008 ) (in percent )**

| | Brazil | | Russia | | India | | China | | South Africa | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** | **1980** | **2008** |
| **Food, beverages & tobacco** | 17.3 | 18.9 | 12.5 | 16.4 | 20.1 | 17.0 | 10.6 | 10.2 | 15.0 | 15.7 |
| **Textiles & Textile Products** | 26.3 | 23.5 | 9.3 | 5.8 | 34.6 | 32.6 | 15.0 | 15.1 | 15.4 | 9.0 |
| **Leather & Footwear** | 4.9 | 5.1 | 1.5 | 0.9 | - | - | 2.2 | 4.6 | 2.5 | 1.4 |
| **Wood & products of wood &Cork** | 4.7 | 3.8 | 4.1 | 5.2 | 13.4 | 9.7 | 3.4 | 6.9 | 5.7 | 4.2 |
| **Pulp, paper, paper products& publishing** | 5.9 | 4.9 | 2.7 | 4.0 | 2.3 | 3.2 | 4.9 | 8.0 | 5.1 | 6.6 |
| **Coke, refined petroleumProducts, nuclear fuel** | 0.8 | 1.3 | 1.9 | 2.0 | 0.1 | 0.1 | 0.5 | 0.7 | 1.2 | 1.2 |
| **Chemical &chemical products** | 5.0 | 4.0 | 5.1 | 4.8 | 3.0 | 3.7 | 5.6 | 5.5 | 5.4 | 5.4 |
| **rubber & plastics products** | 2.9 | 3.4 | 1.8 | 2.9 | 0.6 | 1.2 | 5.1 | 8.2 | 3.0 | 4.0 |
| **other non metallic mineral products** | 5.1 | 5.0 | 7.4 | 6.9 | 8.6 | 8.8 | 13.6 | 5.8 | 5.6 | 5.2 |
| **Basic metal & metal products** | 7.9 | 8.6 | 9.7 | 11.0 | 6.7 | 6.9 | 8.3 | 6.8 | 18.0 | 15.3 |
| **Machinery NEC** | 4.0 | 5.0 | 19.8 | 15.4 | 2.0 | 2.6 | 11.7 | 8.1 | 5.9 | 7.9 |
| **Electrical &Optical equipment** | 3.7 | 4.3 | 9.8 | 8.7 | 1.3 | 2.0 | 5.6 | 10.7 | 5.3 | 5.3 |
| **Transport Equipment** | 3.5 | 4.7 | 11.2 | 11.1 | 1.4 | 2.5 | 3.3 | 4.2 | 7.1 | 10.9 |
| **Furniture, manufacturing n.e.c & recycling** | 8.0 | 7.5 | 3.3 | 4.9 | 5.7 | 9.6 | 10.2 | 5.4 | 4.7 | 8.0 |
| **Total** | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Industrialization Lessons from BRICS: A Comparative Analysis , P15

## 8.11: Conclusion

The prosperity of any economy depends on the productivity of its economic assets. Many studies have shown the vital role technological innovation plays in engendering productivity growth and long-run economic growth. In a globalising world economy, the link between innovative capacity and prosperity has grown ever tighter and a rapid rate of innovation is needed to drive productivity growth. Advanced countries are becoming increasingly labour-constrained. Maintaining economic growth will, therefore, demand a stepped-up rate of innovation, and perhaps, the importation of skilled labour from other countries, as has been witnessed in some countries in recent years. Economic development in developing countries will in a similar vein depend on a more efficient use of resources as well as stepped-up innovation.

Like other countries, India in its quest to achieve industrialisation and improve the quality of life of its people, has fostered an Industrial and S&T policy since the introduction of planning process. Indian policies have been rewarding . The nation has attained some maturity in the area of science and technology. However , we do not have any room for complacency , India's performance is below optimal - lower than the expected achievement.

The sub optimal performance started in the late 1960s. In the protected regime it could not build capacity to innovate and produce internationally competitive technologies. The process of liberalization that started in the 1980s and accelerated in the 1990s, however, put competitive pressures on Indian firms to modernize and upgrade their technologies. At the same time, many MNCs entered the Indian market via FDIs and technology investments. Several foreign owned and jointly-owned R&D centres have been established. Indian organizations and institutions have been encouraged to become more commercial-orientated and outward looking.

Indian polity has responded to Increasing challenge of globalization . India has drawn up a new science and technology policy document. Greater emphasis has been attached for enhancement in its technological capability to overcome the present lacuna and for long term sustainability. Measures have started yielding positive results. India's economic progress in the recently – during the last decade indicates

that knowledge intensive sectors have been driving India's growth. Experience suggests favorable trend in IT, Biotech or Pharmaceuticals among many more skill intensive service sectors. Indeed Indian industrial sector is now more knowledge based – further speed is required . Indeed India is imminently poised for a successful transition to a more matured stage of knowledge economy. Indian polity thus concentrate on extending India's technological capability building. Public funded creative pursuits should be closely knitted with industrial applications. Encouraging private entrepreneur for RD activities should be included in our pursuit of accelerating technology.

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# Chapter-IX

## Knowledge Expansion and Human Recourse Development in India

### 9.1: Introduction

Knowledge economy has been gaining momentum across the world. Accelerated translation of scientific knowledge into technology is the primary reason. No less significant if not relatively more in the present world for devising means and ways for widening the use of technology -wider acceptance and mass consumption of knowledge intensive commodities.. Invention of mobile phone and personal computer has made revolutionary change in this direction. We should not undermine the increased requirement of skilled manpower- knowledge worker - In producing sophisticated knowledge intensive products. Entrepreneur or organization is at the base of Knowledge Based Economy too. We cannot ignore the significance of human capital.

Both scientific knowledge and technology are self propelling .The development process is newer kind of skilled persons. Experience suggests negative externality is short lived. In other words applying new knowledge continuously results in innovation which yields dividends –inducing quality of human capital. Wealth generation becomes easier as has been perceptively observed by Peter F. Drucker:

*"We now know that the source of wealth is something specifically human knowledge. If we apply knowledge to tasks we already know how to do, we call it 'productivity'. If we apply knowledge to tasks that are new and different, we call it 'innovation'. Only knowledge allows us to achieve these two goals."* Indeed , changes in quality of human resource is implicit.

## 9.2:Human Resource Development: *skill , efficiency and organization*

Sustaining a competitive advantage increases the probability of long-term survival and financial success of the organization. In knowledge era, this competitive advantage can be obtained by the effective involvement, management and development of workforce. The most strategic way to invest in people is through learning activities. Human resource development has evolved as a critical element of broader business and human resource management strategies. The importance of an appropriately skilled and developed workforce is recognized by many in business as essential to the implementation of continuous improvement programs. An educated and empowered population resulting from proper human development strategies contributes significantly to increased productivity and sustainable economic growth and development.

Human Resource Development (HRD) is the precondition for attaining progress in developing a knowledge-based society, reducing skills mismatches in the labour market, and promoting a country's international competitiveness thereby supporting social and economic development and well-being of the people. In an integrated sense, it also encompasses health care, nutrition, population welfare and employment and poverty.

The experience of the majority of countries suggests that the focus of human resource development policies has been on promoting knowledge and skills through education and training and enhancing the employability; improving access and equality of opportunity to all to live and work in a knowledge and information based society (ILO, 2001).

HRD, or education and skills of the labour force, is singled out as a fundamentally and centrally important dimension for a country’s development into a Knowledge Based Economy. Deficiency of labourers in understanding the new knowledge and putting it in usage will not be fully assimilated.

## 9.3:Human Resource Development : Implanting Productivity

Human Capital refers to the productive capacities of Human beings as income producing agents in the economy and may be defined as the ‘stock of skills and

productive knowledge embodied in people (Rosen, 1989:682). Human capital formation rests on the proposition that people enhance their capabilities as producers and consumers by investing in themselves through schooling, health, on the job training, searching for information about job opportunities and by investing in migration (Schultz, 1962).

The importance of human capital for economic growth was recognized since early times. However, a formal induction of the concept into economic analysis may be attributed to T. Schultz and Gary Becker during the 1960s.

The relevance of education and acquired capabilities in determining the nature of economic functions performed was emphasized by Plato . He distinguished between the innate abilities of individuals and education for artisans that led to an increase in economic wealth. Aristotle gave importance to the economic role of education in society and emphasized the need for state support to the education sector in society and emphasized the need for state support in order to ensure general welfare (Alex, 1983). Among the classical economists, J. B. Say asserted that since skills and abilities are acquired at a cost, they should be classified as capital. J. S Mill paid attention to the acquired skills of human beings and classified this as capital. Later on, Irving fisher conceptualized capital as including specialized human capital and argued that a skilled individual should be placed in the category of capital. Adam Smith argued that division of labour led to an improvement in the dexterity and skill of workers thereby contributing to production in the economy (kiker). Marshal also stressed education as investment in human capital.

## 9.4: Human Capital: Conceptual Transition

The contribution of Schultz (1961) marks the beginning of the formal induction of human capital concepts into the mainstream of economic analysis. Schultz stated '---investment in human capital accounts for most of the impressive rise in real earnings per worker'. He also emphasized the distinction between specialized human capital and general human capital, and pointed out the importance of the latter in generating increasing returns in the economy. Becker (1962) added another dimension of on-the-job training to the formation of human capital and influenced the analysis of firm-specific investments in training, labour relations and

contracts. The limitations of the human capital approach spring from the neo classical framework within which these theories are located. The growth models such as that of Solow also treat human capital in a narrow fashion. This is evident in the way in which only the one way relationship wherein labour contributes to production is considered and the role of labour in creating new technology is overlooked.

The new endogenous growth theories seek to go beyond the Solow growth model and address themselves to the question of generation of new technology. Lucas (1988) emphasises investment in human capital more directly and links it to long term rates of economic growth. These human capital theories indicate how investment in education enables the entire production process to benefit from positive externalities. Educated people not only use technology more efficiently, they are also likely to innovate and spread the benefits of such innovation to co-workers thereby increasing the efficiency of all factors of production. The endogenous growth approach, despite being in the evolutionary stage has provided many critical insights regarding the role of education and investment in R&D in economic development. However, the theory does not pay adequate attention to the set of conditions that are necessary in the economy for translating individual level skills into enhanced productivity. This set of 'attitudinal and institutional characteristics' (Abromovitz, 1995:4) which is termed 'social capability', is a critical factor in economic development.

Stiglitz (1995:65), pointing to the importance of this factor states,'---the externalities and scale effects associated with human capital arise not just from the number of educated individuals, or from the number of years of schooling of each. India may have more college graduates than Hong Kong. Rather, it arises from the patterns of specialization and interaction which may arise; but whether these patterns of specialization and interaction do arise are matter of economic organization as well; they are affected, for instance, by patterns of individual organization and social organization. Governments may affect both'.

Rosen (1999) states the human capital as 'an investment that people make in themselves to increase their productivity'. More recently, Frank & Bemanke (2007) define that human capital is 'an amalgam of factors such as education, experience, training, intelligence, energy, work habits, trustworthiness, and initiative that affect the value of a worker's marginal product'. Additionally, some researchers define that

human capital is 'the knowledge, skills, competencies and attributes in individuals that facilitate the creation of personal, social and economic well-being' with the social perspective (Rodriguez & Loomis, 2007).

Consequently, human capital simultaneously includes both of the instrumental concept to produce certain values and the 'endogenous' meaning to self-generate it. In order to dependently/independently create these values, there is no doubt that leaning through education and training can be an important in terms of defining the concept of human capital. Considering that experience can be included as a category of knowledge, the human capital is a synonym of knowledge embedded in individuals.

## 9.5: Quality Improving Strategies of Human Resource

Human resource development **(HRD**) has featured prominently in the international discourse on development. Most countries are implementing a systematic strategy for HRD in support of economic growth and development. The growing complexity of the work place – accelerated through the dynamic impact of globalisation on national economies, production and trade – has put the question of HRD at the heart of contemporary public policy and development strategies.

Developments in the global context make it imperative for all countries to respond effectively to the dynamic and competitive forces that impact on how national economies relate to the global economy. With regard to HRD, economic competitiveness is measured not only by the aggregate skills of a country's workforce, but – perhaps more importantly – by the flexibility and capacity of the workforce to adjust speedily to the rapid changes in technology, production, trade and work organization. Consequently, the ability to respond to these changes with speed and efficiency has now become the area where many countries seek a competitive advantage.

According to Ziderman (1997:352),*'There has been a move from primary reliance on policies that emphasized capital investment in plant, machinery and infrastructure, or export-led growth strategies, to a broader approach that assigns a central role to investments in human capital. Expenditures on improved education, training and health are now no longer regarded solely (or mainly) as benefits*

*stemming from economic growth and rising incomes; increasingly, they are also seen as investments in human capital that make this sustained economic growth possible. This approach is shared not only by national governments, but is endorsed in the investment policies of international aid agencies.'*

Most countries and multilateral institutions acknowledge the need to give systematic attention to the role of HRD in supporting national economic growth and development programmes. This Global acknowledgement of the importance of HRD is illustrated by the response of the United Nations, which formally inserted HRD on its agenda through Resolution 33/135 of 1978, following discussions on the subject over many years. The 1989 General Assembly Resolution 44/213 declared:

> *" …..human resources development is a broad concept … requiring integrated and concerted strategies, policies, plans and programmes to ensure the development of the full potential of human beings … so that they may, individually and collectively, be capable of improving their standard of living" (United Nations Programme in Public Administration and Finance, 1995:5).*

The United Nations, in its Programme in Public Administration and Finance (1995, p. 3) makes an emphatic case for HRD and human face as *'It is generally agreed that if overall human conditions are to improve, there must be increasing emphasis on human resources development. Appropriately, such development provides for increases in productivity, enhances competitiveness and supports economic growth.'*

The contribution of education and training to economic and wider development has been demonstrated in varied national contexts. However, experience and systematic research has also emphasized an important qualification: HRD is a necessary condition, but it is not a sufficient condition for economic growth and development. Thus, if HRD is to create the desired development outcomes, it needs to be integrated with the whole range of development strategies currently being implemented. Without doubt, the lack of adequate human resources severely constrains social and economic growth and development. Almost all countries have therefore identified HRD as a key policy and development priority.

## 9.6:Knowledge Acquisition – Education Attainment

The World Development Report asserted that knowledge, not capital, would be the key to sustained economic growth and improved human welfare (World Development Report, 1998 and 1999). Education supplies the economy with human resources with the requisite knowledge, training and qualification to meet the demand for economic development. Education produces knowledge and skills in the labour force which add to productivity. Education widens choices and broadens horizons of life style and pattern of production. Education is an investment which yields high rate of return.

### *International trend*

Institutions of higher education are destined to play a fundamental role in knowledge societies, based on radical changes in the traditional patterns of knowledge production, diffusion and application. Enrolments in higher education almost doubled between the early 1970s and 1990, the estimated number of students rising from 28 to 69 million, and reaching the figure of 122 million in 2002. According to certain projections, the student population could reach 150 million in 2025. This trend is not confined to the wealthy countries. In Africa, Asia and Latin America, strong population growth has helped to swell numbers at the primary and secondary levels, thereby boosting enrolments in higher education, although to a lesser extent than in Europe or North America.

The BRICS nations are investing heavily in building their human capital. They created their huge platform for the world's best education and technical training, which helped them launch many small companies and become world leaders. The BRICS countries have attracted global attention to their talent, education, technical knowledge, people management, and large investment in intellectual capital.

'Brazil is focusing on its own style; Russia has learned and adopted many new practices; India is changing the world's perception of it through development; China has become self-reliant, and South Africa continues to progress despite its problems. China and India are both on the verge of large development projects. These countries' successes are entirely due to their investments in HRD projects. This success is not

limited to America, the UK, or the BRICS; any nation can be successful through intellectual development investments, via strategic HRD initiatives.'

## 9.7:Knowledge Creation in India

India is probably the top HRD builder among the BRICS countries. The article 45 of the constitution proclaimed and promised that the state shall endeavour to provide within a period of ten years from the commencement of the constitution for free and compulsory education for all children until they complete the age of fourteen years. The objective of incorporating education in the concurrent list was to facilitate evolution of all India policies in the field of education. In addition to policy formulation, the ministry of HRD has the responsibility for educational planning. The union government continues to play the lead role in the evolution and monitoring of educational policies and programmes, the most notable of which are the National Policy on Education (NPE), 1986, the Programme of Action (POA), 1986. The National Policy envisages a national system for education, which would take determined steps for the universaliation of adult literacy.

### *Gross Enrolment Ratio* and *Adult Literacy*

The adult literacy in India as per UNDP Statistical Update 2008 was 65.2% which ranked India at 148 among 179 countries. Adult literacy rate in 2007 was 66% in India as against 90% in Brazil, 90.8% in Sri Lanka and 92% in Indonesia. The combined gross enrolment ratio (GER) in education was 61% in India as compared to 87.2% in Brazil and more than 68% in Sri Lanka and Indonesia. As of 2007, the GER was 78.3% for school education and 12.39 % for higher education (age 18 to 24 years). In 2009-10, there are about 1.5 million schools in India with a total enrolment of 250 million students starting from pre-primary to standard XII. The total enrolment in higher education is about 20.7 million in 2009-10. The long term goal included in the Government's plan for 2007-2012 is to ensure that good quality higher education is accessible to all. India's gross enrolment ratio in higher education of around 12.40% in 2007 is lower than the world average of 23.2% as well as lower than the average of 22% for Asian countries. The government's aim is to increase the GER to 25% by end of 2015-16 and 30% by 2020. Already, the Government permits 100%

FDI in the higher education sector. The number of people acquiring post-secondary education would positively affect the knowledge base of the workforce.

The current challenges of HRD in India are to universalize secondary education and provide the right to education to all children, achieve full literacy for adults, upscale higher and technical education and expand opportunities for vocational training.

Study shows on education attainment, the ratios of economically active population with senior secondary education or above were 99.9% in Japan, 90.8% in the US, 86.5% in Canada and 72.7% in Australia in the year 2008. The ratios of the high-performing India and Asian economies were above 70%.

### *HRD Investment in India*

Public investment in education as percentage of GDP has been increased from 2.60% in 2004-05 to 3.23% in 2009-10. Public investment in education has been increased from 9.70% in 2004-05 to 10.6% in 2009-10.

### Vocational Education and Skill Development

Development of vocational skills is an integral part of HRD. Vocational training in India is primarily imparted through the government and private industrial training institutes (ITIs). As of February 2012, there are in total 9,447 ITIs, with a total seating capacity of 1.3 million. The total numbers of government ITIs are 2,244 with a total seating capacity of 472,738. The total number of ITIs has increased during the recent past (2007–2012) by 11.5%, while the total number of seats has increased by 12.2%.

India had not focused on skill development before the Eleventh Five Year Plan, which has created a gap with a large supply of learners. Recent Data shows that only 5% of the population of 19-24 age group has acquired skills under vocational education. Therefore, the Government of India has announced a National skill Development Mission which comprises of a comprehensive skill development programme covering the entire country with a target to achieve 500 million skilled persons by the year 2022. As part of the National Skill Development Mission, 1000

new polytechnics are proposed to be set up in the government as well as private sector.

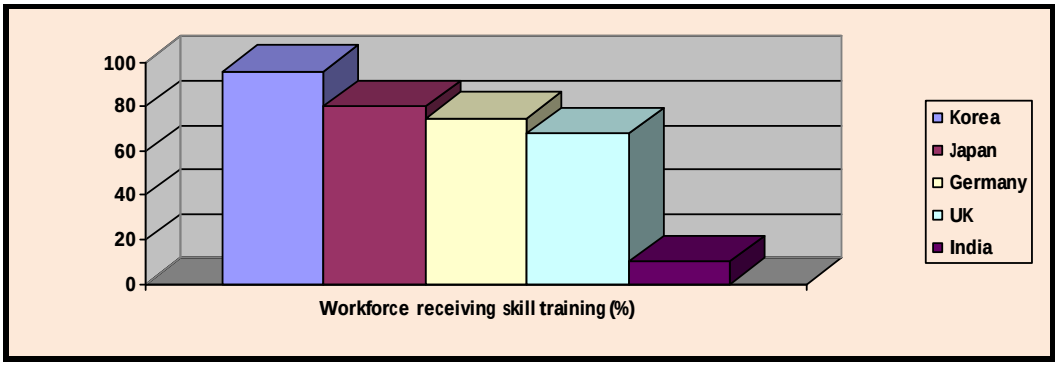
### *Skill Development*

India has seen rapid growth in recent years, driven by the growth in new-age industries. The increase in purchasing power has resulted in the demand for a new level of quality of service. However, there is a large shortage of skilled manpower in the country. In the wake of the changing economic environment, it is necessary to focus on inculcating and advancing the skill sets of the young population of the country. India lags far behind in imparting skill training as compared to other countries (table 9.1 ). Only 10% of the total workforces in the country receive some kind of skill training (2% with formal training and 8% with informal training). Further, 80% of the entrants into the workforce do not have the opportunity for skill training.

**Table9.1 - Percentage of workforce receiving skill training**

| Country | Workforce receiving skill training (%) |
|---|---|
| **Korea** | 96 |
| **Japan** | 80 |
| **Germany** | 75 |
| **UK** | 68 |
| **India** | 10 |

*Source: Planning Commission Report (2008)*

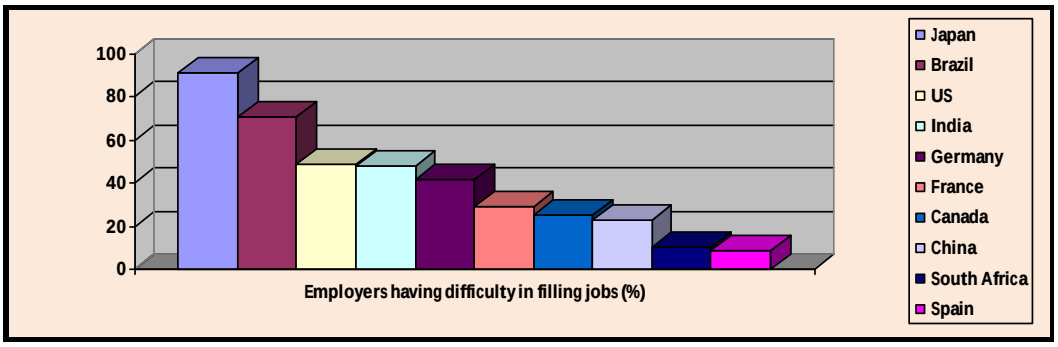


The accelerated economic growth has increased the demand for skilled manpower that has highlighted the shortage of skilled manpower in the country. Employees worldwide state a variety of reasons for their inability to fill jobs, ranging from undesirable geographic locations to candidates looking for more pay than what the employers have been offering. India is among the top countries in which employers are facing difficulty in filling up the jobs. For India, the difficulty to fill up the jobs is 48%, which is above the global standard of 34% in 2012. The lack of available applicants, shortage of hard skills and shortage of suitable employability, including soft skills, is some of the key reasons in finding a suitable candidate for available jobs in the country.

**Table-9. 2: Percentage of employers having difficulty in filling jobs – Country wise (2012)**

| Country | Employers having difficulty in filling jobs (%) |
|---|---|
| ***Japan*** | *91* |
| ***Brazil*** | *71* |
| ***US*** | *49* |
| ***India*** | *48* |
| ***Germany*** | *42* |
| ***France*** | *29* |
| ***Canada*** | *25* |
| ***China*** | *23* |
| ***South Africa*** | *10* |
| ***Spain*** | *9* |

*Source: ILO*




According to the NSSO survey (2004–05), only 6% of the total workforce (459 million) is in the organized sector. The World Economic Forum indicates that only 25% of the total Indian professionals are considered employable by the organized sector. The unorganized sector is not supported by any structured skill development and training system of acquiring or upgrading skills. The skill formation

takes place through informal channels such as family occupations, on-the-job training under master craftsmen with no linkages to formal education training and certification.

### *National policy on skill development*

In order to provide adequate training to the youth and develop necessary skills, the government of India took steps to improve the skill training scenario in the country. In 2009, the government formulated the national skill development policy that laid the framework for skill development, ensuring that individuals get improved access to skills and knowledge.

## 9.8: Projected Growth and Sector Demand

India is expected to grow at a rate of 8%, on an average, in the next 10 years. More than 700 million Indians are estimated to be of working age by 2022. Out of these, more than 500 million require some kind of vocational or skill development training. In Twelfth Five Year Plan, the country has set a tough challenge in the field of vocational education and training in its approach paper in the Twelfth Five Year Plan. It is estimated that 50–70 million jobs will be created in India over the next five years and about 75%–90% of these additional employment avenues will require some vocational training.

**Table-9.3: Projected employment during Twelfth Five Year Plan - Sector wise**

| Year | GDP Growth Rate | Projected Employment (in million) | | | |
|---|---|---|---|---|---|
| | | Agriculture | Industry | Services | Total |
| **2011-12** | 9% | 229.2 | 105 | 153.5 | 487.7 |
| | 7% | 225.4 | 102 | 149 | 476.4 |
| | 5% | 221.5 | 99.1 | 144.6 | 465.2 |
| **2016-17** | 9% | 240.2 | 126.2 | 189.5 | 555.9 |
| | 7% | 232 | 116.8 | 174.8 | 523.5 |
| | 5% | 224 | 108.1 | 161.2 | 493.3 |

*Source: National Skill Development Corporation*

## 9.9: Capacity Development in India

In India, about 12 million people join the workforce each year comprising highly skilled, skilled, semi-skilled and un-skilled work force. The last category constitutes the majority of the population entering the workforce. However, the current skill capacity of the country is about four million. It is therefore required to enhance skilling and technical education capacity to about 15 million (considering that even sections of the existing workforce would have to be trained).

The capacity of just over four million a year needs to be upgraded substantially in order to meet the targeted skill requirements till 2022. There exist a significant mismatch between the massive populace of unemployed youth and existing vacancies, which leads to low employability quotient of people. It is therefore a critical next step to focus on the needs of both learners and the labor market in order to make the requisite kinds of skills available by forging partnerships between public administrators, suppliers of educational services, industry and civil society

India has the second-highest population in the working age group (15–59 years) in the world. The skill set of this population group plays a critical role in the growth of the country. It is imperative that adequate skill training is provided to this age group to make them productive. India is facing a skill deficit on account of the large demand-supply gap, which results in a large pool of potential learners.

Government focus on skill development Skill development is one of the priority agendas of the government for the Twelfth Five Year Plan. The government plans to set up sector skill councils to prepare standards required for training programs. The industries are also proactively taking steps to partner with the government and reduce the skill gap.

### *Private partnership support*

The private sector, in association with the government, will work to identify and quantify skill deficiencies in their respective sectors and constitute a sector plan to address these deficiencies. The National Skill Development Corporation or National Skill Development Trust is entrusted with the job to identify areas where support and implementation will be required from the government.

NSDC has identified 21 high-growth sectors (including the unorganized sector) to provide expanded employment. It has 10 high-growths sectors on the manufacturing side and an equal number on the services side. Of these, manufacturing, textile, construction, automotive, retail and health care are the key focus sectors. Currently, 59 corporate houses/private players/private education institutes are associated with NSDC for imparting vocational education and training in India. With the help of private players, NSDC aims to reach its desired target (150 million skilled persons) by year 2022.

## 9.10: Conclusion

Knowledge is an important engine of growth. As revealed by the development history of most economies, knowledge contents in human resources and production will hold the key to the future, sustainable development of Indian economy.

In recognition of the importance of knowledge, Indian administration has stepped up its effort in promoting HRD in recent years. Correspondingly, the labour force has witnessed a consistent enhancement in education and skills.

The Government's expenditure on education has risen in recent years and represented a comparatively high proportion to total public expenses, yet its ratio to GDP is relatively low. In the observation period, the number of graduates of post-secondary education has increased and as a result, the educational attainment of the labour force has generally improved with a higher proportion of workers, especially the younger ones, attaining secondary and tertiary educational levels. But it is far from desired level. The private sector should actively participate in this process in order to supplement the efforts and resources of the government so as to facilitate a faster and balanced development of human resources.

By 2050 India's working age population will amount to a staggering 900 million. The potential for India's economic growth via its human capital is stupendous and exceeds that of the major competing nations. The opportunity of "demographic dividend" may be lost if the upcoming working population does not have access to quality education. Both the government sector and the private sector have realized the critical role education plays in building skilled manpower and in turn boosting

economic growth. Sustained action is required to ensure provision of quality secondary education, achieve full adult education and considerably expand opportunities for vocational education.

HRD represents a key lever for accelerating economic growth and development in all economies including India. Literacy, education and skill development together help to raise the level of human resource development. Hence, the responsibilities of the government arising from the set strategy are significant. However, the strategy is not solely related to the responsibilities of government. It is a call to all stakeholders and agents that have a role to play in HRD: workers, employers, the non-governmental sector, educators, learners, parents, individuals, the community and international partners. This calls for increased bilateral and multi-lateral cooperation in order to fully exploit the potentials of human resource development. Enhancing the capability of human resources is urgrntly required since The wealth and prosperity of a nation depend on the effective utilization of its human and material resources through knowledge intensive industrialization . The use of human material for knowledged based economic development demands its education in science and training in technical skills.

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# Chapter-X

## Conclusions, Findings and Recommendations

### 10.1: Conclusions

The knowledge, the ability to comprehend and utilize nature to our advantage contributes enormously to our growth and expansion processes. Knowledge and thus efficient utilization of knowledge are jointly contributing in our progress. Energy from wood and coal may be now regarded as primitive, even the utilization of potential difference of water flow into energy is superseded by nuclear energy. We have long been stepped into nuclear age. We want to develop commercial process to utilize sun ray. We are yet to imagine some other form of energy to substitute electricity. We have diluted the physical distance of communication and spread of information. Transforming knowledge into human use – technology is upheld. Philosophy and social sciences have contributed too but have not been adequately focused.

Creation of knowledge is not the end in itself. Technology helps us to widen our production frontier. That the pride of human civilization live and let live required for sustainability is a multidisciplinary sphere. Both wealth creation and judicious distribution are equally important. While the contribution of scientific knowledge (Physical Science and Mathematics) is relatively more in wealth generation, contribution of social science is greater in the latter field. It is therefore worthy to comprehend the concept of knowledge with particular reference to economic growth and development.

Defining knowledge economy is a difficult proposition like knowledge. However, understanding knowledge based economy is necessary. Primacy obviously lies with the latter one. Conceptualizing knowledge is difficult for its complexity but application or utilization of knowledge is within our perception – like air or quality. We have realized the novelty of knowledge in the forward march of civilization. In our personal life and in society, application of knowledge normally occurs without

being conscious about it. Utilisation of acquired (simple knowledge) focuses the ability of human mind or society as the case may be, to comprehend and to harvest benefits. Translation of knowledge into action in our life is complex, nevertheless we are continuously practicing.

Interpersonal and transnational differences persist. Explanation is various – two most significant factors are efficiency and stock of knowledge. Knowledge is to be produced – the end product of our enquiries which may be directed or in other words gained by conscious disciplined efforts. Human civilization has also been benefited by knowledge gained as by- product of some seemingly unrelated experiment or investigation. Invention of electricity is one of the classic examples.

Knowledge has also contributed by fashioning different stages of human bondage required for optimum wealth creation. Means of production is important but no less significant is mode of production at the aggregate level and organization and management at the grass root level. Good governance is prescribed at all micro and macro level for optimal harvesting. We are convinced about the power or necessity of good governance to influence the environment for productivity and to bring about more harmony in the society. However, relatively greater primacy is attached with productivity augmenting knowledge, that is, technology. In conceptualizing knowledge based economy, researchers have concentrated more on technology - application of knowledge for improving or influencing production frontier. Nevertheless, knowledge also contributes in changing economic order or socio economic and political economy for example ameliorating various types of asymmetry in the world –inter and intra-regional inequality in the level of development.

Economic order of the society has been undergoing continuous (mutative) changes. Primitive – prehistoric society- has been modeled in the literature as traditional. Traditional Economic society was simple – technology was unheard. Collection, gathering and hunting were the means of production and survival. Utilizations of knowledge and experience were sublime. Agriculture society from scattered nomadic societies was born from Knowledge of how to use seed to sow and harvest .Development of agriculture society was influenced by discovery of variation of land fertility and crop suitability of land and understanding of seasonality.

Utilizations of knowledge or invention in the material world are continuously been supplemented by social science in the growth and development of human societies. Civilization marched forward by inventing the power of exchanging necessities and information in the society. Bartering was the centrifugal element. Primitive Traditional economy or barter economy has not completely been abolished. We experience mutative changes in many spheres; nevertheless we continue to brand it as traditional system.

Feudalism was born and successfully pushed forward production and productivity. Barter or exchange system became mostly inoperative – money and market mechanism replaced exchange of goods and services in kind. We rarely understand that market system is our powerful social invention. Regime of traditional economy is however continued to operate in which agriculture was the strength. Economists ignored the governance part which also underwent changes for efficient operation of market mechanism and early stage of economic expansion is univocally termed as agricultural economy. Feudalism prevailed for considerable part of agriculture economy in which land was the primary resource. Growth of market economy was facilitated by revolutionary changes in socio-political outlook on the one hand and scientific knowledge on the other.

Technology is relatively more emphasized in the literature. We therefore mostly observe economic expansion with reference to traditional agriculture economy and industrial economy. Takeoff of Rostow is the classic example. The systems have always been complex- superimposed mapping of socio-political and scientific knowledge is ignored. Knowledge development in every sphere is contributory to socio-economic development and shaping the presently emerging Knowledge Based Economy. Scientific invention translated into technology has been at the centre and still dominating the underpinning of Knowledge Based Economy or Knowledge Economy

*We resolve that applications of knowledge are relatively more important than creation of knowledge in the forward march of human civilization – economic progress in particular. Economic development presupposes economic growth.*

*Indeed,* knowledge is used since the time immemorial as a product or a tool for the creation of wealth leading to economic well-being. *Knowledge is to be produced or procured like other factors of production or commodities. Continuous endeavor is required for extending the frontier of knowledge which in the literature is branded as research and development - R&D. It is naïve to state that education and training facilities are the centrifugal element in knowledge creation and transforming knowledge into human use – translation of scientific invention and discovery into technology. Industrial revolution bears the testimony which made manufacturing activity as the significant source of wealth generation and the world economy transformed from agriculture based to industry based. Indeed industrial revolution is the main contributor of asymmetry in the development process in the world economy. Without prejudice it may be said that colonial system of exploitation is a negative externalities of Industrial revolution in the westen hemisphere. Legacy still continues.*

That our country was overpowered by British – we are to experience colonial exploitation may at least partially be attributed to inefficient utilization of our knowledge. Indian continent is a land of culture and education. India has had a strong background of formal education dating back to fifth century BC. It stands among the world's most favourite education accesses especially since the time of Taxila and Nalanda. It also had the Gurukul system of education. It was the earliest form of residential education prevailed in India since the Vedic Period. There has been a continued effort for expanding India's education system-formal and informal starting from the Vedic Period to Ancient India and from the Medieval Period to the Colonial Era down to the period of national administration.

After gaining political power in 1947, a concerted effort has been made to expand the formal education network through setting up of schools, colleges and the universities. The establishment of the UGC in 1956 and technical institutes like the IITs, NITS, National Institutes of Sciences, professional institutes such as medical colleges, judicial colleges and universities, IIMS, engineering colleges and universities, national laboratories etc. throughout the country have created a benign atmosphere of sound knowledge base of the Indian economy and society.

The 86th amendment of our Constitution in 2002 has made education a fundamental right. Along with this, the passing of the Right of Children to Free and

Compulsory Education Act, 2010 has given a great fillip to our education system. According to this Act, it is obligatory from the part of the State Governments and local bodies to ensure education for all the children in the age group 6-14.Access to education is thus recognized as the most important element to the growth and sustenance of a knowledge economy. India has a strong, vibrant and mature education base available under formal and lifelong learning systems. We have derived dividends and gradually transformed our economy into Knowledge Based Economy.

Indian administrative effort has been rewarding .India has made a soft beginning of Knowledge Based Society and Economy. It is the connectivity that is vital circulatory system of a knowledge economy. Apart from ICT based connectivity, all other conventional methods of connecting people are addressed and organized effectively for the growth and expansion of a strong and sound knowledge economy.

Growth of service sector and that of a solid industrial base along with wider application of science and technology in agriculture and agri-business are providing a very strong enabling environment for the emergence of India as a Knowledge Economy.

Beneficial changes are observed in various spheres in Indian economy – indeed we should not have any hesitation to state that we have Knowledge Based Economy. However we have to address lot more areas to facilitate acceleration of our Knowledge Based economy for maturity and to improve our global standing.

Performance of Indian economy is fluctuating, however praise worthy compared to third world economies. India since independence and especially since 1980s achieved moderate to high increase in income and standard of living of its population. Political maturity of India may be identified with social science research and adoption of planning process on the one hand and attention to scientific research in various spheres. It will be no exaggeration to state that Indian polity started preparing herself to encourage Knowledge Based Economy as early as the third quarter of the last century. However the process was very slow.

India took up new economic policy during 1990s and as a result of which a lot of changes have taken place in the spheres such as opening up sectors to private investment, encouraging foreign direct investment, reducing red tape, further

liberalizing trade policy and exchange rate regime and reforming capital markets leading to an improved investment climate. Central controls are receded for provinces to have more freedom to maneuver. Regional experience is asymmetric. ; some states such as Andhra Pradesh, Karnataka and Maharashtra have shown tremendous progress in encouraging private investment.

Every country in the world today is touched by the forces of globalization and the rise of the knowledge economy. Globalization and the knowledge economy have lead to poverty, unemployment, inequality and marginalization in some countries. The biggest challenge before most of the developing countries (including India) is to channelize the forces of globalization and the knowledge economy for the alleviation of poverty and the empowerment of people to lead a decent standard of living.

In an agrarian economy as we have in most of the Asiatic countries land is the most critical factor of all factors of production. Similarly, in an industrially advanced country natural resources such as coal and iron ore are the main resources for its productive activities. Similarly in knowledge economy 'knowledge' itself is the key resource. A knowledge economy is one in which all the sectors of the economy such as agriculture, industry and services amply use knowledge in their productive activities. It is at all not a new concept. In every sphere of life knowledge is used and the use of knowledge has been increasing especially since the industrial and agricultural revolution. The whole world has seen an explosion in the application of information and communication technologies in all areas of production, marketing and community life especially since the onslaught of globalization in early 1980's. Knowledge economy does have effect on each and every aspect of the economy, on goods and services and on every aspect of business chain from research and development (R&D) to production, marketing and distribution channels. The marginal knowledge or information is virtually Zero. Naturally knowledge is being greatly intensified in all sorts of economic activities.

India is one of the world's largest economies which have made tremendous efforts in the growth of its economy and society in the past three decades. Growing at about 3.5 percent from the 1950s to 1970s, India achieved a growth rate of about 5.5 percent during 1980s. It achieved an annual growth rate of 6.7 percent during 1992-93 and 1996-97. This was possible only because of adopting new economic policy in

1991 through which the economy was mere open to the global competition. The growth of the economy went down drastically during 1997-98 to 2001-2001 to 5.5 percent and further to 4.4 percent in 2002-2003. This was mainly due to poor rain and its impact on agricultural output. Good weather during 2003-2004 pushed up agricultural output and consequently the growth of the economy was 8.2 percent. This fact however focuses our inability to overcome the adversity of climatic factors.

India undertook a series of reforms during 1990s majority of which are opening up more sectors to private investment, encouraging FDI, reducing red tape, further liberalizing trade policy and the exchange rate regime and reforming capital markets. As centre have receded control for states to have more freedom to progress their respective economies. In this way same states such as Andhra Pradesh, Karnataka and Maharashtra have made tremendous progress in encouraging private investment.

India is now poised to realize even faster growth. It is thus an opportune moment for India to make further progress towards a knowledge economy one that creates, disseminates and uses knowledge to enhance its growth and development. The knowledge economy is often taken to mean only high-technology industries or information and communication technologies (ICT's). The concept may broadly be used to improve the productivity of agriculture, industry and services and increase overall welfare. Great potential exist in India for increasing productivity by shifting from low productivity and subsistence activities in agriculture, informal industry, informal service activities to more productive modern sectors as well as to new knowledge –based activities and in so doing , to reduce poverty and touch every member of society. India has potential to become a leader in knowledge creation and use.

India has many of the key ingredients for making this transition. It has a critical mass of skilled, English–speaking knowledge workers, especially in sciences. It has a well-functioning democracy and its domestic market is one of the largest in the world. It has a large and impressive Diaspora, creating valuable knowledge linkages and networks. This list goes on: Macro Economic stability, a dynamic private sector, institution of a free market economy a well-development financial sectors and

a broad and diversified science and technology (S&T) infrastructure. In addition the development of ICT sector in recent years has been remarkable.

Discussing India's educational and human resource advancements with the help of World Bank data, 2005 we see that there has been marginal improvement during 2000-2005. India leads South Asia and Africa regions, but lags behind Poland, Russia and Korea. It is successful in the progress of literacy but its average years of schoolings 5.06 years [(larger than Brazil (4.88) but less than China (6.35), Poland (9.84), Russia (10.03) and Korea (10.84)]. In case of secondary and tertiary education also India is far lagging behind. World Economic Forum (WEF) made a qualitative rankings and this shows that India is ahead of many of the above countries in terms of science and math education, internet access in schools and management education. India's position in human resource development compared with China, Russia and Poland is not satisfactory.

One that disturbs India is its huge migration of skilled human resources to abroad. Policy makers and economists require information on global trends in agriculture and competitive prices of commodities, legislation that will improve agricultural production and marketing. With such a wide spectrum of the various information needs of agricultural stakeholders, it is very clear that information professionals need to develop a strategy of information provision so as to satisfy the information needs of those information users in agriculture. With this in mind, we have analyzed agricultural marketing information system in Indian context.

A marketing information system (MIS) consists of people, equipment and procedures to gather, sort, analyze, evaluate and distribute needed, timely and accurate information to marketing decision makers (Kotler and Aamstrong, 2002). MIS distributes information to the concerned stakeholders in the right form at right time to help them make better decisions. We have seen that various media, radio, television, literature and newspapers are mostly utilized by the extension workers to transfer agricultural technology to the huge illiterate and literate segments of the rural people. There is a great transformation in agricultural extension approach in dissemination of knowledge. The advancement made in information technology is so fast that every areas of livelihood have to be well organized to tie up such technology. It has been seen that generally the benefits of information technology have restricted

primarily to the urban areas. This is only due to lack of understanding about the new Information Technology in rural areas. Now after the revolution of IT a new approach has come up which actually strengthening the communication and training centres like Agricultural Science Centres and Farmers Training Centres which have reinforced the overall agricultural scenario.

In Indian rural markets, private traders largely dominate the marketing activity. Farmers, especially the marginal and small farmers are generally inadequately aware of market information like supply, demand, prices prevailing in the market, market charges etc. These are indeed crucial for proper decision making. There is no system of disseminating market information for the benefit of the producers and consumers. As such, the farmers who are in the villages have no chance to know the prevailing prices in the neighbouring markets at subdivision and district levels. They are never sure what price they will get until they reach the market. Prices fluctuate particularly in the peak season, when many farmers try to sell their production, under such circumstances the rural producers largely accept the price quoted by the traders.

Due to various economic reasons like indebtedness, need for cash, insufficient storage, lack of adequate transportation and other infrastructure facilities farmers are also at a disadvantage in striking the bargain. As a result, they are engaged in distress sales. Farmers may enjoy better price realization, if they are provided with the full market information regarding the price and demand of the crops they grow on time .This will ultimately motivate farmers to move towards better decision regarding production and sale decisions. This will prevent the tendency of farmers to jump into a decision on the basis of ruling price levels and later on discover that the prices have crashed when they are ready to sell their produce at the end of the season.

Credible and timely information plays a crucial role in agricultural marketing, particularly for perishables. Due to lack of proper market information channel and interference of middle man, the farmers have been exploited often and forced to sell their produce at lower price in their nearby market. The harvested produce can be sold at a premium price; information of the nearest alternative markets is disseminated to farmers on demand and daily basis. They can make better decision to harvest the

produce at right time and send their consignment to particular market where the market price is higher for his/her produce.

Knowledge or research and development efforts play a key determinant role in shaping trade pattern in manufactured goods (Raymond Vernon, "International Investment and International Trade in the Product Life Cycle", Quarterly Journal of Economics 80, 1966, pp. 190-207). It begins with the analysis of new trade theories explaining the impact of R&D (knowledge) on international trade, ICT application in trade facilities, and e-commerce and trade facilitation at global level.

IT and Internet transaction help to minimize the adverse intervention of intermediaries in the business activities and consequently results in cost reduction. E-Commerce becomes more effective in enhancing international trade and commerce. Administrative efforts are required to develop infrastructure for faster and bigger capacity of communication such as phone, cable, and radio and satellite network. Strong general as well as technical education base of a country widen the scope of E-Commerce. The assurance of education is thus a priority for the growth of learning and research process. Administrative steps in this sphere are required for furthering the progress in India.

Contribution of knowledge in Industrial economy of our country is praise worthy. External influence in the industrial economy of India though can not be overlooked. It is naïve to state that western industrial revolution influenced industrialization in India. Political sub-judication by industrially developed western world is equally significant. India experienced a discrete jerk from the western countries – Great Britain in particular, the economy most fortunate to harvest early gains from industrial revolution. Results of western influence is mixed – industrial economy of India was shattered and at the same time we owe much to west for large scale industrial operation and widening of industrial sector. Resource base of the country started improving but west harvested maximum benefit. In what follows, Indian entrepreneur class could successfully utilize the available technology in the international market. In consequence we have moderately developed industrial sector at the time of transfer of power. Scientific research and planning process in India immensely helped industrial development during the post independent period and ultimately industrial sector of the country started becoming more knowledge

intensive. Corner stone of knowledge based economy – in particular knowledge based industrial sector – is quality human capital.

Human resource development has evolved as a critical element of broader business and human resource management strategies. The importance of an appropriately skilled and developed workforce is recognized by many in business as essential to the implementation of continuous improvement programs. An educated and empowered population resulting from proper human development strategies contributed significantly to increased productivity .

Human Resource Development (HRD) is the precondition for attaining progress in developing a knowledge-based society, reducing skills mismatches in the labour market, and promoting a country's international competitiveness thereby supporting social and economic development and well-being of the people.

Indian experience suggests that the focus of human resource development policies has been on promoting knowledge and skills through education and training and enhancing the employability. Indian administration emphasized improving access and equality of opportunity to all to live and work in knowledge and information based society as suggested by ILO, 2001. We have seen that HRD or education and skills of the labour force, is singled out as a fundamentally and centrally important dimension for a country’s development into a Knowledge Based Economy.

Although India has a high pool of science and technology graduates capable of competing with any country ( e.g., USA, China, Brazil and the like) Indian software companies have so far failed to master the own brand product model in any substantial measure. What specifically India lacks is its inability to develop complementary capabilities in marketing. This is essential otherwise India will face serve competition from American and European firms in future. Increasing interdependence of flows of trade, investment, technology and capital is now the order of the day. Thus particular attention is needed to integrate trade with investment and technology strategies for great coordination. It is also necessary to achieve a higher level of integration among the domestic and international policies. India moves from creating, acquiring and adapting knowledge to become a generator and user of new

knowledge and technologies. India needs to create some special issues that are essential in terms of broad business environment.

## 10.2: Significant Findings and Observation

Following are some of the significant observations and findings of our investigation:

i. India has been successful in transforming its economy into a knowledge economy.

ii. India possesses a large pool of highly educated and vocationally qualified people (Chapter-IV). We have found that industrially advanced economies have been able to take the fullest advantage of the forces of globalization for the creations of wealth and the well-being of people. For the less equipped developing economies, globalization and the knowledge economy may lead to poverty, unemployment, inequality and marginalization (although this might not always be true). The challenge before these economies, including India, is to channelize the forces of globalization and the knowledge economy for the alleviation of poverty and the empowerment of people to lead a decent standard of living. This calls for educational attainment of every citizen and human resource development through quality training and education.

iii. Marketing information plays a vital role in the functioning of the whole market, by regulating the competitive marketing process. It ensures that each marketing transaction is a fair one, and that all participants share the risks and benefits. However, this does not happen in India and in many developing countries. This is because of the fact that marginal and small farm communities do not have marketing information as has been in the case of big and medium farmers. Thus, it is observed that distribution of marker information to farmers is asymmetric.

iv. It has been observed that in the rural markets, the marketing activity is largely dominated by the private traders. Farmers are generally not aware of market information like supply, demand, prices prevailing in the market, market charges etc., which are crucial for proper decision

making (Chapter-VII). Indian economy is striving to improve the environment for advancing her knowledge based rural economy.

v. India is addressing the issues to accelerate the process of knowledge based industrialization. The nation has fostered an Industrial and S&T policy since the introduction of its planning process. Indian policies have been rewarding. This is particularly noticed in eradicating poverty and building infrastructure(human and social).This can be substantiated from the fact that India has attained some maturity in the area of science and technology. Still India's overall performance is below optimal.

vi. There are cases of application of information and communication technologies in extension that have made a difference in the delivery of extension services in rural India. Some of these include the Warana Wired village Project in Maharashtra; Milk collection in dairy co-operatives (National dairy Development Board); Information Villages Project (MS Swaminathan Research Foundation-International Development Research Centre); Information Technology application for Indian Rural Postal System (CMC Limited, Hyderabad); Knowledge Network for grassroots innovations (IIM, Ahmedabad); Application of Satellite Communication for Training Field Workers and Extension Workers in Rural Areas( ISRO); Computerisation of Mandal Revenue Offices (MROs) and computer aided administration of revenue department in Andhra Pradesh. But these services should be evenly distributed across the Indian villages.

vii. On the basis of overall analysis we may infer that India has made a stride in all the spheres of the economy-in agriculture, in industry and in services, which, in fact, have improved the quality of life and ultimately the well-being of its population.

## 10.3:Recommendations

On the basis of our analysis we may make the following recommendations:

i. Skills, knowledge and connectivity are some of the important forces for development of any economy. These are not equally distributed to all parts of the globe. Even within a country there remains variation in their distribution. This is more so in the developing countries like ours. In India for example, rural people are weakly connected with knowledge. To improve their conditions, it is of utmost importance to spread education, infrastructure facilities to all the people living in rural areas too.

ii. In software, India is an export-oriented powerhouse. But India lacks in domestic market if compared with other competitors like China and Brazil. Steps to be initiated for creating a vibrant domestic market. Administration should play more active role. We plead to strengthen intellectual property rights and their enforcement.Second, India needs to improve access to venture capital. Third, private sector should be encouraged for increased investment, productivity and employment opportunity. The ultimate object is thus to expand opportunities for the poor, Fourth, measures are required to attract more foreign direct investment in order to contribute strongly to the economy and society. Fifth, very often it is cited that India's infrastructure is very poor. This in fact is a major obstacle to economic growth. It requires improving transportation, access to reliable power. Power sector reform is urgently required to improve business performance in India.

iii. Satisfactory production and economic results in agriculture can best be achieved through forming production cooperatives which should address formation of a complete production chain beginning with primary production, over getting a number of half-products, to finalization. Ultimately, these cooperatives would work as a multipurpose cooperatives starting from primary producers to the suppliers of inputs for agricultural production, buying agricultural crops, providing finance at a reasonable rate of interest.

iv. India produces more than two lakh scientists, engineers and technocrats every year. In spite of this, it has not been able to harvest full economic benefit because of mismatch between education and labour market.

v. It is also essential to initiate measures to control brain drain from India.

vi. It is necessary to improve the quality and skills of India's current and future pool of technical manpower both from private and public institution for scientific R & D.

vii. We plead for increasing university- industry partnership to ensure consistency between research and the actual needs of the country.

viii. We also need to establish partnership between Indian and the foreign universities in order to attract and retain highly qualified faculty. This also provides opportunity to Indian students to acquire internationally recognized credentials.

ix. Asia spends alone more than 30 percent of world R & D expenditures. China for example has shown remarkable achievement in respect of R & D expenditure linking between the R & D and the market (World Bank, 2005). India may learn lesson from Brazil which has shown larger development effectively utilizing public funding and a large networks of partners to conduct R & D activity.

x. Our overall analysis shows that India has gained praiseworthy achievements in the IT domain. Data on the use of Internet, Telephone and Computers show that India has progressed lot in information and communication technology (ICT), but its overall information infrastructure needs to be further strengthened in order to become truly a knowledge economy.

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