TOWARDS A KNOWLEDGE SOCIETY

Final Draft for the Vision 2020 Committee

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January 1, 2003

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India: Vision 2020

Imagine an India in which elementary school enrolment (I-VIII) and adult literacy are approaching 100%, school drop out rates are near zero, all children who are not going on for higher academic studies receive vocational training, and computer literacy is almost up to the standard of Western nations. Imagine a country in which nearly all citizens have access to all forms of print and electronic communication media—television, telephone, the Internet.

Compare that with India as it is today, with only 64% of its people meeting even the most minimum standard of literacy, where 59% of students never complete 5th standard, where secondary enrolment is 58% but of those that enrol 54% (68% of the total age group) never complete 8th standard, where only a small percentage of youth receive vocational training before entering the workforce, and where probably less than 1% of the working age population is computer literate.

Now try to conceive of how much more productive, prosperous, dynamic and expansive would be the India that you have imagined. Think about the potential benefits of new educational methods that would make it possible for school children to complete the entire secondary school curriculum within the first five or six years of education, with greater comprehension and retention and greater capacity for thinking, problem solving and creativity. How much more knowledgeable, skilled, and competent would be the nation's workforce? Imagine the impact on social productivity and living standards of corporations, universities, and government administrations staffed by such a workforce. How much more efficient and innovative? How much better informed would be the decisions taken by individuals regarding education, occupation, politics, business investment, health, child-rearing and life-style? How much more effective the institutions operating for the development of society? Imagine a workforce able to meet the entire world's shortage of technical and professional graduates. Imagine companies and universities from around the world gravitating to India as the premier scientific and technological research and development environment. Imagine an India in which cities are far cleaner and more modern, citizens more enlightened and responsible, entrepreneurs more dynamic and sophisticated, institutions far more effective and responsive. Surely as a minimum, this India would enjoy a per capita income three to four times higher, perhaps ten times higher, than the country does today.

This India of your imagination is merely a dream today, but it can become a reality within the next two decades, provided the nation's intellectual, political and business leaders have the vision to perceive the country's enormous untapped human potentials and make a full and determined commitment to fully develop those potentials. *Knowledge is the key to realizing this vision of India in 2020.*

Knowledge Society

Knowledge has always been an essential and distinguishing characteristic of human society, for human beings are unique among all species in their extended capacity to formulate, systematize, preserve and consciously transmit organized bodies of knowledge from one individual,

community, generation and location to another. That is the essence of all that is known as *education*.

The term 'knowledge society' has gained prevalence in recent years due to the revolutionary strides in technology and the rapid evolution of new systems for the gathering, transmission and application of information. A confluence of technologies—television, computers, networking, satellite communications and the internet—constitute the technological basis for the knowledge revolution. Their rapid proliferation over the past decade has made possible movement of information around the world at lightning speed. This dramatic acceleration in the development of information technologies; in the speed and extent of global knowledge accumulation, dissemination and exchange; in the blurring and transcendence of traditional boundaries between fields of knowledge; and in the emergence of new knowledge-based industries are defining characteristics of the knowledge revolution.

The knowledge revolution marks a fundamental shift in human development beyond the limitations imposed by *material processes* toward the unlimited, indeed, infinite creative potential, of *human processes*. In fact, this shift is really not as unusual as we may have thought. All resources, even land and minerals, are products of the human mind. Anything becomes a resource only when the human mind recognizes a valuable use for it. Development has always been based on the creative and imaginative capacity of the human mind. In this sense, the Knowledge Society is not really something that has just suddenly emerged out of nowhere.

The concept of Knowledge Society includes also that of the learning society. The pace of knowledge generation and adoption is so rapid in the world of today that learning can no longer be confined to formative years of youth. All members of the population must continue to acquire knowledge throughout their adult lives in order to avail of the economic opportunities that rapid development makes possible. This requires the development of innovative delivery systems for dissemination of practically useful information on a continuous basis.

A guiding and inspiring vision of what India has the opportunity to become by 2020 must take into account the enormous productive potential of knowledge to accelerate the development and transformation of the country. The knowledge revolution is not a fashion or a fad. However, in striving to adapt and respond to the opportunities generated by the knowledge revolution, two guiding principles should be kept in mind. First, efforts to spread the Knowledge Society should avoid as far as possible the empty hype and fads currently sweeping the world and concentrate rather on the real role of knowledge as a catalyst for development. Second, rather than blind imitation of other countries, India should seek to innovate new strategies and new applications of the knowledge revolution adapted to local needs, conditions and culture. To do so it is necessary that we appreciate the true role of knowledge in development.

The Question of Resources

All efforts to project India's future progress get blinded sooner or later by the question of resources, by which is meant the financial resources needed for investment in infrastructure, industry and institutions. Annual budgets, Five-year Plans, company reports place primary emphasis on the importance of capital investment. But money is not the most important contributor to a nation's growth. A study by Denison of the factors contributing to growth of the US economy from 1929 to 1982 attributes 94% of the total to factors relating to knowledge generation and dissemination: 64% of that growth is linked to advances in knowledge generation (i.e. R&D) and another 30% to advances in education. Better resource management, which is an

application of knowledge, is also identified as a more important factor than capital. *This fact bodes well for countries whose economic planners are able to escape from their faith in the pre-eminent importance of capital and fully tap the enormous productive potential of non-material, knowledge resources.*

The knowledge revolution is not just a short term blip on the radar screen which peaked in 2000 with the boom in dot.com companies. It is a real and profound opportunity for countries around the world to increase the speed and spread the benefits of development. What is termed the knowledge revolution marks a significant shift in the relative importance of different resources or factors of production in the development process. As futurist Alvin Tofler has documented, the shift from physical power to wealth power to mind power is an evolution in the foundations of the global economy. It marks a fundamental shift in the character of social evolution.

In earlier stages of development, land and minerals constituted the principle resources for development. Technology was rudimentary. Human beings were valued mainly for their physical labour. Today, technology, organization and information—three basic components of the knowledge revolution—have become critically important resources for development. All economic activities are becoming more knowledge-intensive. By one recent estimate, 50-60% of all industrial output is based on information. Modern manufacturing industries depend as much for their success on the management of information relating to quality, cost and scheduling as they do on the management of materials and production processes. The service sector, which is the greatest source of new jobs and economic growth in the world economy, is essentially knowledge-based. The phenomenal growth of employment opportunities in this century has been mostly driven by the rapid expansion of services. The four most important service sectors in the US economy today—financial services, insurance, health and education—are especially knowledge-intensive. This shift from material to knowledge-based resources opens up vast opportunities for developing countries to accelerate the pace of development. *India's rate of economic growth can be substantially increased if the country becomes a superpower in knowledge and if the potentials of information and information technology are fully understood and exploited.*

These knowledge-based resources differ significantly in character from the scarce natural resources on which traditional economic assumptions have been made. Natural resources are subject to inherent limits of availability. The knowledge-based resources are not. Natural resources are consumed when they are utilized. The knowledge-based resources are not. Knowledge expands as it is shared rather than being consumed. Knowledge is not lost when it is freely given away. Knowledge is readily transportable at rapid speed and very low cost. Development today depends to a much larger extent that ever before on resources that can be freely multiplied, distributed and utilized by the entire population, provided people have the educational background to receive and utilize it effectively. *This makes possible a vast acceleration in rates of development.*

Historically, development has occurred under conditions in which access to critical resources was restricted to a relatively small portion of the population. The distinguishing characteristics of knowledge as a resource make it possible for the first time to spread and share a resource among the entire population. The pace of India's progress toward a Knowledge Society will depend to a large extent on its ability to make available the latest and most useful knowledge to vast sections of the population.

Role of Knowledge in Development

We now understand that the pace and extent of development is determined to a very large extent by a host of non-material, intangible factors: access to information, knowledge and skill; generation and application of technology; the quality and efficiency of social systems and public institutions; expertise in building and managing organizations of all descriptions; and ultimately on the aspirations and attitudes of the people.

In its essence, development is a human process that is determined by the response of people to their external environment. Development is the process by which human beings become aware of opportunities and challenges, formulate responses, make decisions, and initiate organized actions. This process follows the sequence from knowledge to inspiration to action. When human beings acquire knowledge, they become aware of opportunities and challenges. When that knowledge matures, they acquire the motivation or urge to translate that knowledge into action. No matter how great the opportunity or how dire the necessity, without that knowledge no adaptive response occurs. Knowledge is fundamental to each step in the development process. It is essential for creating awareness of opportunities and challenges, evaluating alternatives, formulating responses, effective planning, organizing initiatives, and implementing those initiatives.

Development depends on a very broad range of knowledge—technical knowledge of productive processes, commercial knowledge of markets and business practices, personal knowledge of human health and nutrition, knowledge of laws and legal processes, knowledge of political and administrative processes and public policies, knowledge of organization and management, knowledge of emerging fields of science, and a conceptual knowledge of the nature of the development process itself, by which we may acquire the wisdom to unleash and harness the energy, resourcefulness and creativity of the people.

Knowledge contributes to development in several different ways: as a productive resource; as an essential input for education, scientific research and industrial technology; as a catalyst for social change and economic development; and as a basis for civilization and cultural values that promote social integrity and harmony, which is the essential foundation for all development.

Knowledge is only one input to the development process, but it is an absolutely essential one. Without adequate knowledge all the other essential inputs—land, infrastructure, factories, capital, technology, administrative and social organization—cannot yield full results. Enhancing knowledge generation, dissemination and application is the fastest, most cost-effective means of increasing the productivity of all these other resources and accelerating national development.

Development depends on four knowledge processes:

- Knowledge generation and acquisition through scientific discovery, R&D and transfer of technology.
- Knowledge adaptation through innovation to particular fields, needs and operating environments.
- Knowledge dissemination through formal and informal channels from knowledge developers and adapters to those responsible for applying the knowledge in society.
- Knowledge application through skilled action in fields, factories, classrooms, hospitals and every other field of activity to achieve practical results.

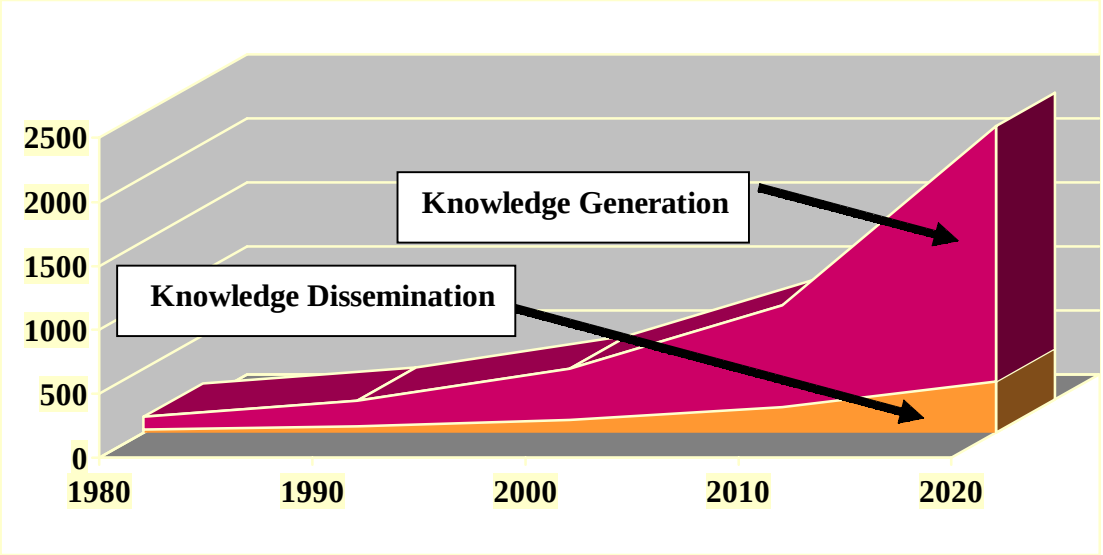
India's Knowledge Gap

The task of harnessing available knowledge for development is complicated by the fact that the rate of global knowledge generation is growing exponentially and old knowledge is quickly superseded or nullified by new knowledge which generates more and better results, faster and at lower cost. Humanity's knowledge base, which has been accumulating slowly over centuries, is now doubling every 3 to 5 years.

Not only is knowledge much more available, it is also much more essential for survival in an increasingly complex and competitive world. Factory workers, urban citizens and even housewives today require a much broader range of knowledge and practical skills to perform even routine functions such as operating sophisticated machinery and appliances, complying with laws, interacting with government departments, benefiting from modern medical technology, etc. The minimum knowledge required of every Indian citizen is increasing. At the same time, the maximum opportunities for those that acquire the most knowledge in any field are boundless, as the recent surge in the IT industry dramatically illustrates.

The pace of knowledge dissemination in India has also been growing rapidly. The expansion of media coverage through cable TV has multiplied the range of programming. Rising levels of education have fueled a proliferation of specialized journals on a wide range of topics. The spread of information technology, telecommunication facilities and the Internet have created far wider access to a much greater range of knowledge. But, in spite of these significant achievements, there is a growing gap between the rate of knowledge generation and knowledge dissemination in the country as illustrated in Figure 1.

Figure 1: India's Knowledge Gap

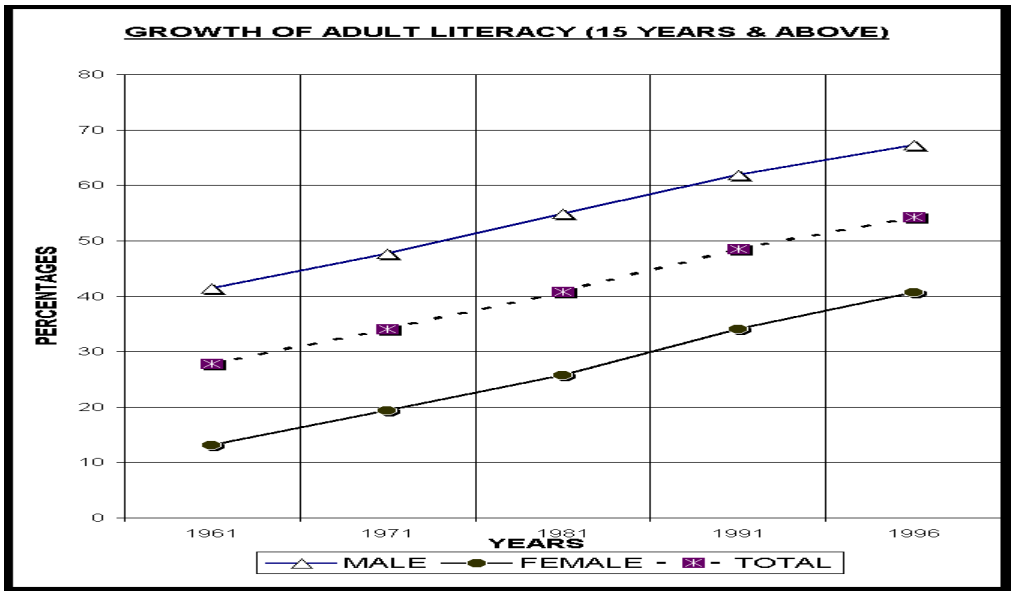


India's knowledge gap is not easily quantified, but we can roughly measure it by examining the country's progress on literacy, education, application of technology, R&D and growth of the media.

Literacy

Literacy rates in India have doubled over the past four decades. This impressive progress is diminished by the fact that the starting rates were extremely low. This still leaves approximately 300 million illiterate adults in the country, 30% of the entire population. For these people, the traditional avenues of knowledge dissemination through education and printed information are ruled out. It is precisely the people in this group that are most vulnerable to the challenges posed by the knowledge revolution because they are least equipped to rapidly expand their knowledge base. Since many of them are relatively young adults who will still be active in 2020, the country cannot afford to ignore them or leave them behind. Innovative approaches will be needed to increase knowledge dissemination to this group.

Figure 2: Growth of Literacy in India

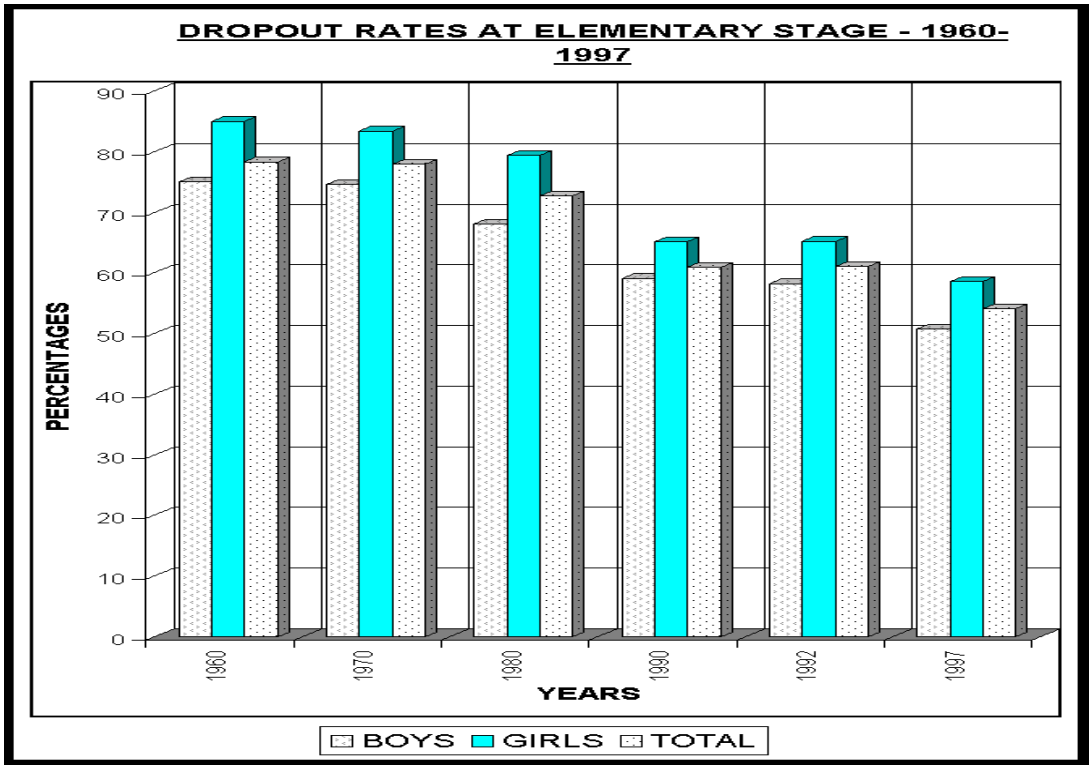


Education

A second way of estimating India's knowledge gap is to look at the number of people who do not acquire even a minimum of formal education. Education is the primary and most effective means so far evolved for transmitting practically useful knowledge from one generation to another. *Education is the process of passing on to future generations in a concentrated and abridged form the essence of knowledge accumulated by past generations.*

India's educational system has expanded exponentially over the past five decades. But, drop-out rates from primary and secondary school remain so high that a very large proportion of children do not acquire even high school education, which must be considered the minimum education required to adapt and succeed economically in modern society.

Figure 3: Elementary School Drop-out Rates



In spite of significant progress in reducing school drop-outs, 40% of children still drop out before completing the 5th grade and 70% drop out before completing high school. Therefore, apart from addressing the needs of a large illiterate population, India's knowledge strategy must also develop innovative approaches to enhance knowledge acquisition among the large community of school drop-outs. Unless something is done to drastically reduce drop-out rates, by the year 2016 there will be approximately 500 million people in the country with less than 5 years of schooling and another 300 million that will have not completed high school. In other words, about two-thirds of the population will lack the minimum level of education needed to keep pace with and take advantage of the social changes occurring within the country and worldwide.

R&D

The rate of knowledge generation in the country is another aspect of the knowledge gap. At the global level, science and technology are expanding at unprecedented rates. There are many ways in which this global knowledge permeates into the domestic economy, but the capacity of any country to adapt and fully harness these advances depends to a significant extent on domestic R&D activity.

Estimates of R&D activity can only be taken as crude indices of the knowledge gap, but the figures do suggest that knowledge generation in the country is not keeping pace, even proportionately, with the global knowledge revolution.

Table 1: R&D Expenditure

Country	Exp in US $	Exp as % GNP
Japan	825	3.0%
USA	568	2.9%
Korea	146	2.1%
India	2.4	0.8%

Two points are important to note about India's performance. First, atomic energy, space and defense research account for 71% of all Central Government spending on science and technology, which means that relatively little is left for investment in agriculture, energy, telecommunications, health, education and other crucial sectors. Second, R&D expenditure in India's fast growing IT sector is currently 3.1%, suggesting a strong correlation between investment in R&D and economic growth.

There are other indicators that also suggest an increasing knowledge gap resulting from inadequate knowledge generation.

- India's share of global scientific output in 1998 was only 1.58% of the world's total.
- India's annual output of science papers declined from 13,000 in 1981 to 12,000, while world output has risen from 4 lakh to 7.6 lakhs per year.
- India's share of global scientific citations in 1997 was only 0.7% of the world's total.
- India's rank on the Science Citation Index has fallen from 8 to 13 since the early 1980s.

Knowledge generation directly impacts national development when it results in new and improved, patentable industrial processes. Every year more than 500,000 new patent applications are filed globally. Of these, China accounts for 96,000 and Korea accounts for 72,000, while India accounts for only 8000. Korea produces nine times as many patents as India with only twice India's total investment in R&D, suggesting that not only the quantum of investment but the management of R&D activities is a critical determinant of knowledge generation.

Application of Technology

A fourth way to estimate the country's knowledge gap is to examine the extent to which commercially viable technology is being applied in the country. Since agriculture is still the largest source of employment in India, the application of technical knowledge in this field can be a useful index of knowledge dissemination through agricultural education, agricultural extension services and other delivery systems.

The table below compares agricultural productivity in the USA and India. There are many reasons for these differences in productivity, including size of land holdings, level of investment and quality of inputs. But in addition to these, there are vast differences in the extent to which available scientific knowledge is applied by farmers in their fields. According to empirical studies and field research conducted in India by California Agricultural Consulting Services, knowledge accounts for more than 50% of the difference in productivity on American and Indian farms.

Table 2: Agricultural Productivity in USA & India (kg/hectare) [1]

Crop	USA	India	USA/India
Rice	6622	2928	2.3
Maize	8397	1666	5.0
Wheat [2]	4400	2583	1.7
Groundnut	3038	912	3.3
Soy beans	2452	1007	2.4
Potato	40,238	17,307	2.3
Lint Cotton	700	333	2.1
Tomato	59,295	15,138	3.9

To test this conclusion, numerous experiments have been conducted in which the knowledge available to California farmers has been provided to Indian farmers. Without any change in the size of the land holdings or quality of inputs, productivity on the Indian farms rose by 100 to 300% as shown below.

Table 3: Crop Productivity Improvement by Knowledge Application

Location	Crop	Yield (kg/ha)		Increase
		Local	Test	
Tamil Nadu	Tomatoes	31,250	1,05,000	236%
Tamil Nadu	Lint Cotton	335	978	192%
Kerala	Black Pepper	426	1716	303%
Bihar	Maize	1125	2568	128%
Karnataka	Lint Cotton	347	1045	202%

These results illustrate the enormous potential for accelerating India's development by closing the knowledge gap and point to the great importance of improving the quality and relevance of the rural educational system.

Knowledge Dissemination through the Media

Knowledge dissemination occurs through the system of formal education and through a variety of informal channels, of which the media is the most prominent. Therefore, the development of the media can be taken as another rough index of knowledge dissemination in the country.

The number of publications and growth of readership in India is expanding rapidly, as shown below:

Table 4: Indian Newspapers & Journals

Year	Publications	Circulation	Circulation/1000
1987	24629	57 million	71
1997	41705	89 million	91

[1] Data in this table is from the FAO web database for 1999.
[2] The figure for USA wheat yield is for irrigated wheat which is the best comparison since almost all Indian wheat is irrigated. The overall average yield for irrigated and rainfed wheat in the USA is 2872 kg/ha.

The Indian newspaper industry has expanded enormously as the population has expanded and literacy rates have risen. India currently publishes 4719 daily newspapers with a total circulation of 40 million. Still, the percentage of the Indian population reading newspapers remains relatively low.

Table 5: Daily Newspaper Circulation per 1000 Population (1992)

Country	Circulation
Korea	412
Singapore	336
USA	236
France	205
India	31
Pakistan	6

The number of publishers and books published is another index of the capacity for knowledge dissemination. Currently India has about 3000 active publishing firms publishing at least 20,000 books annually.[3] This figure compares favourably with 49,000 books published annually in the USA, the world's largest publisher, however, there is still a huge difference in the number of copies of each title printed and circulated.

Cable television coverage has expanded very rapidly in India over the past two decades and currently reaches 37 million people. While little current programming is directed at knowledge dissemination, this medium has enormous potential for closing the knowledge gap.

The Internet is currently the fastest growing media channel in India and around the globe. The table below compares India's current position with that of some other countries.

Table 6: Internet Penetration (1999)

Country	Netizens	% of Households
India	2 million	2.5%
China	10 million	1.7%
Japan	20 million	30.0%
Taiwan	4 million	35.0%
USA	80 million	50.0%

The following table projects the growth of India's IT infrastructure over the next eight years. Cable TV is included in this list because it will become a important means of delivering internet access to households.

Table 7: India's IT Infrastructure

	2000	2008
PCs	4.3 million	20 million
Internet subscribers	1.0 million	35 million
Internet users	3.7 million	100 million
Cable TV subscribers	37.0 million	70 million

[3] Some sources indicate the number may be as high as 56,000 books, taking into account multiple language editions, but the authors preferred to cite the more conservative figure.

NASSCOM projects that the number of television sets will triple from 75 million to 225 million by 2008 and that cable television coverage will expand from the current level of 37 million households to 70 million. While little current programming is directed at knowledge dissemination, this medium has enormous potential for closing the knowledge gap.

The Internet is the fastest growing media channel in India and around the globe. Currently 2.5% of Indian households are connected to the web compared with 30% in Japan and over 50% in USA. According to a recent study by Pricewaterhouse Coopers, the number of internet current users will rise to more than 25 million by 2005, representing a 50% annual growth rate. Other studies project that by the end of 2008, 100 million Indian will have access to the Internet, of which 25% will be serious users. India is also investing in IT infrastructure to support rapid growth in this field. Over 200 Indian cities and towns have internet access. Seven private international gateways were operational by the end of 2000 and at least 12 are expected to be operational during 2001. It is projected that between 2000 and 2008 the number of PCs in the country will increase five-fold from the current base of 5 million.

These various measures indicate that the Knowledge Gap in India is indeed very great and very great will be the benefits of implementing strategies to close that gap. The measures also reveal that India has a substantial media infrastructure that is not being effectively utilized for knowledge dissemination.

Knowledge is only one input to the development process, but it is an absolutely essential one. Without adequate knowledge all the other essential inputs—land, infrastructure, factories, capital, technology, administrative and social organization—cannot yield full results. Enhancing knowledge generation and dissemination is the fastest, most cost-effective means of increasing the productivity of all these other resources and accelerating national development.

FigureFigure

Figure

In formulating a realistic, achievable vision of India in 2020, we need to take into account both the magnitude of the challenges the country faces and the magnitude of the opportunities afforded by the still nascent revolution in knowledge. As the evidence indicates, the nation's knowledge gap is widening and this trend will not be arrested by incremental changes in strategy or implementation. It will require bold, innovative initiatives to formulate and experiment with new models suited to the new context. The primary incentive for bold initiatives is not the pressure of physical circumstances, since India today is more prosperous and comfortable than at any time since Independence. It is rather the recognition that it is possible within a short period of time to bridge the great developmental distance that presently separates this country from other nations that were not more advanced than India was just a few decades ago and now stand out among the most developed nations of the world.

Essential Role of Education

It is now evident that capital is a result and product of the development process rather than its source. The true source and driving force for development is human capital—the values, attitudes, knowledge, skills, organization and motivation of the people. The current knowledge gap points to the vast underdevelopment and underutilization of that most precious of all resources, a resource which India possesses in greater abundance than all but one other nation. Accelerating

the development of the country's human resource base by imparting greater knowledge and greater access to information should be the mainspring of our efforts to leap forward into a more prosperous future.

Education is the process of passing on to future generations in a concentrated and abridged form the essence of knowledge accumulated by past generations. It is arguably the single most important input both for the growth of the society as well as for the individual. Properly planned, educational input can contribute to increase the gross national product, enhance cultural richness, build greater receptivity to technology, and improve the quality and effectiveness of government. Education opens new horizons for the individual, releases new aspirations and develops new values. It strengthens competencies and develops commitment. Education generates in an individual a critical outlook on social and political realities and sharpens the ability for self-examination, self-monitoring and self-criticism.

During the last five decades India has gained valuable experience in all spheres and stages of education. The expectations of the people regarding education and the potentialities for future growth are better understood. But the present reality and future potential are separated by a wide gap in the level of social commitment, institutional credibility, quality of human and institutional resources, and efficiency of functioning. Contrary to expectations at the time of Independence, disparities in levels of education within the society are increasing. There is a visible loss of credibility of existing systems of imparting education in schools and institutions of higher learning. In addition, educational infrastructure is inadequate and even the effective utilization of existing infrastructure has not been ensured.

Table 8 estimates the probable state of education in India 2020 based on current policies and trends and compare it with a best-case scenario in which maximum attention, resources and effort are directed to raise the educational status of the population.

Table 12: Education Scenarios in 2020

	1980 Actual	**2000 Estimated**	**2020 Business-as-usual**	**2020 Best-case Scenario**
Primary enrolment (1-5)	80%	89%	100%	100%
Elementary enrolment (1-8)	77%	79%	85%	100%
Secondary enrolment (9-12)	30%	58%	75%	100%
Drop-out rate (1-5)	54%	40%	20%	0%
Drop-out rate (1-8)	73%	54%	35%	0%

This is the time when the nation should commit to a whole-hearted effort to move toward a learning society and a knowledge society. That effort must begin by ensuring 100% literacy by

2020, including all those who have already passed into adulthood without acquiring this minimum capacity for knowledge acquisition. It should also commit to fulfil the objective of Article 45 of the Constitution of India to provide a minimum of 10 years of *free and compulsory education* to all children up to 14 years of age. *Universal primary education should be considered one of the most essential objectives and highest priorities of the coming decade*. Extending the reach of scientific and technological literacy to all sections of the population should become an essential aim of all child and adult educational programmes. These achievements are essential for providing all citizens with more equitable access to knowledge and more rapid economic advancement.

Beyond this minimum level, greater efforts need to be made to enhance the quality and increase the breadth of educational options at all levels. India has a few institutions such as the Indian Institute of Technology and Indian Institute of Management that compare with the best in the world, but it also has a vast multitude of institutions that lack even the minimum infrastructure required to function effectively. The minimum standard of these institutions needs to be elevated in order to serve the vast majority of the population.

Other qualitative changes are needed as well. Present evaluation systems need to be discarded and replaced by a shift to accreditation and certification. There is need to create an active interface between the formal educational system and systems of open learning and distance education that are now emerging via television and the internet. A concerted effort is also needed to improve the management and administration of educational processes and institutions in terms of their systems, content, utility and credibility.

Our vision of India in 2020 is to create a learning and a knowledge society. By 2020, India must achieve near 100% adult literacy and elementary education for the age group 5-14 years. School curriculum need to be enhanced to promote creative thinking, initiative, self-respect, social responsibility, peace, harmony, social cohesion and a composite culture. Education should empower learners for self-employment, self-growth and higher quality of living. Distance and open learning need to become an integral part of education at all levels. Virtual classrooms and self-learning via the internet and television need to be strengthened. Educational management systems need to become more sensitive, open, transparent and learner friendly.

Elementary Education

In spite of increased efforts to impart literacy, reduce the drop out rates and expand the educational system to accommodate more children, the quantitative expansion of the educational system is still too slow to meet the country's needs, depriving tens of millions of young people of the minimum education required for their development. India rightly prides itself on its adherence to democratic principles, but the effective exercise of those principles depends directly on the education of the electorate. Nothing can have greater impact on the preferences of the nation's voting public, the quality of elected government officials, and the productivity of the workforce.

Upgrading rural primary and secondary education is possibly the single most important initiative that the country can take to secure a better future for its people. The very low productivity of Indian agriculture, which is the main source of income for the majority of people, is one reflection of the inadequacy of the rural educational system. India has followed a policy of opening a school in every village on the principle that no child should be far away from a primary school. As a result the rural primary school system consists predominantly of single teacher schools that lack the minimum infrastructure and teaching staff to provide a relevant quality

education. The task of upgrading the rural primary school system can be facilitated by adopting a strategy presented by Professor P. V. Indiresan. The present system of 500,000 village primary schools can be consolidated into around 60,000 centralized schools established in each cluster of eight or nine villages and located at the epicentre of the clusters. This would provide each school with at least nine teachers. Such consolidation offers substantial economies of scale in terms of cost of management and cost of delivery of quality.

Improving the Quality of Education

A quantitative expansion of the educational system will provide access to more young people, but it will not ensure that the education provided is of adequate quality to keep them enrolled or dramatically improve their capacity for social adaptation and achievement. Many of the methods commonly adopted in the nation's schools are based on practices developed in the distant past that have outlived their value and utility. Simultaneous with the quantitative expansion of the educational system, there needs to be a concerted effort to experiment with new approaches to education that will increase the quality and speed of knowledge transmission. The qualitative change needed should include –

Shift from teaching to learning

The traditional emphasis on the teacher as the active source of knowledge and the student as the passive recipient who simply receives what is taught needs to be replaced by a pedagogical system in which the student is taught to actively seek knowledge through a variety of means from a variety of sources and the role of the teacher is as facilitator and guide for that process.

Shift from traditional academic to life-based curriculum

The current curriculum is a product of many different influences. Most of it was developed in countries with very different values and social conditions, some of it in earlier centuries when life was altogether different than it is today. The high drop out rates in India reflect that fact that the school curriculum is only distantly related to the knowledge and skills needed by most Indians for adaptation and achievement in life, especially in rural areas. The dawn of a new millennium is an appropriate time to begin formulation of an entirely new educational curriculum, one which will relate to the cultural, social, political and economic life of the country and the skills, attitudes and values needed for individual initiative, personal achievement and nation-building.

Computer education

Computer literacy is an increasingly important qualification for both for individual employment and growth of the national economy. It requires a minimum of 10 to 20 computers in order for the operation and maintenance of a computer laboratory to be economical. The consolidation of primary schools into clusters would facilitate investment in adequate centralized facilities to provide at least minimum access to computer training for all students. But teaching students how to operate computers represents only a tiny part of the benefits of computerization. The greater potential of computerization is as a medium and aid for teaching any subject. ***Experience shows that computer-based general education can be at least twice as fast and effective as normal classroom methods now employed in India.***

Value-based education

The word 'values' is normally employed with reference to ethical and moral concepts. But it can also be used in a much wider sense to connote principles that are essential for national development. Values are those attitudes which based on long experience society has come to recognize as most essential for individual and collective achievement. Values represent the quintessence of life wisdom about what is necessary for continued social progress. It is possible to identify a list of 20 or 30 work values that will be critical for the future growth and development of Indian society and its greater participation in the emerging global economy, values such as cleanliness, punctuality, self-reliance, self-respect, honesty in trade, entrepreneurship, systematic functioning, etc. As practical skills can be trained, values can be trained too. Rather than merely imitating the West, a study of India's most successful individuals, organizations and communities will reveal the core values that form the inner foundation for their outer accomplishments. Efforts should be initiated to identify those values that are most critical to India's future development and to evolve a curriculum to effectively impart them to students of all ages.

Model schools

Even while the effort is still underway to expand the school system to cover the entire population, a simultaneous effort is needed to introduce and experiment with new philosophies and methods of education more in tune with the needs and possibilities of the 21st Century. As a modest beginning, experimental schools can be established in every district to test and demonstrate new methods and serve as models for other schools to emulate.

Promoting indigenous knowledge

For learning to be relevant it must be tailored to local needs and encompass indigenous knowledge systems. Knowledge about indigenous techniques for water resource management, preparation of fertilizers, preservation of foods, utilization of herbal medicines for better health and nutrition, personal and community hygiene are essential elements of a complete education that should be incorporated in the school curriculum. The curriculum needs to be expanded to include traditional knowledge systems such as Ayurveda, Siddha and other forms of herbal medicine.

English language education

In this era of globalization, command over the English language is a precious asset. It significantly improves access to information and employment. There is enormous popular interest in learning English, but most existing teachers are not qualified to teach it and fear for their careers if it is given importance. As a consequence, the rich-poor divide only widens. Rich children learn English and monopolise high paid jobs and the poor are condemned to low paid ones. Without antagonising existing teachers, the government can encourage private initiative to provide supplementary courses in English and support it to the extent that it will be affordable by all families.

New Methods and Delivery Systems for Adult Education

A mere expansion of the educational system will do little to help the hundreds of millions of people who have already missed or dropped out of the formal educational system. Innovative alterative methods are needed to extend basic education to these people as well.

Utilize flash card method for early childhood learning, adult literacy and school drop outs

Applied research in India based on methods developed in the USA has demonstrated that flash cards can be very effective for both early childhood and adult learning. These methods, which can be applied at home, in school, on television or over the Internet, involve very rapid flashing of words or general information on large cards at the rate of one card per second with simultaneous oral pronunciation of the words or explanation of related facts. Research indicates that the rate of learning achieved by these methods can be at least double those achieved through conventional classroom techniques. Delivered over the television, these method can rapidly improve reading capabilities at a far lower cost than alternative methods.

Develop video versions of the entire school curriculum for delivery over cable TV

Television can be a very effective means for educating both school going and non-school children and adults. It can deliver teaching material in a more dynamic, entertaining, and interesting manner, utilizing the nation's best teachers and multimedia teaching materials on each subject. A TV based curriculum can be utilized by slow learners to supplement classroom teaching, by fast learners to learn at much faster rates than the rest of the class, by drop outs to acquire knowledge they missed in school and by adults to expand their level of education without returning to school.

Farm Schools for Applied Agricultural Science

Knowledge leads to development when it is expressed in skilled action. That action requires practical skills for knowledge application. A primary reason for the phenomenal success of India's IT industry is the fact that India operates the world's largest system of computer training institutions. Over the past decade thousands of training institutions have sprung up around the country to provide knowledge and practical skills relating to every aspect and level of the IT industry.

Earlier we stated that the gap in India's agricultural productivity is primarily the result of a knowledge gap, rather than to the small size of land holdings or a shortage of sunlight and water essential for plant growth. In spite of the fact that agriculture is the primary occupation for two-thirds of the population, the agricultural education system primarily caters to those who seek employment in government or research rather than application of agricultural knowledge on the farm.

The highest priority should be given to establishing a national system of farm-based training institutions to impart advanced knowledge and farming skills to the nation's farmers. Farm schools should be established in every block of the country. Each farm school should consist of 10-20 acres of irrigated farm lands equipped with a sophisticated computer program for analyzing soil types and recommending best practices to achieve maximum yield and profitability and supported by access to a high quality, soil testing lab capable of accurately analyzing the complete spectrum of plant nutrients. Cultivation on the farm schools can be carried out on lands leased from local farmers by student farmers enrolled at the school and drawn from the local population, so that the demonstrations will have maximum impact. The farm schools should be self-sustaining, profit-making educational organizations. Each farm school should demonstrate multiple cropping patterns that generate a minimum of Rs. 25,000 to 50,000 per acre annual income. In this way, each farm school can achieve a minimum annual revenue of Rs. 5 to 10 lakhs and minimum annual profit of Rs. 2.5 to 5 lakhs from ten acres. Farm school instructors should be offered profit-sharing incentives to achieve maximum yields. After demonstrating high

yields for three consecutive years, they should become eligible for special loan programs to enable them to establish their own private farm schools.

Vocational Training for All Productive Skills

In most countries the ratio between engineers and technicians is 1:3, but in India their numbers are nearly equal. That forces many engineers to perform tasks that can be done better by technicians. The problem lies in the poor state of vocational training in the country. Vocational education is one of the weakest links in the educational system. Little social recognition is accorded to vocational skills or certification because of relatively poor career prospects and emoluments paid for vocational skills. Responsibility is divided between the Ministries of Education and Labour. Industries are lukewarm to the idea of supporting this type of education, except in fields such as computerization where the commercial rewards can be enormous. Academic institutions are not geared to provide quality vocational training in all its myriad forms.

Currently only 5 percent of the country's labour force in the 20-24 age category have undergone formal vocational training, compared with 28 percent in Mexico, 60 to 80 percent in most industrialized nations, and as much as 96 percent in Korea. This is an important reason why our share in global trade is very low. A strategy to achieve full employment must include as an important component a strategy to ensure that all new entrants to the work force are equipped with the knowledge and skill needed for high productivity and high quality.

The Government has created a national infrastructure of industrial training institutes that has been taken down to the block level. India has over 4200 Industrial Training Institutes imparting education and training in 43 engineering and 24 non-engineering trades. Of these, 1654 are government run ITIs, while 2620 are private. The total seating capacity in these ITIs is 6.28 lakh. Most of this training is conducted in classroom style in the form of 1 to 2 year diploma courses. In addition, about 1.65 lakh persons undergo apprenticeship vocational training every year in state-run enterprises. If a wider definition of applied courses is taken that includes agricultural, engineering and other professional subjects, the total number receiving job related training is about 17 lakh per annum, which still represents only 14 percent of new entrants to the workforce.

But it is now clear that national development involves upgrading the skills of the workforce on a much wider range of activities relating to every occupation. In addition to carpenters, metal workers, machinists and computer programmers, the country needs to produce large numbers of qualified journalists and illustrators to meet the needs of newspapers, television stations, and internet companies. It needs trained entrepreneurs, managers and supervisors to start and operate new and existing businesses. It needs more qualified lawyers' clerks, inventors, mechanics, marketers, trainers, physiotherapists, dental and medical technicians, teaching assistants and hundreds of other skilled workers for which there is no training or insufficient training presently available.

The existing institutions for imparting basic technical and vocational skills are limited in number, enrolment and the variety of skills they offer. There is already a shortage of basic skills in the country, which is why carpenters, masons and electricians are scarce and command such high wages. Craftsmen and vocational training institutes can be established in every block to impart a wide variety of basic technical skills including vehicle and pump repair, house and building construction, furniture making, printing and book binding, lathe operation, etc.

Vocational education can be split into two parts and offered as a sandwich consisting of academic courses after the elementary school stage and hands-on apprenticeship training under master

craftsmen. Employers can be asked to offer at least one apprenticeship for every ten employees with a stipend equal to, say, half the minimum wage or pay the equivalent of a cess.

The tremendous success of private computer training institutions in India, frowned on by some as an instance of commercialization, has enabled the nation to respond to the rapid surge in demand for trained software professionals which the public education system could not have accomplished on its own. Investment and active involvement of business in the development and delivery of vocational training programmes is vital for creation of a viable system. Rather than frown on profit making, incentives should be offered to businesses that evolve quality certification training programmes.

A comprehensive strategy is needed to enhance the nation's employable skills. It must begin by preparing a catalogue of the entire range of vocational skills needed to support development of the country. The network of vocational training institutes and the range of vocational skills taught needs to be expanded substantially to impart those skills for which institutional training is most suitable. The private sector, which promoted the rapid proliferation of computer training institutes throughout the country, should be encouraged to recognize the commercial potential of vocational training in many other fields.

A comparison of India with countries at higher levels of development will reveal that the workforce in these countries have acquired a greater range and higher level of skills in every field of activity. A comprehensive list should be prepared of those skills needed to support development of the country over the next two decades and a plan prepared to expand both public and private training institutions to offer these skills to the population. The farm school model can be adapted and applied to many other fields of activity such as school management, hospital management and small enterprise management.

Computer-based & TV-based vocational training

The nature of vocational skills makes it impossible for vocational schools to fully address the nation's need. The variety of skills needed by the workforce is far too great. The changes in technology and work processes too rapid for training courses and their instructors to stay up-to-date. The cost of training is also relatively high and often demands full time study for a prolonged period. Some vocational fields do not lend themselves to classroom or laboratory study.

In addition, it is essential to fashion more effective and efficient mechanisms for disseminating useful knowledge and skills, especially through the TV media and through computerized vocational training. The importance of computer has been widely recognized as a means to improve efficiency in business, government and formal education, but its application in vocational training is not fully appreciated. Rates of learning on computer are four to ten times faster than they are in classroom setting and learning retention is likely to be much higher. This is true for both academic as well as vocational or skill-based subjects. Computers can provide multimedia, interactive, customized and individually-paced learning with instantaneous feedback and testing. It eliminates the need for producing and deputing large numbers of highly skilled instructors. Course content can be rapidly modified to reflect changing needs. For many types of vocational skills, computerized training also offers specific advantages over the live delivery of skills in a classroom. Training can be delivered wherever computers are available.

Private software companies can be commissioned to develop education and training CD-ROMs and videotapes to disseminate useful knowledge and skill in many different fields. In the USA such material already exists for acquiring knowledge and skills in such diverse fields as CNC

machining, mining and excavation, foundry maintenance, aluminium smelting, engine repair, aviation training, law, psychiatry, fire-fighting, furniture and upholstery making, door panelling, industrial safety, driving and police training. Programmes can be developed in crucial areas such as methods to improve crop productivity, recharging aquifers, machinery maintenance, machining and tool making, medical testing, etc.

A nationwide network of 50,000 computerized vocational centres, run as private self-employed businesses similar to the STD booths and Internet cafes, can deliver low cost, high quality training to 10 million workers every year—more than five times the total number covered by existing programmes Incentives can be introduced to encourage private sector investment to establish computerised vocational training centres to offer knowledge and skills for a wide range of vocations..

Higher Education

Since Independence, India has built up a substantial infrastructure for higher education, yet the system suffers from a variety of inadequacies. In most cases, education does not match job requirements. A large percentage of graduates remain unemployed. The content of the curriculum does not keep pace with rapid advances in knowledge. Most teachers are under-qualified or of poor calibre. Most talented students migrate abroad. Infrastructure facilities are insufficient. Recruitment and promotion are politicized and caste-based. Seniority rules preclude recognition of merit. University bureaucracy and policy-making are too slow to keep pace with rapid advancements of knowledge. There is no system for discontinuing outdated courses. Research positions are not sufficiently attractive to the brightest students. These deficiencies are not easily eradicated from the system without changes in the basic strategy for delivery of higher educational content. A new approach is needed that shifts the emphasis from classroom based teaching to full utilization of all available technologies to delivery content in the most cost- and quality-effective manner.

Develop multimedia forms of the school & college curriculum for delivery over the Internet

The advent of the Internet offers an exciting new learning medium that can literally transform our concept of school and classroom from physical into virtual realities. Future studies in the USA project a radical reshaping of higher education over the next two decades as a result of the digital revolution. Many traditional colleges will close as more course work is delivered at a distance through alternative channels. The traditional boundaries between education and other sectors will fade as publishers, for-profit and non-profit organizations offer accredited, multimedia-enhanced courses directly to students by-passing the university. The traditional classroom type of education, which is most useful for students that require personal attention and assistance and for subjects that involve hands-on experimentation, will no longer be the predominant model. For all other purposes, it is very costly and not very efficient in the way it uses the time of both teachers and students. Given the huge numbers of young Indians that will quest for higher education in the coming decades and given India’s outstanding expertise in the IT industry, the country should embark on a massive program to convert the entire higher educational curriculum into a multi-media, web-based format and to establish accrediting standards for recognition of distance education courseware.

Community colleges

Education begins with literacy but should not end there. Adult literacy programmes should be augmented by post-literacy and vocational programmes to transmit knowledge related to the

individual's the social and cultural environment. Drawing lessons from the phenomenal success of community college systems in Australia, Canada and USA in providing wider access to higher education to both students and adults, India should develop its own system adapted to the specialized needs of the country. India's model should include courses designed to meet vocational, professional and personal interest needs including subjects such as music, media, computer, agriculture, horticulture, banking, hotel management.

Social Systems for Knowledge Dissemination

In addition to the educational system, India can adapt from other countries and originally innovate a wide variety of other organizations to facilitate the generation and dissemination of Knowledge to the population.

Build a National Rural Information Delivery System

Knowledge is a catalyst for the development process. The gaps in practical knowledge that retard development can be identified and filled by creating new systems and institutions to transmit information that is not being adequately conveyed by traditional means.

Several efforts are already underway in the country to utilize the Internet as a medium for delivering practically useful information to the rural population. Within five years, every revenue village in the country should be equipped with a web-based computer system providing timely information, including prices for agricultural commodities in local and regional markets, technical advice on issues such as pest alerts for local crops, advice on health and nutrition, announcements of government programs, credit schemes, school and college scholarship applications, and self-employment opportunities. Such a system can form the backbone of a national development information system that caters to a wide range of practical needs.

Awards for Social Innovation

Awards can be a highly effective means to stimulate innovation, dissemination and application of knowledge in new ways. Three different levels of award can be established: for imitation from other countries or fields, for imitation adapted to local conditions, and for pure original innovation. Literally hundreds of awards can be introduced at the national, state and local level to promote research, innovation and application of better methods.

- Awards for improving utilization of any resource such as water conservation methods or reduced electricity consumption: In the 1980s, the State of California instituted a prize leading to the development of refrigerators that consuming 50% less electricity. The resulting savings eliminating the need for constructing thousands of megawatts of additional power generation capacity.

- Awards for innovation of practical technologies: When Napoleon was seeking a means to conserve food so that his army could move more quickly and further from base, he instituted an award that led to the development of canned foods.

- Awards for application of technology to achieve higher productivity or better quality: One pioneering farmer has recently demonstrated maize yields four times higher than the average in India. Another has achieved levels of productivity for vegetables equivalent to those reached by California farmers.

- Awards for improved government administration to provide faster, more convenient or quality public service.

- Awards for high performing public and private sector companies that demonstrate highest productivity, efficiency, quality and profitability.

- Awards for management excellence in fields such as banking, medicine, hotels, retail, transportation, telecom and industry.

- Awards for innovation in education, including development of new vocational courses and more effective teaching methods.

- Awards for public education: Television stations that develop outstanding educational or vocational training programmes, computer companies that produce innovative educational software, and newspapers that publish the best educational columns can be recognized.

Establish a National Knowledge Foundation

In earlier centuries, development has been an unconscious process of the society that occurred gradually over decades by trial and error exploration and experimentation. Only in the 20th century did government take upon itself primary responsibility for directing and achieving the development of society in order to accelerate and abridge the process. But experience has proven time and again that government cannot develop a nation. Development is a process that involves awakening and releasing the energies of the whole population and propelling them into action. At most, government or any institution can only guide, support and facilitate that process.

A new possibility exists today, drawing upon the experience of this country and other nations, to convert the *unconscious process* of development into a *conscious social movement*. Indian development is taking place as an unconscious process. What now occurs in 10 or 25 years can be abridged to 3 or 5 years by making the process fully conscious. Making it conscious means that the society as a whole becomes aware of the process of development taking place in the country and endeavors to support it. Objective, factual information and rejection of superstitions--both traditional and modern--are essential conditions for making it conscious.

The leader of this movement can be any institution that understands the process, identifies the stage of society's current development and recognizes what is needed to propel it to the next stage. An institution of this type can accomplish in many fields what until now government has sought to accomplish through huge investments and comprehensive programs. The creation of a National Knowledge Foundation can accelerate the gradual process of social development in the country and convert it into a *National Prosperity Movement*. A National Knowledge Foundation can play a central and unique role in the development of the country and evolve a new type of social institution as a model for India and for other nations to emulate.

In India today there are many areas where considerable progress has been made and many in which neither the goals or right methods and steps are very clear. The creation of a National Knowledge Foundation can help make Indian society conscious of its direction and goals and offer it the intellectual clarity and practical guidance needed to achieve those goals. This can speed up the process, avoid lapses and pitfalls, inspire the elite with hope and give the masses material support to progress.

The role of the Foundation could be to:

- disseminate information about opportunities, technologies, programs, accomplishments, and achievements;
- conduct and commission studies and surveys to obtain quantifiable statistical data in support of important issues and then publicize the data to educate policy and decision-makers;
- prepare documentaries presenting effective strategies to achieve the results; compile directories of best practices in each field;
- publish reports on the suitability and profitability of more productive technologies;
- study and publicize successful systems and organizational innovations in every field;
- publish newspapers, journals and syndicated columns in other journals to disseminate information on success stories and best practices, publicize research findings, challenge superstitions and out-moded beliefs, and report on successful initiatives that should be imitated;
- establish models and demonstrations of new development potentials and solutions to problems;
- provide assistance to pioneers who agree to take up a new activity as an example to others; establish programs to support those who want to imitate the pioneer;
- institute national and local awards to encourage and recognize innovation; and commission short stories and novels portraying the development potentials and achievements in dramatic and interesting fashion.

The Foundation would have the option of supporting constructive programs in a wide variety of fields without being guided by any overall master plan or strategy to accomplish any specific development goals. This is, in fact, the normal mode of functioning for institutions of this type. However, it would also have the option of trying to become an institution of a new type, which assumes for itself certain overall national objectives and develops an agenda of programs designed to achieve them.

It is in this sense that The Foundation can play a role in promoting Indian prosperity akin to that which the Indian National Congress played in Indian freedom. As the Congress awakened the nation to its political potentials and generated a mass movement in support of specific political goals, The Foundation can awaken the nation to its vast economic and social potentials and unleash a mass movement of the population for national prosperity.

Rightly conceived and properly executed, The Foundation's programs can highlight literally hundreds of "next steps" which Indian society can take to further its development. By studying the process of development in more advanced nations and more advanced parts of the country or sections of the population, these steps can be readily identified, appropriately modified to suit present conditions, and then presented to the population in a form that the people will readily understand and act upon.

The Foundation can generate a national register of possibilities and potentialities of the country covering all fields of the national life and make it available to the public so that it can be made more comprehensive by their further contributions. When the initiative for development is taken up by the people, then development ceases to be a program of the government and becomes a movement of the whole society. Once created, The Foundation can achieve in a brief period and with token investment developmental results comparable to those achieved by the five year plans.

A comprehensive strategy covering major sectors such as agriculture, industry, commerce, education, environment, health, management and public administration can be developed and executed over a five year period. The strategy could be implemented with an investment ranging from Rs 100 to 500 crores, much of which could be funded on a project basis rather than from the Foundation's endowment.

The programs could include--

- 100 - 500 studies of development potentials and problems to get at the facts
- 100 - 500 information publicity campaigns to project the opportunities
- 100 - 500 documentaries to educate and motivate people for action
- 100 - 500 syndicated columns to disseminate new perspectives and findings
- 100 - 500 articles to dispel out-dated superstitions and beliefs
- 100 - 500 short stories to dramatize development potentials
- 100 - 500 demonstrations of how to tap the potentials
- 100 - 500 success stories to publicize achievements
- 100 - 500 seed projects to support pioneers
- 100 - 500 programs to encourage imitation of the pioneers
- 100 - 500 awards to recognize pioneers, innovators and high achievers

The Foundation can educate the elite of the country, the framers of public opinion, which means the *national mind*, and create a Blue Book on Indian Prosperity spelling out actions that are needed for achieving rapid development in all fields. *The Foundation can become a model for a new type of institution, not only for India, but for other developing and developed nations and for the international community.*

Promote professional associations

Government, business, educational institutions and the media can play crucial roles in national development. But, in addition, there are many types of non-governmental, non-commercial organizations that can make vital contributions to the country’s progress. Among these, professional associations are a category whose importance is often overlooked. There are over 16,000 professional associations in the USA covering the entire gamut of human activities from broad general categories such as law, medicine, engineering, agriculture and computer science to highly specialized fields such as tool & die manufacturing, plastic injection mould-making, custom home electronics installation, hybrid seed production, irrigation engineering, mining technology, internet banking and web marketing. Associations of this type can serve as powerful instruments for the generation, adaptation, dissemination and application of knowledge. They can sponsor research, conduct conferences, encourage pooling of information and exchange of

experiences, publish new research findings and best practices, propagate management practices appropriate to each specialized field. India can benefit enormously by a proliferation of professional associations. Creation of new professional associations can be supported by the formulation of criteria and standards for professional associations; establishment of a national, non-governmental agency for accreditation of new associations; and creation of a venture capital fund to provide seed money for the promotion of new associations.

Establish national network of centres for research & public debate on development issues

Public debate is a well-developed institution in India, but too often it focuses on emotionally charged political issues backed by little supporting information, rather than on objective analysis of the nation's development opportunities and challenges—a role which public television very effectively plays in the USA and other Western countries. When properly conceived and executed, public debate can be an effective mechanism for creating awareness, disseminating information and sensitizing the population to development issues.

As the national scientific laboratories were established in the 1950s to create the essential infrastructure for research, we propose the establishment of a national network of centers for research and public debate on development issues. Each center could conduct research on pressing regional and national development issues, host public debates open to specialists and the general public, and arrange coverage of these topics by regional newspapers, radio and television. These debates should focus on issues that can strongly influence the general public and spur people to constructive action. Debate topics could include --

- *Solutions to national and international disputes:* such as political, social and economic solutions to the Kashmir problem and to water disputes between states.

- *Educational standards and curriculum:* Comparison of educational standards in different types of schools, regions of India and different countries to assess the scope for improving standards and making the school curriculum more relevant to the needs of individual students and the development of the country.

- *Self-employment vs. Salaried jobs:* The opportunities and benefits of self-employment for achieving higher income and greater economic security.

- *Management practices:* The tremendous importance of management practices in determining the success or failure of business enterprises of any type and size, indices of good practices and ways to acquire greater knowledge and skill.

- *Labor productivity:* Differences in labor policies, attitudes and practices in different regions and countries and their impact on the development of business and the prosperity of the working class.

- *New forms of democracy:* Examination of practices in different parts of the world designed to make democracy more representative and effective in fulfilling people's needs and national goals.

- *Savings vs. investment:* Discussion of strategies to tap India's huge reserve of private gold savings (estimated value is upwards of $200 billion) for investment in national development.

Compile an Internet-based Development Encyclopaedia

Over the past five decades, the pace of development has accelerated around the world. Changes that used to occur over centuries or decades are now occurring within a few years. Humanity's knowledge of development is accumulating so rapidly that it is difficult to keep track of all that has been learned or to access information on relevant experiences in specific fields.

The advent of the World Wide Web now makes it possible to create a compendium of development knowledge, information and experience, a well documented and continuously updated source of knowledge and practical experience on all fields of national development. This Development Encyclopedia could view every subject from the perspective of social development. It could catalog proven technologies, successful strategies and best practices in different fields, so that the information is readily accessible to people all over the country.

Compilation of the encyclopedia would need to be managed by a central editorial team, but the actual generation of material could be contributed by thousands of experts located around the country. All contributions could be screened and edited, placed in a central repository on the web and updated regularly for a fraction of the cost of printed sources of information. Since publication of new material would be progressive and continuous, the Encyclopedia could be launched and operative very quickly and continue to grow in value as additional material was added.

The Encyclopedia could contain both theoretical knowledge and practical information. On the theoretical side, it could examine topics such as the role of agriculture as an engine for employment and industrialization, the global growth of the service sector as the major source of new jobs, the impact of information technology on productivity and economic growth, the role of social and cultural values in development, the relationship between peace and development, the impact of rising levels of education on democracy and economic development, the relationship between education, prosperity and corruption, and the relationship between inflation and development. It could contain articles examining the factors responsible for the development achievements of different countries. It could formulate a series of scales and indices to compare the effectiveness of social organizations in different countries.

On the practical side, the Encyclopedia could document both in text and multimedia format methods to improve agricultural productivity, preserve foodgrains, conserve water, recharge aquifers, improve nutrition and health care, create low-cost housing, introduce complementary local currencies, stimulate entrepreneurship and job creation. It could catalog and evaluate alternative technologies for power generation, agriculture and aquaculture, various industries and environmental protection. It could compare the effectiveness of public policies and administrative systems in different countries and regions.

The Encyclopedia could also become a virtual forum for national and international debate on policies, priorities and strategies for national and international development.

Formulate a comprehensive theory of development

Theoretical knowledge is the highest level in the hierarchy of knowledge that rises from data to information to ideas. Good theory represents the essential knowledge contained in vast quantities of data, information and practical experience. While it is relatively easy to compile a large quantity of data and information about development, when it comes to drawing theoretical

conclusions that will be valid over time and space, all the knowledge we have acquired over decades and centuries gets distilled into a few principles.

Looking back on the impressive accomplishments of the 20th Century, a vast multitude of technological inventions, economic activities, political and social organizations, and material riches have emerged from the relatively less complex and accomplished centuries that preceded it. A whole new range of problems and challenges has accompanied these achievements. Looking forward on the century now commencing, we may well wonder what further accomplishments await humanity, what new challenges they will pose, and what ultimate limits there may be to the creative process that drives these changes.

Regardless of whether we look backward or forward, the same questions arise: What is the essential nature of human development? By what process does it occur? What force accomplishes it? What factors propel and retard it? What conditions are essential or detrimental to it? Through what stages or phases does it pass? What is the role of the individual in this process? What is the relative importance of subjective factors such as ideas, attitudes, values and choices, compared with objective factors such as material resources, political systems and technology? What is the source of the problems and failures that it generates? *And, most importantly, what is the role of the human being in this process?*

The formulation of valid theory possesses enormous power to elevate and accelerate the expansion and development of human capabilities in any field, leading to fresh discoveries, improvement of existing activities and capacity for greater results. Science is replete with examples of theoretical formulations that have led to important breakthroughs, such as the discoveries of Neptune and Pluto, electromagnetic waves, subatomic particles, and new elements on the periodic table. A broad range of technological achievements in this century has been made possible by the emergence of sound theoretical knowledge in fields such as physics, chemistry and biology. As management expert Peter Drucker put it, "There is nothing more practical than a good theory." Valid theory can tell us not only what should be done, but also what can be done and the process by which it can be achieved.

Social development can be summarily described as the process of organizing human energies and activities at higher levels to achieve greater results. Development increases the utilization of human potential. In the absence of valid theory, social development remains largely a process of trial and error experimentation, with a high failure rate and very uneven progress. The dismal consequences of transition strategies in most Eastern Europe countries, the very halting progress of many African and Asian countries, the increasing income gap between the most and least developed societies, and the distressing linkage between rising incomes, environmental depletion, crime and violence reflect the fact that humanity is vigorously pursuing a process without the full knowledge needed to guide and govern it effectively.

Advances in development theory can enhance our social success rate by the same order of magnitude that advances in theoretical physics have multiplied technological achievements in this century. The emergence of a sound theoretical framework for social development would provide the knowledge needed to address these inadequacies. It would also eventually lead us to the most profound and practical discovery of all – the infinite creative potentials of the human being.

Now is an appropriate time to launch a new inquiry into the theoretical basis for human development, drawing upon five decades of rich experience both within India and internationally, in order to fashion a fresh conceptual framework for the development process that will give us a

greater theoretical understanding of its essential nature and a greater practical knowledge of how it can best be fostered and accelerated.

Knowledge-based Industries

No discussion of India's emergence as a Knowledge Society would be complete without reference to the central role played by knowledge-based industries in this transformation. This term is often used with reference to industries directly involved in the creation and application of computer hardware and software and the information and communication technologies that have spurred the growth of the global IT industry over the passed two decades. Numerous studies have been undertaken by NASSCOM identifying specific strategies that will support and accelerate the development of the IT industry in India. These strategies call for increased public and private investment in telecommunications infrastructure, liberal policies regarding investment, trade and taxation, and increasing investment in technical education.

Enhancing educational capabilities in software services is one of the essential thrust areas for upgrading technical education. Currently, India trains some 68,000 software professionals a year and has around 280,000 people working in the software service sector. To maintain and enhance its capabilities, India needs to develop over 2.2 million additional knowledge workers by 2008 and it needs to ensure that this workforce is equipped with the right mix of technical, business and functional skills to meet the needs of different business segments and customer markets. This will require a significant development of IT related education both in quantitative and qualitative terms.

But the term 'Knowledge-based industries' includes a much wider range of commercial opportunities. The recent growth of IT enabled service businesses in India—call centres, medical transcription, technical support and back office processing—are powerful evidence that the potential of IT technology and knowledge based industries extends far beyond the development of software and hardware. As the application of information technology spreads and saturates traditional industries, it can generate new employment opportunities ten times greater in number than those directly involved in core IT industries.

The concept of Knowledge-based industries can be extended still further to encompass all those in which the application of mental, judgment and skill rather than the application of mechanized production technology is the core resource. Education, health services, insurance and financial services are among the leading industries in this category. They are also among the fastest growing industries in the world. Added to these there is enormous scope for other knowledge intensive activities such as clinical drug trials and many types of scientific research.

The management of all types of information is emerging as a major growth industry worldwide and India is well poised to become a global leader in these fields. Increasing demand for education within the country and worldwide will create tremendous demand for qualified teachers with adequate language skills. Increasing demand for health services will create even greater demand around the globe. Already nurses and medical technicians are in short supply. The USA has a doctor-nurse ratio at least twice that of India. Yet the US currently faces a shortfall of 117,000 nurses, which is more than three times India's total annual production of new nurses. Physicians, nurses, medical technicians and other scientific occupations will become growth industries to rival the IT sector within the next decade.

Public Policies

What can India do to avail of these emerging opportunities? Foremost priority must be given to education of all types and at all levels. It should now be abundantly clear that India's vast population can be converted into a tremendous development asset by equipping all its people with the requisite knowledge and skills. Whatever the country may be lacking, intellectual capacity is not among those deficiencies. But development of that native capacity to its full potential will require an enormous commitment and effort by the entire society. India's leaders need the clarity and far sight of vision to see that knowledge in all its forms offers a key to the country's emergence as an economic superpower.

Among the most critical policy issues will be those relating to formal education and the development of the electronic media as instruments of education.

Investment in Education

Our vision of India in 2020 is predicated on the belief that human resources are the most important determinant of overall development. But full development of India's enormous human potential will require a shift in national priorities to commit a greater portion of the country's financial resources to the educational sector. India currently invests 3.4% of GNP and 12% of total government spending on education. This compares unfavourably to countries such as Mexico which invests 5.5% of GNP and 23% of total government spending on education. A doubling of investments in education is the soundest policy for doubling the country's GDP.

Expanding the nation's corps of school teachers

A tremendous expansion in the number of teachers will be required to support a quantitative and qualitative improvement in the country's school system. Eliminating primary school drop outs and reducing the teacher pupil ratio from the present high level of 1:42 down to around 1:20 will together require an additional three million primary school teachers, tripling of the number currently employed. Similar increases will be required at upper primary and secondary school levels. The training of such large numbers will require the establishment of additional teachers training colleges and much larger budget allocations for teachers' salaries. [iii]

Expansion of schools and classrooms

A tremendous expansion in the number of schools and classrooms will be required to support a quantitative and qualitative improvement in the country's school system. In order to achieve the best case scenario depicted in Table 8, total school enrolment would have to increase by 75 million students or 44%. That would require a proportion expansion in the number of classrooms. In addition, efforts to improve the quality of education by reducing class size would require further 20% increase in the number of classrooms. Together, this would require increasing the total number of classrooms by 65% within 20 years.

Role of Private Sector

Such a dramatic improvement in the quantity and quality of the nation's educational institutions cannot be achieved without enlisting and unleashing the full and active participation of the private

sector in the expansion and upgradation of educational facilities and operations. Introduction of more modern curricula, upgrading teaching skills and standards, more efficient management of schools and financial resources, and innovation in teaching methods will all require strong involvement by private corporations. This can be achieved by policies to encourage investment in education and incentives for delivering quality educational content to poor sections of the population.

Computerizing general education & vocational education

Mere quantitative expansion in classrooms and teaching staff is an efficient way of tackling the nation's educational deficit in the age of computer. Recent experience has proven that computerizing education, i.e. utilizing computer and computerized teaching materials as instruments for general education, can dramatically increase the quality of education and the speed of knowledge acquisition, while dramatically decreasing dependence the knowledge and skill of teaching staff.

A fundamental policy decision should be made to fully utilize the capacities of computer for general education, not just for computer training, and to launch a major initiative to convert the entire school curriculum to computer-based, CD-Rom teaching materials.

The effort at computerization can be extended to include not only general school curriculum but vocational training on a very wide range of occupational skills, which can then be made accessible through private and public vocational training outlets throughout the country.

At the same time, a national campaign should be launched to develop low-cost teaching computers that can introduced into existing schools on a very large scale. A tie-up may be possible with major international computer manufacturers to provide long term credit for this investment as it will serve as model for other countries and expand the entire world market for educational computers.

ENDNOTES

[i] Data in this table is from the FAO web database for 1999.

[ii] The figure for USA wheat yield is for irrigated wheat which is the best comparison since almost all Indian wheat is irrigated. The overall average yield for irrigated and rain-fed wheat in the USA is 2872 kg/ha.

[iii] Current TPR is 1:42 for primary, 1:37 for upper primary and 1:31 for secondary level. An additional 9 lakh primary teachers will be required to support 100% net primary enrolment in 2016 (an increase from 79 million to 116 million students). To reduce TPR from 1:42 to 1:30, an additional 11 lakh teachers will be required, bringing the total to 39 lakh teachers, which is double the present number. An additional 5 lakh upper primary teachers will be required to support 100% net upper primary enrolment in 2016 (a net increase from 46 million to 66 million students). To reduce TPR from 1:37 to 1:30, an additional 4.5 lakh teachers will be required, bringing the total to 22 lakh teachers, compared to the present level of 12.5 lakh. Higher enrolment and lower drop out levels in secondary school could require a doubling of the high school teaching corps which presently consists of 15 lakh teachers.