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PERSONAL

By Hand

DAP to Mashelkar

April 12, 1999

Dear Ramesh;

Thank you so much for your kind letter No DG/PS [243]/99-409 dated 16th March, 1999 enclosing a copy of your Lecture on **The Economics of Knowledge.**

As expected, it is a brilliant exposition—clear, concise, persuasive and penetrating. My congratulations.

My comments on/reactions to, the numerous points, propositions and arguments you have presented in the Lecture are follows :

(a) It has often been said that India is unique not only in the developing world but also in the highly industrialised world. A key feature of this uniqueness is that our society is a highly stratified one—politically, economically, socially and culturally. This reality has been attempted to be captured by formulations like "India lives concurrently in the 16th to 20th (and now perhaps the 21st) centuries". Our society is characterised by deep and brutal inequalities of all kinds, and unfortunately, recent studies seem to

suggest that these inequalities have tended to accentuate since the launching of Liberalisation, and Globalisation in 1991. The danger of there being not just two India's -- the rich and the poor the urban and rural-- but indeed of many Indias' is becoming, if it has not already become, a grim reality.

(b) If we are to overcome the above problems and create an equalitarian society-- let alone an equitable and just society--we need ACTION on a whole host of issues, the knowledge for which is already exists--from the successful experience of either the developing or highly industrialised countries and, in some cases, both. The grim reality of our predicament however, is that none--or almost none--of that ACTION is being taken. This is largely because of the ineffectiveness, the inappropriateness and the corruption of most of our institutions--be they political, economic, social or cultural--public or private. As a result the ACTION needed to rapidly improve the conditions of bulk of our people is just not being taken.

(c) The Nehruvian, Indira Gandhian and Rajiv Gandhian heritage we have been so very fortunate to have in S&T, a heritage, a capacity and a capability in S&T which all of them believed would be a key and powerful instrument for rapid and equitable all round development, has, because of (a) and (b), not taken place. All the leaders mentioned above believed that modern S&T, including the most advanced and sophisticated forms of such S&T would be the independent variables, and that our political, economic, social and cultural problems and institutions would become dependent variables of that S&T capacity. Most tragically, however, our experience over the last 50 years has belied that hope of theirs: We have found that in

area after area, S&T is the dependent variable, and often, a pathetically weak dependent variable at that. Our performance and present predicament in the areas of health, education and welfare, are classic instances of this. We have the knowledge to make all our people literate--indeed to have made them literate and even semi-skilled by now--but we have failed to use that knowledge, including S&T--in terms of both pedagogy and substance--to attain the objective. The same is the situation in the area of malnutrition, communicable disease eradication or population control. The condition of the approx 250 million Dalits and Adivasis-- 25% of our population --is a blot on our nation.

(d) You state in the penultimate para at the bottom of page 5 that :

> "One might wonder as to why physical assets, such as machinery in a factory, are becoming less important. Plant and machinery are tradable commodities today. Even capital was a scarce commodity until recently and was used as competitive advantage. But with globalised markets the companies around the world have access to finances at inexpensive rates. So even capital is no longer a scarce commodity. (emphasis mine) It is intangible assets which are knowledge based, and that are non-replicable, unique and proprietary, that are providing companies with a competitive edge".

I understand and resonate with your analysis However, the realities are that the above para is really applicable more to, if not only to, the highly industrialised countries of the OECD. For us who still have a long way to go before we have built a modern agricultural and industrial economy somewhat approaching even that of the OECD countries of today, "physical assets such as machinery in a factory" are not becoming less important; they

continue to be of great importance. Similarly several items of plant and machinery, particularly in key industries like IT, Atomic Energy, Space and in the whole of the Defence system are not tradable commodities for us today. This is because; the OECD/NATO is and has been subjecting us to embargos and severe restrictions of access to those commodities since at least 1975. Similarly again, capital is still a scarce commodity for us as our high interest rates compared to those of the OECD reflect. Even foreign capital, whether FII of FDI from the OECD, is a scarce commodity for us because we have to compete with OECD countries themselves i.e. intra OECD flows of FII & FDI, and with East Asia and China for them.

(e) So, we must keep the importance of knowledge-based industries, and knowledge-based economic activities more broadly in proper perspective. We need to build industrial muscle power (by way of industries producing basic, intermediate and consumer goods for a (hopefully) terminal population of around 1.5 billion Indians by 2030. Such muscle power is, in my view, as important as knowledge power for us. Then there is our capacity to produce the food, fodder and fuel for our vast agricultural system, in which Biotechnology can and must play a crucial role in the next 10-15 years, and BT involves a number of elements in addition to knowledge bases.

(f) I also do not agree, I am afraid, with your observation:

> "Let us realise that India is not being looked at as a bottomless pit of demand but as a global competitor" (emphasis added)

The whole behavioural pattern of FIIs and companies coming in here with FDI over the last 8-9 years is to tap the BEM i.e. The Big Emerging Market of India's supposedly 200 million "middle class" (which really refers to our rich class). Their gross misassessment of the size of that "middle class" and its effective purchasing power, can be seen in industry after industry—be it white goods, autos, telecom (e.g cell phones) consumer electronics etc. and even basic primary products like steel & cement being in serious trouble. Yes, there is a place where India is being looked at as " A global competitor". However it is not at Microsoft, Compaq, or the numerous IT companies across the USA where this is happening (because our so-called IT exports are largely of technically low levels, with low value added, and in the form of sub-contracts from US IT giants, rather than as autonomous ~~competitors~~ competing sources of supply) - though this is changing in our favour to some extent in the last 2 years. Where India is being looked at as a threat— not a remotely as a competitor in the politico-strategic terms in the US White House, State Department, Pentagon and CIA and in their equivalents in the UK, Canada, Germany and other NATO countries', that this threat is being perceived. and a de-stabiliser of a cosy G-7 and P-5 (UN Security Council) dominated world.

Which also will collapse if the price of food is increased by just a factor of 2

(g) The points you make in the next para to the above quote and in the It is section entitled "Building Knowledge Networks": are very well taken. However, your plea that:

> "There has to be a meeting ground between the long term horizon of R&D institutions and the short term horizon of (OUR NATIONAL) business units". (insertions in capitals mine)

This is a plea we have been making since as far back as 1970, if not earlier. Yet, business has not really changed its mind set. If it had, one would not see a household name like Godrej in the area of domestic refrigerators rush to tie-up a 50:50 "partnership" with a GE, USA which itself is in serious trouble in its domestic market viz. the USA, as a result of the massive onlaught of Sanyo, Mitsubishi, Samsung, Electrolux and Bosch. The Godrej family did not seem to see that GE USA was getting more out of the JV than themselves - tragically, they are beginning to "discover" it now - 5 years after the tie-up was consumated.

(h) I am afraid I do not think or assess "CSIR's "partners" today include giants such as Mobil, General Electric, Du Pont, Boeing and so on", as necessarily a positive development from a national economic/commercial competitiveness or national interest (including security) point of view. This is because, I have always held and continue to hold the view that the fruits of the technological outputs of our R&D institutions, particularly, when like CSIR, they are set up and dominantly financed by Government, should go only to Indian companies in both the public and private sectors and thereby increase the international competitiveness of our companies. CSIR laboratories like NCL may gain in terms of cash flows to them from abroad but the nation as a whole would lose - a point Paul has expressed to me with concern about. So, this type of "globalisation of knowledge/know how/technology/expertise", I do not, I am afraid, support. What is more, if we do not follow the kind of policy I have argued for at 'A', the technological gap between our country/companies and those of the OECD will continue to widen rather than shrink. The fact that this deleterious

Paul Ratnaraj

development is taking place as a result of the use of the brains of Indian scientists and engineers only makes it more deleterious, indeed ironic:

The points you make in the next para of that page, is fine from the viewpoint of the TNCs, but not from our viewpoint. May I draw your attention in this connection to the fact that Japan and South Korea have long followed and continue to follow, "quietly" a policy in which none of their government laboratories e.g the Electro-Technical Laboratory of the Agency of Industrial S&T of MITI, or the many laboratories of the Ministry of Posts and Communications of Japan let alone the laboratories of Japan's national telecom monopoly NTT, accept any contract research from non-Japanese companies. Equally, the Bell Telephone Laboratory of the USA does not accept contract research projects from Hitachi or Alcatel or Siemens.I also know from long association with MIT, USA and the Tokyo Institute of Technology, Tokyo, that proposals for contract research made to them by foreign companies are screened extremely carefully and not accepted, where confidential US Government agency-based or MITI-based internal committees feel that such acceptance of a particular applied research or development and engineering project would compromise or even weaken the economc/commercial (not security)competitiveness of US or Japanese industry respectively.

I am afraid I have similar reservations is regard to the propositions, arguments, you make and the positions you take in the last para of page 10. A key issue to me is what exactly is the nature, dynamics and cost-benefit to India of the "partnering" you argue for.

I would also suggest that the statement:

> "The high technology companies are asking as to what skills, capabilities and technologies they should build up, rather than asking a stereotype question, as to which ~~makers~~ markets should they enter, and with which products".

needs reconsideration. Subject to our agreeing on a more precise definition of " high technology companies," I do not see the behaviour of almost any companies of the OECD countries in almost any sector of industry in our country in which the approach of the "hi-tech cos," is skills/capabilities/technologies oriented rather than which markets they should enter. The way OECD companies have rushed into the only two remaining BEMs viz. US and China in almost all sectors which government policy permits them to enter, clearly indicates that access to markets is a MAJOR consideration even for "hi-tech" companies. My position would be that such companies take both skill etc and markets into account with a tilt towards markets.

(i) I need hardly say that I agree entirely with you on your position in regard to IPR. All the points you make in paras 1 and 3 of page 11 are well taken. However, I would like to encapsulate all the points you make in para 3 into the formulation that we do not have " An IPR Policy" as you elaborate on the first two paras on page 14 but also associated strategy and tactics. We urgently need to design and start implementing such a policy, quietly and in a highly confidential if not secret manner—INSOME RESPECTS—as the OECD boys do. I am working on such a policy and strategy paper to

address the consequences of the recent amendments of our Patents Act in conformity with the TRIPS provisions, our adherence to the Paris Convention and the PCT so as to minimise the damage to, and maximise the benefits from, these legislation as a nation. Will share with you when it is ready.

(j) Where in regard to IPR I have some difference with your formulation is in regard to the points made in para 2 on page 11. As I go around our labs, IITS, RECs, and industrial R&D centres--but particularly the labs and the higher educational institutions - I find that, despite "Many of the Indian R&D institutions and industrial firms (having) so far focussed on imitative research or reverse engineering", there are huge amounts of IP "lying around" which neither the scientists and engineers who have worked on the projects which have generated that IP, nor the managers and the Directors of the institutions concerned, JUST DO NOT KNOW/APPRECIATE is "gold " from an IP standpoint. It is not reverse engineering, though reverse engineering has also taken place and continues to take place. You will recall what happened on Bamboo in NCL. I have identified some patents that Ashok Jhunjhunwala of IIT, Madras could have taken out on WILL, which he has not done because he and Director Natarajan did not know/understand/appreciate adequately enough their IP potential and significance. You know that NRDC has got both US and EPO patents for the blood clot remover anti-thrombotic drug which NRDC and the laboratory concerned -- a tiny Vector Control Research Centre of ICMR in Poindicherry-- have registered under the name "Thrombinase". It is a completely new molecule being jointly commercialised by NRDC and the

pharma company Maladi in Cheenai and is giving fantastic results in terms of purity, speed of blot clot dissolution (6 times faster than "the industry standard" for so long viz the drugs Streptokinase & Urokinase of Sandoz) toxicological side effects (next to nil) and which is now moving into Phase III trials. The same applies to the Gene Therapy Technology developed by a South Campus of Delhi University professor and which NRDC has worked out arrangements with top US pharma companies and Japanese pharma companies for USD 2 million plus royalities of 5% for 18/20 years of which you are aware fully. As you well known there are many many such champions, which, I feel people like you and me should bring to the attention of the nation along with our general approach of the need to move away from primitive reverse engineering.

(k) Your idea that

> " Agencies should be set up to buy knowledge for the public good, including by using principles used in land-acquisition proceedings-but this requires a clear legal and policy framework."

in para 2 of page 12 is excellent. We should develop the idea further and bring it to the stage and shape of a concrete proposal for consideration by Government at the earliest.

"We need innovation in the IP system itself". Well said. Let us work on a policy, strategy and tactics paper I referred to earlier in regard to IP.

(l) "We need to push for TRIPS plus, meaning TRIPS plus equity and ethics" is super. That is the slogan both of us and the entire S&T and Development communities in the country should be, "broadcasting" as we go around the country and as we address diverse audiences and opinion makers.

(m) All that you say and say so well in regard to traditional knowledge and our communities which generate them, resonates particularly strongly with me now, in my position as Secretary, National Commission for SCs and STs. I totally agree with your formulations and arguments on pages 16 and 17.

I am sorry to have written at such length but I believe that your lecture deserves it. We must give it the widest possible circulation and distribution. I am, as a starter circulating it to my Commission and my Secretariat colleagues. But you should mail it very very widely. I shall speak to N. N.

Vohra, Director, IIC and a very long standing and dear friend of mine to also do likewise.

With warm best wishes,

Yours sincerely,

Encl: As above.

[A Parthasarathi]

P.S: **I am enclosing a copy of a paper I have just received from Professor R.Narasimhan, the doyen of our Computer / I T Community which is germane to your lecture.**

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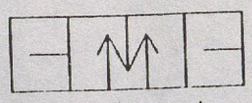
With the best compliments of

Dr. R.Narasimhan



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The Socioeconomic Si[illegible] of Information Technology [illegible] Developing Countries

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Abstract In the industrially advanced societies of the West, economic development has invariably been accompanied by a structural shift of labor from the primary and secondary production sectors to the tertiary or service sector. A systematic analysis of the service sector would show that the "commodity" on which this sector acts is "information." The increasing importance of "information" for control and management in an "advancing" society is the primary reason for the structural shift of labor to the service sector. In this paper the critical importance of the service sector to development is emphasized and it is argued that information technology that underpins activity in this sector is an appropriate technology for speeding-up socioeconomic development in the third world countries.

1. Industrial Development and Structural Change

The industrial transformation of Western societies is a phenomenon that is less than 200 years old. In spite of its recent history we still do not fully understand the sociological, psychological, and eco-

An earlier version of this paper was presented at the International Conference on "Informatics and Industrial Development" held at the Trinity College, Dublin, in March 1981.

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Stage I 1790–1840	Start of the first industrial revolution. Primarily agricultural and small artisan groups move into coal-mining and textile centers and become urbanized.
Stage II 1840–1870	Improvements in industrial productivity through the use of steam power and partial automation, especially in the textile industry. Beginnings of transportation revolution through the use of steam locomotives and steamships.
Stage III 1870–1900	The gradual replacement of steam power in industries by electric power. The increasing impact of chemical industry on textile manufacture.
Stage IV 1900–1945	Transportation revolution based on I. C. engines. Growth of petrochemical and pharmaceutical industries. Beginnings of electronics revolution.
Stage V 1945–1980	Major transformations in the electronics industry. First stage of information technology revolution. Beginnings of the second industrial revolution?

Figure 1. Stages in Industrialization of Western Europe.

through personal apprenticeship involving little formal institutionalized learning. An important change that was brought about through progressive industrialization was the introduction of a variety of new occupational categories and the gradually increased specialization and professionalization of these occupations. Some of the earliest such professional occupations that came into prominence during the first industrial revolution were accountancy and civil engineering.

Talcott Parsons (1968) has pointed out that "professionalization" of an occupational category is based on three core criteria:

(i) there is a requirement of formal technical training accompanied by institutionalized modes of validation of both the adequacy of the training and the competence of the trained individuals;
(ii) the training acquired must include a recognizably intellectual component;
(iii) the training acquired (based in an essential way on the intellectual base) should lead to skills which can be put to social use in an institutionalized setting.

Figure 2 lists a cross-section of the varieties of services that support a modern industrialized society: the classification used is broadly based on that of Hartwell (1973). It will be seen that with techno-economic advance the service occupations that come to play

SOCIAL OVERHEAD SERVICES

- Transport
  road, rail, air, sea, inland waterways
- Communication
  post, telegraph, telephone, telex, data transmission
- Education
- Police, Defense, Justice
- Welfare
  public health, hospitals, social service institutions
- Government Administration

BUSINESS SERVICES

- Trade
  wholesale, retail, estate agency
- Finance
  banking, insurance, brokerage
- Professional & Technical
  accountancy, engineering, management, consultancy, testing & repair, maintenance, advertising, promotional
- Information
  newspapers, periodicals, books, libraries
- Culture
  museums, galleries

PERSONAL SERVICES

- Domestic
- Artisan
  barbers, cleaners, tailors, plumbers, etc., gardners, waiters, etc. in restaurants, hotels
- Professional
  medicine, law, finance, design & décor, training & tutoring

COMMUNITY & COOPERATIVE SERVICES

- Religion
- Professional Associations, Trade Unions, Cooperatives, Clubs, Other Social Groups

CULTURE, SPORTS, & RECREATION

- Entertainment
  radio, TV, theater, cinema, concerts
- Sports & Travel

Figure 2. Occupational Categories in a Modern Economy.

activity without simultaneously having to create additional jobs to cope with this expanded activity. Although in the short term this kind of intensive use of a technology creates social apprehension and consequent resistance to the technology on the part of the working population, historically, in the long term, increased productivity in an economy has always contributed to the general betterment of society. Thus, from the long-term viewpoint, for industrial development and modernization both the extensive and intensive uses of technology should be considered positive, desirable features of an economy.

The all-pervasive nature of the professionalized service sector in an advanced industrialized economy was emphasized earlier. And we also saw that the essence of professionalism is the use of formalized knowledge in a conscious and systematic manner in one's (professional) activities. In this sense, information technology embodied in the form of computers and, more recently, microprocessors,

is the technology underpinning the professionalized service sector. In Figure 4 I have listed the major software application areas. Their relevance to the various service industries are indicated by their corresponding index numbers in Figure 3. From these two figures it will be seen how comprehensive is the applicability of information technology to the service industries.

1. Planning & Decision-Making
2. Transaction Processing
3. Information Storage & Retrieval
4. Text/Word Processing
5. Design Calculations
6. Message Management
7. Real-time Control

Figure 4. Some Major Software Application Areas.

In an extremely interesting paper, Thompson (1978) has pointed out that at present most of the applications of information technology in the service sector are intensive in nature. This technology is being introduced to increase productivity and consequently it results in decreasing labor growth. This is perhaps most immediately evident in the office automation area. And as already emphasized, most of the current apprehensions about the microprocessor technology in the West directly derive from its intensive usage. Thompson emphasizes the need to explore the feasibility of deploying information technology in an extensive manner. The necessity for attempting this becomes especially relevant for the developing countries in the context of creating the hundreds of thousands of additional jobs that are needed to meet the demands of an ever-growing working population. We shall return to this topic a little later and discuss it in more detail.

3. Importance of the Service Sector to Development

The primary and secondary production sectors which are the principal consumers of the services (see Figure 3) are shown expanded into their constituent sectors in Figure 5. From this figure it will be seen that every developing country is more or less industrialized. There are very few developing countries with no industries whatsoever. In countries like India, for example, the industrial base is quite comprehensive. Each one of the primary and secondary pro-

duction sectors identified in Figure 5 is a constituent part of the industrial infrastructure of India. Why is India, then, not an industrially advanced country?

The answer to this will become obvious if one looks at Figure 6. Over a 50-year period during which time this comprehensive industrial base has been built up in India, there has virtually been no structural shift of labor from the traditional occupational categories. The socioeconomic significance of this fact is as follows: although on the surface much industrial development has taken place in India, Indian society as a whole has not been involved in this industrialization process. Industrialization in India has not been the outcome of a total transformation of the socioeconomic structure of the society (as was the case in the West) but it has merely been grafted on as an appendage, more or less, to a society that continues to function in its traditional mode to a large extent. One result of this has been that the many occupational roles that accompany industrialization, which should have been created and made available to individuals, have not been created and are unavailable to increase the diversity of employment opportunities in the country.

Apart from their employment creation aspects, these missing occupational categories are precisely the ones in the service sector that contribute to the efficiency and productivity of the primary and secondary production sectors. A very large proportion of the indus-

Year	*Total Labor Force Millions*	*% Distribution Across Sectors*		
		Agriculture	*Mining & Manufacturing*	*Others*
1921	120	73.1	9	17.9
1931	124	72	8.7	19.3
1941	121	74	9.2	16.8
1951	140	72.8	9.3	17.9
1961	188.7	73	10.4	16.6
1971	226.9	73.8	9.8	16.4
USA				
1976	96.9	4	23	73

Figure 6. India: The Labor Force and Its Distribution.

or Japan. This feature is clearly brought out in Figure 7 which contrasts the levels of information consciousness (in some of the above senses) of the United States, the United Kingdom, Japan, and India.

We have already emphasized the essential role that the service sector has played historically in the industrialized Western countries in improving efficiency and productivity in the primary and secondary production sectors. The service sector has a similar role to play in the development of these production sectors in the developing countries also. It is well known that countries like India have been able to bring about a "green revolution" by making readily available to the farmers agricultural services with a high information content. It is beginning to be realized that in order to sustain this revolution and make it take root, it is imperative to take to the fields the management culture that is usually associated with urban industrial activities. For sustained socioeconomic development the spread of information consciousness in the primary sector has to become deep and wide.

In the secondary production sector the urgent need in developing countries is to make those involved in the production activities conscious of the need for the service inputs shown in Figure 3; and, where such service inputs are available, to make them increasingly professionalized and ultimately to transform them into industries in their own right as has happened in the advanced industrialized countries. A prerequisite to accomplishing this is improvement in communications in the developing countries, especially digital data and message communication. It is also relevant to note here that employment opportunities for the highly educated and qualified segment of the population in developing countries cannot be increased without systematic upgrading and enlargement of the professionalized service sector in these countries.

But apart from the importance of the service sector and, thus, of information technology, in improving the production of goods in developing countries, it is worth discussing in some detail why information technology to the developing countries is an intrinsically relevant technology which will improve their *quality of life*.

Rural – Urban %

	1901	1921	1931	1941	1951	1961	1971
Rural	90	88.8	88	86.1	82.7	82	80.1
Urban	10	11.2	12	13.9	17.3	18	19.9

Distribution of Villages According to Population
1971 Census : Total Villages : 575,721

Population	<500	500–999	1000 –1999	2000 –4999	5000 –9999	≥10000
% of Villages	55.3	23.1	14.2	6.3	0.9	0.2

Figure 9. India: Population Distribution.

classified as literate they are unable to play an effective role in the socioeconomic and political affairs of the country.

Provision of education to eradicate illiteracy, health care to improve the standard of living, and community services to upgrade the quality of life, to the geographically dispersed small communities of people in countries like India poses a tremendous challenge. It is clear that the mere magnitude of the problem (the number of people to be serviced and the distances to be covered) makes it infeasible to tackle these problems through conventional means. One cannot hope, in the foreseeable future, with the resources available, to provide conventional schools, diagnostic clinics, hospitals, and so forth to service the inhabitants of each village. Apart from the problem of constructing structures to house such service centers, the qualified manpower to manage them cannot be obtained. Radically innovative, unconventional solutions will have to be found and tried.

The manpower profile of India, as shown in Figure 8, is typical of less developed countries: a vast majority of the population is illiterate or functionally nonliterate; a very small percentage is very highly qualified; and a somewhat larger percentage is qualified up to and immediately beyond the school-leaving level. To improve the availability of services to the vast majority of the population, the

ices in a society. In this sense, information technology is an appropriate technology for socioeconomic development in the third-world countries.

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