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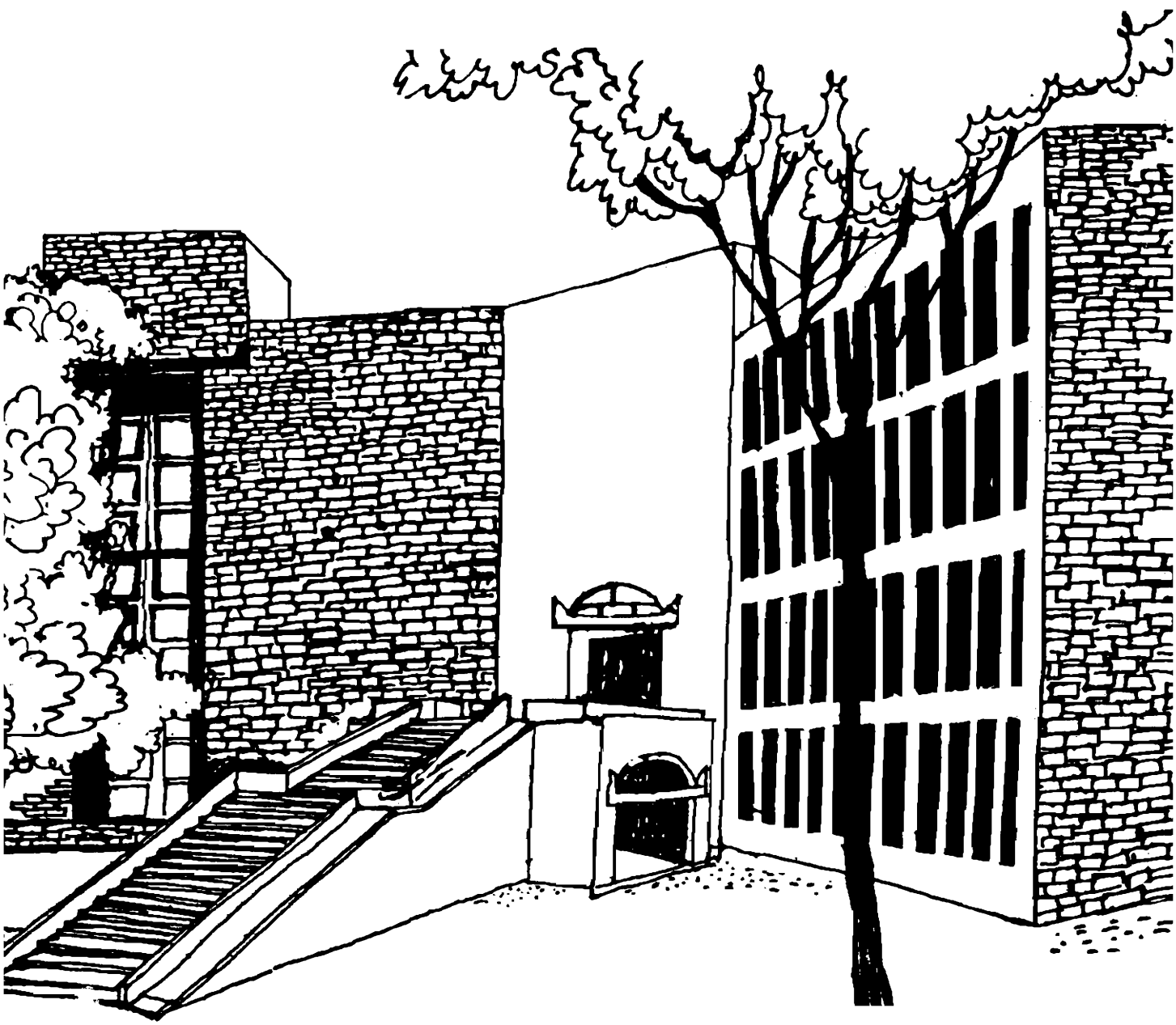

INDIAN TECHNOLOGY POLICY : USE OF NEW & TRADTIONAL TECHNOLOGIES

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ABSTRACT

The debate on Technology Policy in India is not a recent phenomenon. The Indian Technology Policy has tried to maintain a balance between the anti-modern technological view of Gandhian philosophy and new modern technologies. The net result is pluralization of society in terms of benefits gained by different parts of society from different levels of technologies.

1.0 INTRODUCTION

Technology policy has been a major subject of debate and discussions in India during the 1970's. For the last four decades, the Indian Government has attempted to direct technology related activities through a variety of policy instruments. Broadly the policy has been concerned with two critical interventions :

(a) control of technology entering the country,
(b) promotion and protection of locally available, whether indigenously developed or previously imported technologies.

However, the technology policy in India over the period,has gone through a number of important changes both in emphasis and content. Inspite of these changes, there remained a socio-political compulsion to maintain a semblance of the continuity of the basic objectives.

The objective of the technology policy in successive five year plans is to achieving equalitarian growth. That is basic socio-economic goal and it still remains the officially pronounced goal of policy, even if some powerful group may like to change it. the fact that the official statement of the policy goal could not be changed indicate the socio-political compulsions and pressures on the one hand and the socio-economic reality on the other. This is the basic framework to remember in understanding both short-term changes in technology policy and long-term strategies.

The debate on technology policy in India is not a recent phenomenon.The so called anti-modern technology view of Gandhian philosophy with emphasis on self reliant, local resource-based,

decentralized technologies have many powerful protagonists in India. Same is true for the new modern tecchnologies. As a result, it seems that the technology policy in India has always tried to maintain a compromise balance between the two camps. The net result of this compromise has not been merely polarization but pluralization of society in terms of benefits gained by different parts of the society from different levels of technologies- from craft technologies to modern technologies of the organized sector. As an ex-Governor of Reserve Bank and an eminent economist Dr. I.G. Patel observes :

" There is no escape from this Janus-like approach to technology in labor surplus economies - moderating its pace in one area while accelerating it in an other. Mere subsidies or pricing policies cannot tackle these problems adequateley unless they are supported by relevant research, training, extension services and organizational support. India's record in this respect is very creditable. It's handloom industry for example has shown remarkable vitality under state support. But one gets the feeling that the energy and ingenuity that was put in support of traditional crafts and industries in the early years after independence or in agriculture research after the mid sixties have ebbed somewhat in recent years. And the package of new economic policies in India will remain lopsided and largely irrelevant if it were not to put new vigour into these somewhat mundane and well-established endeveours."[1]

It is within the above mentioned framework we will examine in this paper the evolution of India 's Technology Policy.

2.0 EVOLUTION OF TECHNOLOGY POLICY

The Indian Five Year Plans inaugurated in 1952 were designed to bring about planned economic and social development within a "socialist" framework. The plans pursued multiple objectives, which included accelerating planned economic growth through industrialization, with stress on heavy and basic industries.

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1 Patel I.G. (1987), " On Taking India into the Twenty-First Century : New Economic Policy in India ", Modern Asian Studies, Vol 21, No 2.

Right from the beginning they also included reducing inequalities in the distribution of incomes, wealth, economic power and meeting the minimum or the basic needs of the population. It is within this broad objective of the plan, although the stress was given on modern technologies related to basic and heavy industries, indigenous and village based technologies was given importance for its employment generating capacities.

As far as the industrial strategy is concerned, some important elements related to technology policy were followed during the 1950's, 1960's and most of the 1970's. First, there has been emphasis on the role of heavy industry in economic development in order to build up as rapidly as possible a capital goods sector. Secondly, the role of public sector was given a leading critical role for structural transformation of the economy. Not only was the government to play a dominant role in infrastructure investments, many industries especially in the capital goods sector were exclusively reserved for development by the State. Thirdly, major investments in the private sector were to be carried out not by the criterion of private profitability but according to the objectives of the overall national plan. To illustrate, car production even though profitable was prohibited from expansion with a view to prevent scarce materials to be used for luxuries as compared to tractors and ploughs. Fourthly, industrial development was envisaged not only through protection but also emphasised the technological self-reliance and import-substitution through limited role for direct foreign investments by multinationals. Lastly, as mentioned earlier, the plan also

provided both internal and external protection in a number of industries for small-scale and cottage enterprises for which the capital/labor ratio is very low. The age-old handloom industry, for example, was protected by limiting the expansion of the capacity of modern textile industries.

The most important policy instruments to implement the above mentioned industrial policy are (a) Industrial licensing (b) Import and export policy with a highly protective trade regime, (c) Administered prices for a range of 'crucial' or 'essential' products, such as, steel, cement, sugar, aluminium etc. and ,(d) Foreign investment policy, with strict controls on multinationals with a view that such investment would harm internal technological development. (see Appendix)

Thus, we see that in the fifties and early sixties, the policy was relatively liberal, its scope was limited. The mid-sixties saw the beginning of a policy which was more selective and discriminatory against technology imports. The focus during this period was on import-substitution and self reliance. This was partly in response to the scarcity of foreign exchange and was partly considered necesarry to protect indegenous technological activities. These measures, in addition to controlling what was considered over-import of technology, were also expected to (a) bring down the price of the technology imports, and (b) reduce restrictions on the use of imoprted technology and thereby maximize its benefits. Whatever may be the objectives, it is important to note that many of the industries started for import substitution became, in the 1970's, exporters of manufactured goods, including sophisticated equipments such as power

generating equipment. The story of Bharat Heavy Electricals Ltd. (BHEL), is well known in this regard.

All throughout the planning exercises, science and technology has been treated as the master key for achieving the goals. The enthusiasm and personal interest of our first Prime Minister, Shri Jawaharlal Nehru is well known. His legacy was keenly followed by his daughter Mrs. Indira Gandhi. Early on in the planning process, it was realized that to achieve the planned technological goals, the government has to make deliberate interventions in terms of infrastructural facilities, in terms for laboratories, technical institutions etc.

As a result , since 1950, the institutional structure for pursuing scientific objectives expanded enourmously. By 1980's, for example, India has over 1,300 research institutions, including more than 200 specialized laboratories. The number of in-house R & D units, both in public and the private sectors, exceeds 900, and the consultancy firms more thn 200. There are few developing countries which can rival India in size and spread of such institutional network. The resources devoted to scientific pursuits were considerable, particularly for a resource poor country like India.

Consequently, the supply of technology-embodying inputs-capital goods and skills- has increased considerably since the First Five Year Plan. Gross capital formation and machinery and equipment supplies rose six fold between 1950 and 1985. But the domestic output of machinery and equipment multiplied 18 times. Its annual growth rate was nearly 9 percent, with total output doubling every eight years, and expanding eight-fold every 25 years. In

contrast, the imports of machinery and equipments increased a bare three-fold. In consequence, the share of domestic output in such supplies rose from 46 per cent to as high as 80 per cent from 1970 onwards. Import dependence in this key area was rapidly and drastically reduced.

On the other spectrum of skilled manpower, education simply exploded. The most striking change in this respect was the enrollment in Universities and institutes of higher learning. It rose from around 1,50,000 in 1948 to nearly 50,00,000 by 1985. Only the US and USSR were ahead of India in terms of numbers. In the process, India became a skilled country. The stock of science and technology personnel, even when narrowly defined, crossed the 2.7 million mark in 1985. Over one half million migrated to other countries.

The volume of resources devoted to R & D multiplied fifty-fold rising at an annual growth rate of some 12 per cent. They amounted to a mere 0.05 per cent in 1950, which was raised to 1.00 per cent by 1985. It is striking to note that unlike in industrial sector, India has shown a remarkable achievement to build up independent, self-reliant technological capacity to cope with the requirements of accelerated development in the field of agriculture, atomic energy, defence research and space. The achievements in all these sectors are characterised by time-bound integrated programme with enough resource support and imaginative leadership. India became a pioneer of Green Revolution in the mid-sixties. The key factor in these achievements is the presence of pressure of effective demand for national technologies, be it for geo-political or economic reasons.

'It is generally recognized that the ability of the Indian economy to withstand world economic shocks has largely been due to the country's long term strategy of import-substitution, planned industrialization and technological self-reliance.These policies have not only led to the creation of a diversified capital goods industry, but also a deep development of the country's technical 'know-how' as well as 'know why'.[2]

While complex factors may have been responsible for this, we would argue that the role of government policies towards the promotion of indigenous production and of "real technological learning" has been of primary importance.

To illustrate, take the case of the heavy electrical equipment industry- turbine generator sets, large transformers and switchgear - where India has made a determined effort at import substitution. Upto 1969-70, for turbine and generators, the share of imports in the installed capacity was 90 per cent of the annual additions to such capacity. By 1978-79, indegenous manufacturers provided 90 per cent of such capacity. The balance of payments implication of this development are worth noting : had the imported proportion remained at the 1969 level, the additional expenditure in foreign exchange in the Fifth Plan would have been close to $ 7 billion ; the maximum value of India's total annual exports during this period was $ 5.5 billions.

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2 Lall,S. (1984), " Exports of Technology by the Newly Industrializing Countries ", World Development

3.0 CHANGES IN POLICY

The debate on India's technology policy became sharply intense during late 1960 's. Inspite of successes achieved as discussed above, the plan strategy was found to be utterly ineffective in dealing with poverty of about 50 per cent of India's population, largely in rural areas. There was therefore an imminent political compulsion (considering ensuing general election) to focus the plan strategy to attack this problem of mass poverty, which was encapsuled in the form of a popular slogan of the then Prime Minister, late Mrs. Indira Gandhi, Garibi Hatao (Remove Poverty). Thus, in 1970 's the strategy of plans included the programme for a direct attack on poverty through integrated rural development, basic needs strategy etc. based on 'appropriate technology'.

The Ministry of Industry of the Government of India opened a cell for appropriate technology in 1971. This was closely followed by the opening of a number of centres of research into appropriate technology in some of the leading institutues. It is important to note here that while the appropriate technology movement in the West grew mainly to prevent the pernicious effects of modern science and technology on human society, in India it was promoted as a new solution to the limited application of science and technology where people had not "fully enjoyed the benefits of science and technology and eke out life in absymal poverty and squalor".[3]

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3. Reddy, A.K.N. (ed), "Rural Technology", Indian Academy of Sciences,Bangalore, Preface

Over a period, this strategy of indigenous development of appropriate technologies have met with quite a remarkable success, wherever these technologies met the felt needs of the people. The spread of these technologies cover wide areas of application starting from renewable energy technologies (eg. biogas, woodstove, gasifier, solar systems), to handpumps for drinking water, mini grain mills, groundnut decorticator, energy food tropicultor, farm ponds, low cost house-building technologies, low cost sanitation etc. In generating these technological options, three basic approaches are followed : (1) cheaper western technology, (2) develop ab initio an alternative technology, and (3) transform traditional technology. As mentioned above , success of some of the technologies have been spectacular with far-reaching politico-economic implications in the future policies. To illustrate, the massive promotion of handpumps for drinking water and woood-stove programme in rural Karnataka was reported to have helped the opposition party(non-congress) to win successive elections with massive rural votes.

While the programme of promotion of indigenous appropriate technology development and promotion was going on, there developed a serious debate on India's economic performance, particularly in the industrial sector. Within the government and certain intellectual circles there has been intense dissatisfaction with the country's long run strategy of import substitution, planned industrialization and technological self-reliance.[4] In support of these arguments, these economists cited

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4. See for example, Ahluwalia, I.J. (1985), Industrial growth in India : Stagnation since the Mid-Sixties, Oxford University Press, Bhagwati, J.N. and Desai, P(1970) India's Planning for Industrialization, Industrialzation and Trade Policies since 1951, Oxford University Press.

'India's rate of growth of GDP with other Asian and Latin American countries. Between 1963-73, India's rate of growth of GDP was about half as high as that of the other Asian and LAtin American countries as shown in Table 1.

In fact, these critics argue that the fact that India's growth rate has risen to the average level of the Asian countries and is of course way above of the Latin American countries during the 1980's proved the efficacy of the new economic policy which was to follow in the mid-1970's.

Following these criticisms, a number of high-level government committees have enquired into various aspects of the country's planned industrial regime; import-export policy, policy on industrial licensing and other controls on the magnitude, composition and direction of domestic investment, control on prices, fiscal policy and particularly the tax regime within which the private business operates, the role of public enterprises.[5]

According to the critics, the main defects of the earlier plan strategies are summed as :

(a) barriers to entry into individual industries limiting the possibility of domestic competition, (b) adverse effects of the policies to 'protect', small scale industries and regional dispersal of growth on the choice of the optimum scale of

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5 See, for example, GOI (1978), Reprt of the Committee on Imports-Exports Policies and Procedures, headed by P.C. Alexandre Ministry of Commerce; GOI (1985), Report of the Committee to Examine Principles of a Possible Shift from Physical to Financial Controls, headed by M. Narsimhan, Ministry of Finance; and GOI (1985), Committee on Public Enterprises, headed by Arjun Sengupta.

Table 1: Growth Rate of GDP (1975 Prices) in Asian and Latin American Countries, 1963-73, 1973-79, 1979-84[5]

(Percentage per annum)

	1963-73	1973-79	1979-84
ASIA			
China	8.6	4.9	8.2
India	3.4	4.3	5.4
Indonesia	6.9	7.1	5.6
Korea	9.6	9.8	5.8
Malaysia	6.6	7.3	6.6
Pakistan	6.2	5.0	4.4
Philippines	5.2	6.4	1.9
Sri Lanka	4.5	5.0	5.3
Taiwan	10.7	9.2	6.4
Thailand	8.0	7.7	5.5
Median	6.7	6.7	5.5
LATIN AMERICA			
Argentina	1.8	-1.7	Not available
Bolivia	4.7	4.7	-4.4
Brazil	8.3	6.9	0.8
Chile	3.6	2.7	-1.1
Colombia	5.9	5.0	2.0
Ecuador	7.2	6.8	1.7
Mexico	7.8	5.7	2.0
Peru	3.9	2.4	-0.5
Venezuela	5.2	5.6	-1.8
Median	5.2	5.0	-0.5

[5] The World Bank Data Bank.

production, (c) barriers to exit, even if an industry is sick or non-viable, (d) administrative hurdles in a system of physical controls;(e) little or no incentive for technological upgradation. Added to this long list was World Bank's pressure for opening up the economy with emphasis on market forces and private enterprises.The critics suggested that the factors mentioned above were largely responsible for the low long run growth of India's industrial economy, but more importantly for the decelaration in the manufacturing growth rate after the mid-1960's, as indicated in Table 2.

Table 2 : Growth Rates of Net Value Added

(Per cent per annum)

	Compound Growth Rates				Annual Growth Rates		
	55-56 to 65-66	65-66 to 75-76	75-76 to 80-81	80-81 to 83-84	81-82	82-83	83-84
1. Agriculture	0.9	3.9	1.0	3.5	4.1	-3.6	10.4
2. Industry	6.5	3.5	4.6	6.2	6.2	7.3	5.1
Manufacturing	6.2	3.3	4.5	5.8	5.8	6.9	4.7
Registered	7.5	3.2	4.9	7.3	7.4	9.4	5.1
Unregistered	4.5	3.4	3.8	3.3	3.2	2.6	4.1
Electricity	12.9	7.8	7.6	7.2	8.0	6.7	6.8
Mining	7.1	3.0	3.3	9.9	9.0	12.3	8.3
3. Construction	6.2	2.5	3.8	1.8	1.3	0.3	3.7
4. Railways	6.4	3.2	1.5	0.1	-2.0	4.2	-1.6
5. Other Services	5.4	4.5	6.0	7.7	7.3	8.3	7.5
Total	3.2	3.9	3.4	5.3	5.3	2.8	7.9

Source : National Accounts Statistics, quoted in Ahluwalia, (1985) op.cit.

As Table 2 shows, there has been improvement since the mid-1970's and the critics ascribed this to the fact of new policy which began in mid-1970's.

These critics of earlier plan strategy and the several committee reports as mentioned earlier favoured radical reorientation of the Indian economic policy in the direction of a greater openess towards the world economy. Interestingly, the new economic policy as suggested by the critics and expert committees were not uncritically accepted by many distinguished Indian economists , perhaps a majority. They were sceptical of the intellectual rationale of the new policy and are extremely doubtful of its wisdom during the foreseeable period of sluggish and uneven growth of the world economy.[6]

Be that as it may, it was the critics and government's expert committees who won the day with the political power centre. The modification of economic policy began in the evoutionary way in the mid-1970's. But they have gained real momentum since the late Prime Minister Rajiv Gandhi came to power with his promise to usher India into the " 21st Century Technology Era ". Importantly, the new economic policy of greater internal and external competition to promote efficiency and modernization has been confirmed by the Planning Commission's report on the Seventh Five Year Plan (1985-90), the Plan envisages a considerable

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6 See, for example, Chakrabarty S., (1979) " On the question of Home Market and Prospects for Indian growth", Economic & Political Weekly,Special number; Chandra N.K.(1986) "Modernization for Export-Oriented Growth :A Critique", Economic & Political Weekly, Vol. XXI, No. 29, July 19; & Raja K.N. (1985), New Economic Policy,, V. Krishnamachari Memorial Lecture delivered at the Institute of Economic Growth, Delhi, November 20.

extension of the policy during the next five years and beyond.

Alongwith the new economic policy came the new Technology Policy supporting measure. A careful reading of the New Technology Policy reveals a drastic departure from the earlier policies in terms of liberalization of import policies, relaxations for the entry of multi-nationals and MRTP Act.

The World Bank Report of 1986 which was implemented in 1985-86 states

- Reduction in the numbers of companies coming under MRTP (Monopolies & Restricitve Trade Practice Act) from 1505 to 230 by December 1985
- More scope for MRTP and established foreign equity companies to expand their capacity and diversify products
- Liberal rules for capacity expansions without obtaining licence and recognising additional capacity resulting from modernisation or replacement.
- Increase in number of industries for which no licence required to install or expand capacity.
- Broad banding flexibilities
- Administrative improvements to reduce delay in clearances, especially for larger and foreign collaborations
- New textlie policy removing freeze on mill's loom capacity, no restriction on production and use of synthetic fibres and yarns and reduces excise taxes & synthetic fibres.

4.0 IMPACT OF NEW POLICY

As a result, the 1980's have seen a substantial increase in the number of foreign technological collaborations involving large

payments(see Table 3). The role of foreign collaborations in Indian Industry has remained very important both in the private as well as public sectors.

Table 3 : Foreign Collaborations Approved by Govt. of India *

Year	Total	Of which those involving Foreign Investments
1970	183	32
1975	271	40
1976	277	39
1977	267	27
1978	307	44
1979	267	32
1980	526	73
1981	389	57
1982	590	113
1983	673	129
1984	752	151
1985	1024	239

Source : Centre for Monitoring of Indian Economy, " The Liberalisation Process", July 1986

More than 75 per cent of electronic items, 70 per cent of agricultural machinery, 65 per cent of transport machinery and 35 per cent of all drugs and pharmaceuticals made in the country are products of foreign collaborations. Moreover, about 80 per cent of the foreign collaborations have been renewed between 2 to 5 times, and 20 per cent six times or more. Quite clearly, technological self-reliance in the strategic industrial sector did not register any notable success.

As seen in Table 4 below, the new policy resulted in a substantial increase in the import of capital goods. The sharp increase in imports has obvious implications for the country's balance of

payments position. Capital goods have been the fastest growing category of imports in recent years, increasing from around one-tenth of the total import bill in the mid-1970's to nearly one-fifth in the mid-1980's.

Table 4 : Capital Goods Imports

(Rs. Crores)

	80-81	81-82	82-83	83-84	84-85	1985-
Metal Manufacture	89.5	115.5	143.7	148.7	140.8	185.8
Non electrical machinery and appliances	1089.1	1349.2	1438.7	2051.3	1927.7	2478.6
Electrical machinery and appliances	259.7	326.4	494.2	675.4	730.4	576.2
Transport equipment	472.0	305.0	639.6	446.9	368.9	452.2
Total Capital Goods	1910.3	2096.1	2716.3	3322.3	3167.8	3683.7
Capital goods import as percentage of total import bill	15.2	15.4	19.0	21.0	18.5	18.7

The growing trade-deficit has important macro-economic implications which will affect output and employment levels in the future. However, such imports also have a direct impact on the production, capacity utilization and employment of domestic capital goods industries.

The new technology policy with successive liberalization of imports of capital goods, technology, consultancy services, design engineering package and relaxation of physical controls since 1985 literally works out to virtual Open General Licence for technology

import. In the process, while many established research institutions like CSIR (Council of Scientific and Industrial Research) came under serious attack fromt the industrial interests and the associated political lobbies desiring technical and financial collaborations with transnationals to exploit the local market, it also affected the government funding pattern for R & D.

Table 5 shows that over the years, the share of expenditutre on Defence Research and Development Organization has gone to the top position, followed by atomic energy and space while that of CSIR and ICAR (Indian Council of Agricultural Research) has almost remained the same- the most poorly funded being the Indian Council of Medical Research.

Thus, whether or not the new economic policy embodying a liberalized technology import policy will ultimately be able to achieve its objective of shift from low-quality-high-cost syndrome, export led growth, healthy competitiveness, increased growth rate, technology modernization and self reliance etc. are issues to be settled in the long run. Meanwhile, in the short turn, there are some serious disturbing tendencies developed in India's economy.

To illustrate, taking advantage of the liberalised policies, many big industrial houses under relaxed FERA and MRTP Act, are able to commandeer a considerable part of the scarce capital resources of the economy for non-plan, non-pririty projects and thereby increasing the concentration of economic power in the hands of few.

Table 5: R & D Expenditure by Major Scientific Agencies under the Central Government

(Rs. '00000)

No.	Name of the Agency	1970-71	1975-76	1980-81	1981-82	1982-83	1983-84	1984-8
1.	Atomic Energy	2871.56	5394.00	7347.81	8826.06	11620.10	1493.30	21374.
2.	Council of Scientific and Industrial Research	2155.73	3711.00	6900.00	7877.08	11408.40	12418.60	14648.
3.	Defence Research and Development Organisation	1755.35	5217.00	7970.00	10483.36	127188.00	17188.00	22540.
4.	Indian Council of Agricultural Research	1837.00	3294.00	9744.67	11149.50	10354.00	11462.00	13109.
5.	Indian Council of Medical Research	217.63	332.00	900.11	1195.13	1453.13	1806.00	1946.
6.	Department of Science & Technology	84.18	525.01	4063.69	4608.01	8765.28	9669.68	12555.
7.	Department of Space	-	3666.80	5601.56	7503.44	9735.68	11044.50	17465.
8.	Department of Environment	-	-	373.99	546.88	860.92	1371.53	1977.
9.	Department of Ocean	-	-	-	788.43	4930.00	2367.00	2271.
10.	Department of Electronics	-	238.01	540.55	751.11	484.97	581.23	887.
11.	Department of Non-Conventional Energy Sources	-	-	400.44	989.82	1280.00	1006.00	1445.
	Total	8921.45	22377.81	43842.82	54718.82	73717.20	83207.90	110221.

Source: Research and Development Statistics, 1984-85, DST, GOI, New Delhi.

Also, the activities of foreign drugs and pharmaceutical companies are evidently deleterious for the economy for many reasons. The presure for the entry into India of the Cola group of companies, to take only one example, is typical. Taking advantage of the increasing monetary income of a section of the population- most experts place this a group of some 100 million persons,out of the total population, these companies have now spread a gospel of consumerism through aggressive (often vulgar) salesmanship, which is not only detrimental to the overall savings effort of the community, but also causing evil demonstration effect introducing a dangerous culture not suitable for either egalitarian distribution or economic growth.

5.0 TECHNOLOGY MISSION

While the changes in Technology Policy in terms of import liberalization and modernization has been vigorously pursued, as described above, with its consequent effects in the industrial sector, the massive problems of unemployment, rural poverty and backwardness of millions of villages remained a reality. It is a reality which neither the politicains nor the planners could ignore.

These politico-economic compulsions needed appropriate response which came in the form of Technology missions. The successful experiences of Green Revolution, defence/space/nucleur technologies where focussed, concentrated time-bound approach with unified organizational command and resource commitment yielded results were designed for the Technology Missions.

In the late 1980's, six Technology Missions were initiated, all of which were related to rural sector. They are:

1. Technology Mission on Literacy
2. Technology Mission on Drinking Water
3. Technology Mission on Waste Land Development
4. Technology Mission on Oilseeds
5. Technology Mission on Telecommunications
6. Technology Mission on Immunisation

Interestingly, in all the six technology missions, peoples' participation, decentralised planning, NGO involvement and locally developed indigenous technologies are emphasised. In some of the areas like oilseeds, telecommunication, and immunisation considerable progress has been made.

It would be worthwhile to await the results of these Technology Missions in the coming future, while India follows the 'Janus-like' approach of Technology Policy.

GOVERNMENT OF INDIA

TECHNOLOGY POLICY STATEMENT

PREAMBLE

Political freedom must lead to economic independence and the alleviation of the burden of poverty. We have regarded science and technology as the basis of economic progress. As a result of three decades of planning, and the Scientific Policy Resolution of 1958, we now have a strong agricultural and industrial base and a scientific manpower impressive in quality, numbers and range of skills. Given clear-cut objectives and the necessary support, our science has shown its capacity to solve problems.

The frontiers of knowledge are being extended at incredible speed, opening up wholly new areas and introducing new concepts. Technological advances are influencing life-styles as well as societal expectations.

The use and development of technology must relate to the people's aspirations. Our own immediate needs in India are the attainment of technological self-reliance, a swift and tangible improvement in the conditions of the weakest sections of the population and the speedy development of backward regions. India is known for its diversity. Technology must suit local needs and to make an impact on the lives of ordinary citizens, must give constant thought to even small improvements which could make better and more cost-effective use of existing materials and methods of work. Our development must be based on our own culture and personality. Our future depends on our ability to resist the imposition of technology which is obsolete or unrelated to our specific requirements and of policies which

tie us to systems which serve the purposes of others rather than our own, and on our success in dealing with vested interests in our organizations : governmental, economic, social and even intellectual, which bind us to outmoded systems and institutions.

Technology must be viewed in the broadest sense, covering the agricultural and the services sectors along with the obvious manufacturing sector. The latter stretches over a wide spectrum ranging from village, small-scale and cottage industries (often based on traditional skills) to medium, heavy and sophisticated industries. Our philosophy of a mixed economy involves the operation of the private, public and joint sectors, including those with foreign equity participation.

Our directives must clearly define systems for the choice of technology, taking into account economic, social and cultural factors along with technical considerations; indigenous development and support to technology, and utilization of such technology; acquisition of technology through import and its subsequent absorption, adaptation and upgradation; ensuring competitiveness at international levels in all necessary areas; and establishing links between the various elements concerned with generation of technology, its transformation into economically utilizable form, the sector responsible for production (which is the user of such technology), financial institutions concerned with the resources needed for these activities, and the promotional and regulating arms of the Government.

This Technology Policy Statement is in response to the need for guidelines to cover this wide-ranging and complex set of inter-related areas. Keeping in mind the capital-scarce character of a developing economy it aims at ensuring that our available natural endowments, especially human resources, are optimally utilized for a continuing increase in the well-being of all sections of our people.

We seek technological advancement not for prestige or aggrandisement but to solve our multifarious problems and to be able to safeguard our independence and our unity. Our modernization, far from diminishing the enormous diversity of our regional traditions should help to enrich them and to make the ancient wisdom of our nation more meaningful to our people.

Our task is gigantic and calls for close co-ordination between the different departments of the Central and State Governments and also of those concerned, at all levels, with any sector of economic, scientific or technological activity, and, not least, the understanding and involvement of the entire Indian people. We look particularly to young people to bring a scientific attitude of mind to bear on all our problems.

2. AIMS AND OBJECTIVES

2.1 Aims

The basic objectives of the Technology Policy will be the development of indigenous technology and efficient absorption and adaptation of imported technology appropriate to national priorities and resources. Its aims are to:

(a) attain technological competence and self-reliance, to reduce vulnerability, particularly in strategic and critical areas, making the maximum use of indigenous resources;

(b) provide the maximum gainful and satisfying employment to all strata of society, with emphasis on the employment of women and weaker sections of society;

(c) use traditional skills and capabilities, making them commercially competitive;

(d) ensure the correct mix between mass production technologies and production by the masses;

(e) ensure maximum development with minimum capital outlay;

(f) identify obsolescence of technology in use and arrange for modernization of both equipment and technology;

(g) develop technologies which are internationally competitive, particularly those with export potential;

(h) improve production speedily through greater efficiency and fuller utilization of existing capabilities, and enhance the quality and reliability of performance and output;

(i) reduce demands on energy, particularly energy from non-renewable sources;

(j) ensure harmony with the environment, preserve the ecological balance and improve the quality of the habitat; and

(k) recycle waste material and make full utilization of by-products.

2.2 Self-Reliance

In a country of India's size and endowments, self-reliance is inescapable and must be at the very heart of technological development. We must aim at major technological break-throughs in the shortest possible time for the development of indigenous technology appropriate to national priorities and resources. For this, the role of different agencies will be identified, responsibilities assigned and the necessary linkages established.

2.3 Strengthening the Technology Base

Research and Development, together with science and technology education and training of a high order, will be

accorded pride of place. The base of science and technology consists of trained and skilled manpower at various levels, covering a wide range of disciplines, and an appropriate institutional, legal and fiscal infrastructure. Consolidation of the existing scientific base and selective strengthening of thrust areas in it are essential. Special attention will be given to the promotion and strengthening of the technology base in newly emerging and frontier areas such as information and materials sciences, electronics and bio-technology. Education and training to upgrade skills are also of utmost importance. Basic research and the building of centres of excellence will be encouraged.

Skills and skilled workers will be accorded special recognition. The quality and efficiency of the technology generation and delivery systems will be continuously monitored and upgraded. All of this calls for substantial financial investments and also strengthening of the linkages between various sectors (educational institutions, R & D establishments, industry and governmental machinery).

3. PRIORITIES

3.1 Need for Perspective Planning

The time scales involved in the generation of technology are long, even with imported elements. Therefore, relevant technologies in all areas of priority, particularly where large investments are to be made, should be clearly identified well in advance. The cost and time element involved in the import of technology and indigenous development will be given consideration. Components which could be assigned to the various institutions which are capable of developing them or which could be built up for such activities will be identified. Ministries concerned with large investments and production activities in areas such as food, health and energy will be provided with appropriate technical support through suitably structured S & T groups.

3.2 Employment

Human resources constitute our richest endowment. Conditions will be created for the fullest expression and utilization of scientific talent. Measures will be taken for the identification and diffusion of technologies that can progressively reduce the incidence of poverty and unemployment, and of regional inequalities. The application of science and technology for the improvement of standards of living of those engaged in traditional activities will be promoted, particularly household technologies. Technologies relevant to the cottage, village and small industries sector will be upgraded. In the decentralized sector labour must be diversified and all steps taken to reduce drudgery. In all sectors, the potential impact on employment will be an important criterion in the choice of technology.

3.3 Energy

Energy constitutes an expensive and sometimes scarce input. Therefore, the energy requirements both of a direct and indirect nature for each product and each production activity and the associated technology employed will be analysed. Measures will be devised to avoid wastage or non-optimal use of energy. Fiscal measures as necessary will be introduced to ensure these. Research and Development in the energy sector will aim at improving the efficiency of its production, distribution and utilization, as well as improvement of efficiency in processes and equipment.

3.4 Efficiency and Productivity

Technologies already employed will be evaluated on a continuing basis to realise maximum benefits in terms of increased production and lower costs, specially in the public sector enterprises. Every effort should be made to utilise by-products and wherever possible to recycle waste materials, especially those from urban areas. Programmes to make

use of easily available and less costly materials will be supported.

3.5 Environment

Development should not upset the ecological balance for short as well as long-term considerations. Poorly planned efforts to achieve apparently rapid development, ignoring the long-term effect of many technologies on the environment, have resulted in serious ecological damage. It is, therefore, essential to analyse the environmental impact of the application of each technology. Due regard will be given to the preservation and enhancement of the environment in the choice of technologies. Measures to improve environmental hygiene will be evolved.

3.6 Some Specific Areas

In technology development special emphasis will be focused on food, health, housing, energy and industry. In particular, stress will be laid on:

- agriculture including dry-land farming;
- optimum use of water resources, increased production of pulses and oilseeds;
- provision of drinking water in rural areas, improvement of nutrition, rapid reduction in the incidence of blindness, eradication of the major communicable diseases (such as leprosy and tuberculosis), and population stabilization;
- low-cost housing;
- development and use of renewable non-conventional sources of energy; and
- industrial development.

4. INDIGENOUS TECHNOLOGY

4.1 Importance of Technology Development

Fullest support will be given to the development of indigenous technology to achieve technological self-reliance and reduce the dependence on foreign inputs, particularly in critical and vulnerable areas and in high value-added items in which the domestic base is strong. Strengthening and diversifying the domestic technology base are necessary to reduce imports and to expand exports for which international competitiveness must be ensured.

4.2 Inventions

The spirit of innovation and invention is the driving force behind all technological change. We must awaken our science and technology to the exciting challenges of our times, provide incentives to encourage inventors, and direct their efforts to areas of special importance. The system of rewards and incentives will be strengthened for inventions, innovations and technological breakthroughs and their utilization. The fullest opportunity will be provided to make use of inventions.

4.3 Enhancing Traditional Skills and Capabilities

Traditional skills and capabilities will need to be upgraded and enhanced, using knowledge and techniques generated by advances in science and technology. Technologies which will result in low-cost production and in products marketable close to the point of manufacture, particularly in the rural sector, will be promoted. Support will be given to technologies which reduce pressure on items in short supply and utilize improved local materials and methods. Government will give preference to products of such technologies in its own purchases. The adoption of technologies that can promote decentralized production will be helped through the support to design, marketing, quality control and other services.

4.4 Ensuring Timely Availability

The time cycle from scientific research to utilization is a long one. Hence the need to initiate action well in advance to identify and ensure timely availability and delivery of new technologies. Encouragement and support (fiscal, commercial and administrative) will be given to the production and user organizations to be associated with and participate in technology development efforts at appropriate stages.

4.5 Upgradation to Prevent Obsolescence

Technology is constantly on the move. The base of indigenous technology should be capable of utilizing world-wide advances and adapting them to local needs. The creation and strengthening of institutional structures for keeping track of international developments will receive urgent attention.

A strong central group will be constituted to undertake technology forecast and technology assessment studies and will *inter alia* draw up programmes of purposeful research. Arrangements will be made to provide high-level scientific advice in major sectors of the economy. Where big investments are involved or a large volume of production is envisaged, it will be incumbent on the Ministry or agency concerned to provide a technology forecast covering its requirements over a ten-year or longer period and evolve a strategy for development based on priorities.

4.6 Increasing the Demand for Indigenous Technology

Our country has already invested significant amounts in setting up research and development facilities as well as design consultancy and engineering capabilities. The technological potential inherent in this system of interlinked capabilities must be fully utilized, and in turn provide a fillip for further development from within the system.

Incentives will, therefore, be provided to users of indigenously developed technology, and for products and processes resulting for such use.

4.7 Preferential Treatment

In view of the cost of technology development and the time necessary for successful marketing of a new or improved product, indigenously developed items are invariably at a disadvantage compared with imported products or those based on imported technologies and brand names. Support must therefore be provided through fiscal and other measures, for a limited period, in favour of products made through indigenously developed technologies, care being taken to ensure quality.

4.8 Fiscal Incentives

Suitable financial mechanisms will be established to facilitate investment on pilot plants, process demonstration units and prototype development in order to enable rapid commercial exploitation of technologies developed in laboratories. Linkages between scientific and technological institutions and development banks will be strengthened. Gaps in technology will be identified and suitable corrective measures taken with adequate allocation of resources. Fiscal incentives will be provided in particular to : promote inventions; increase the use of indigenously developed technology; enhance in-house Research and Development in industry; and efforts directed to absorb and adapt imported technology.

4.9 Design Engineering

Capabilities in design engineering are essential for the translation of know-how to commercial production. This is particularly important in areas relating to agricultural production; agro-industries; metallurgical, chemical and petrochemical processes; machine tools; industrial machinery and capital goods as well as for the construction and erection of entire plants. Building up and enhancing these capabilities

will have a catalytic beneficial impact on the utilization of indigenous efforts that have resulted in product and process know-how. Existing design engineering capabilities will be strengthened and upgraded, and interaction encouraged between design engineering organizations, academic and research institutions and industry. Wherever gaps exist, design engineering capabilities will be developed and nurtured.

4.10 Engineering Consultancy

Engineering consultancy is a vital area for ensuring speedy technological and industrial development. It ensures the appropriate utilization of indigenous materials, plant and machinery. Engineering consultancy provides an essential link between R & D institutions and industry, and thus promotes effective transfer of technology. Capability for total systems engineering, process development and project management should be developed with collaboration if required. Wherever capability exists, utilization of Indian consultancy engineering organizations will be promoted. Even where foreign technical collaboration or consultancy is considered unavoidable, association of designated Indian consulting engineering organizations would be preferred. Indigenous engineering consultancy, in both private and public sectors, will be promoted on a sound professional basis in the context of the overall national perspective of technological self-reliance.

4.11 In-house R & D

In-house R & D units in industry provide a desirable and essential interface between efforts within the national laboratories and the educational sector as well as production in industry. Appropriate incentives will be given to the setting up of R & D units in industry and for industry including those on a cooperative basis. Enterprises will be encouraged to set up R & D units of a size to permit the accomplishment of major technological tasks.