SCIENCE AND TECHNOLOGY

Preamble

18.1.1 Science and Technology (S and T) has made a phenomenal impact the world over in shaping the lifestyle of the common man. If India has to really forge ahead in the coming decade, S and T must play a pivotal role in all the important tasks that lie ahead of us. Hence, the deployment of S and T as an effective instrument of growth and change becomes an imperative strategy. In order to derive maximum output from meagre resources, S and T and the associated methodology must be brought into the main theme of economic planning in the agricultural, industrial and services sectors. In this exercise, we are endeavouring not only to plan for S and T but also for integrating S and T in the economic planning.

18.1.2 Globalisation of business and of R and D are noteworthy developments. Meaningful partnerships on the international plane in the areas of mutual global interests are on the anvil. The S and T strategies will have to be suitably moulded to meet these realities.

18.1.3 Some of the old problems remain. This decade will pose further new challenges. The resource crunch, the balance of payment position and the shortage of foreign exchange are hard realities. Liberalisation in technology transfer and trade has been intensified. Resources such as energy, are in severe shortage. The increasing unemployment and continuing poverty constitute a threatening scenario. Improving living conditions of our population, especially in the rural areas, is a challenge demanding greater attention. These are national priorities which would make increasing demands on the S and T inputs in planning. Thus, S and T activities can no longer remain peripheral to our economic planning.

18.1.4 How then to produce more from less? There are ways through which it may he possible to achieve this. Conservation measures in every single endeavour, ranging from conservation of energy to conservation of fores'ts have to he given a high priority. Indeed, conservation of everything — from "oil to soil" - should be the direction in which S and T will have to steer our action plans. Consolidation of existing position in different sectors through in-depth reviews and purposeful modernisation of the manufacturing industry for higher quality and productivity acquire significance. Commitment to excellence in everything we do has to become an essential ingredient if our endeavours have to yield results commensurate with our needs. Quality improvement in our products and related efforts would increase the demand for S and T, not only in concepts and design but right through production, testing, packaging, transportation of goods and post-sale activities. These would, in turn, create greater employment opportunities. Above all, it is imperative that we spread the culture of scientific processes amongst the entire population before the end of this century. Such a spread is essential to increase the quality of life.

18.1.5 Some of the ideas briefly outlined above provide the motivation and the basis for the S and T programmes of the Eighth Plan described in the following sections.

Policy Framework And Approach

18.2.1 The changing global and national scenario is hound to make greater demands on S and T. Our policy framework and approach to S and T planning has to be geared to face this demand. Science and Technology would also have to encompass major strategies towards agricultural and industrial development and this has to take into account the overall objectives of the new industrial and trade policies, besides the changing international situation. The Government policy framework will continue to encompass encouragement of entrepreneurship, development of indigenous technology through investment in R and D, bringing in new technology etc.

18.2.2 There has been a significant growth in our capability as also our accomplishments in several high technology areas such as nuclear and space science and technology, electronics and defence research and development. Many new programmes and initiatives, are envisaged in these, so as to ensure (i) growth in these strategic and vital

sectors; (ii) operationalisation of projects or programmes that have been successfully demonstrated; (iii) transfer of technology to other sectors, particularly in the broader production sector. There have also been significant developments and achievements in S and T related to the sectors with large societal implications such as in agriculture. Efforts have been mounted for developing newly emerging key areas e.g. microelectronics, informatics/telematics, biotechnology, new materials, renewable energy sources, ocean sciences and several areas of basic research. A large base has been created in the areas of biological and industrial research which will be consolidated, expanded and utilized. Consistent with this need for capability building, there has been a corresponding increase in the Government S and T expenditure excluding Defence in the successive Plan periods as shown in Annexure 18.1. Annexure 18.2 gives the outlay and expenditure, during the Seventh plan, for the various components of the S and T sector. It will he seen that the total S and T outlay forms about 2.26% of the total public sector outlay. The S and T expenditure has steadily increased and reached a level of 1.12% ofGNP at the end of the Seventh Plan. There has been a tendency to regard science and technology as a separate and compartmentalised activity, to be carried out in universities, in research laboratories and in large specialised scientific institutions. It is not generally realised that science and technology should be an integral and essential part of all sectors of our national activity. The results of S and T are yet to be felt in terms of a major impact on the economic development, improvement in the quality of life of our people and in the availability of better goods and services etc. During the coming years it should be ensured that the efforts in science and technology are not confined in laboratories and academic institutions but percolate to the grassroot levels so that science, technology and innovations increasingly become part of the life of our people. For this, appropriate mechanisms and management practices would need to be introduced.

Policy

18.3.1 In order to maximise returns from 'he investments in science and technology, it is necessary that policies covering S and T, industry, finance and agriculture must be meaningfully intermeshed. The recent Industrial Policy has reserved only very few industries for the public sector, reduced the sectors where industrial licensing was earlier necessary, liberalised the procedures relating to technology acquisition and investment, removed the restrictions on large companies and redefined the goals of the public sector undertakings. For this, the technology development must take place in a competitive environment and the policy for industrial research and development should he appropriately reoriented. In the formulation of future policy for the industrial R and D, the spirit and guidelines of the New Industrial Policy must be followed. In consonance with the agricultural policy, the S and T inputs must be able to provide the ever-increasing food requirements of our growing population. The S and T agencies would be directed not only to develop capabilities in their specialised areas but also to interact with the various developmental sectors, industries, institutions set up by the farmers and those providing services to promote the utilisation of their expertise. National laboratories/ centres under the S and T agencies should make their facilities available to the scientists from the agricultural and industries sectors and provide services to the university system and evolve collaborative programmes with them. The socio-economic sectors/ Ministries and States, therefore, must lay a greater emphasis on the S and T content in their programmes and place their crucial demands on the S and T agencies.

18.3.2 The following paragraphs highlight the importance of some of the activities planned:

(a) Science and Technology for accruing benefits to people

18.3.3 Priority must be given to utilising S and T in enhancing the pattern of utilisation of all our resources including the natural resources so that large sections of our society could ultimately benefit from the applications of S and T. Efficient management of land , water, and energy resources through S and T would result in significant benefits to the people.

18.3.4 The large infrastructure of S and T has a potential of contributing significantly towards the removal of poverty. For This purpose, the establishment of appropriate "Prnhiem Refen-ad and Data/ Information Network", consisting of linked units from the village through district and State to the national level is essential. This would help in optimising the S and T resource utilisation and in sharing the experiences. The existing Government programmes for poverty alleviation will have to utilise the S and T inputs significantly. Development models based on optimising the total employment at the local level, based on all available resources, should be prepared. The S and T sector must develop innovative and cost effective techniques and technologies for the storage and processing of, and value addition to, the local resources in the decentralised sector. National level S and T efforts should devote a part of the manpower and budgetary resources directly on the R and D efforts related to measures for alleviation of poverty.

18.3.5 The strategy for using S and T inputs should be based on total integration of the various components of the related policies. For this, the involvement and participation of the target groups and also of the voluntary organizations would he very essential. There is a need for taking up specific activities for the benefit of the different target groups in the society who have so far been denied the benefit of S and T, for example the weaker sections, tribal population and women. It would be the endeavour of the scientific agencies and departments to direct specific programmes, wherever possible, so that these target groups derive maximum benefit. Mechanisms should he

devised and implemented to facilitate trained and skilled personnel from the science departments and scientific organisations to actually work in these sectors of our society (rural, tribal areas etc.) and involve them in micro-level planning, relevant to their needs. The trained persons must develop means to get a proper feed-back from weaker sections regarding their problems. Specific programmes must be worked out to ensure that these sections and particularly the women are benefitted so that better working conditions, improved environment and better employment opportunities are created to improve their economic status, besides health care, nutrition, pre-natal and postnatal care for the women and children. New areas of research and technological development to improve the quality of these sections are to be identified in water management, sericulture, post-harvest technology and food processing and implemented. Scientific agencies and departments must give adequate facilities and freedom, recognition and rewards to young women scientists and encourage them more and more to pursue science as a career. The large potential of retired scientists should be effectively utilised for the integrated rural and tribal development programmes and in the related S and T activities.

(b) Integration of S and T in the socio-economic sectors

18.3.6 Science and technology must use innovative approaches and new technologies in such a way that it becomes an integral part of all sectors of national activity and particularly of the major socio-economic sectors, such as agriculture, chemicals, coal, construction, education, employment, various sectors of engineering, energy production and its use, fertilisers, health, population control, rural development and communication. It is necessary for every one concerned with the socio-economic Ministries to draw out a perspective plan for the next 10-15 years with clear objectives and targets and then identify specific science and technology inputs required to achieve them. For this purpose, it would be necessary to start "think tanks" in the form of a Science and Technology Advisory Committees (STAG) in different sectors. These committees should not merely clear a few R and D proposals but should plan an overall S and T perspective for that sector. Proper status should be given to these Advisory Committees. For example, the Committee should be able to report to the concerned Minister directly. Clear- cut demands must be put forward by them on the existing S and T sector, including the educational and research institutions, in the form of time-bound, need-based projects. There should also he an interactive mechanism to ensure that these demands are fulfilled. Some of the arrangements for this may have to be formalised in the form of contracts. The linkage between the S and T infrastructure and the economic ministries must be strengthened so that the use of S and T becomes inevitable. The user economic Ministries should earmark their S and T budgets and must accept responsibility for an effective use of S and T in their sectors, not merely in terms of expenditure but in terms of their full utilisation. The system should also encourage the academic community and the S and T agencies to take up challenging tasks to tackle socio-economic problems which would be assigned to them by the economic ministries.

(c) Technology Missions

18.3.7 The implementation of National Technology Missions and science and technology projects in a mission mode, for evolving new management structures with much closer linkages between, and better interaction and coordination of, many departments/ agencies, and ensuring large scale, time-bound tangible application of S and T, is important. Accordingly, a few more projects on a selective basis should be taken up in important sectors of the economy.

(d) Research and Development in Industry

18.3.8 Since independence, considerable effort has been made to build a strong base for industrial and technological development in the country. Substantial investments have been made over the last four decades in building R and D institutions in the country to meet the requirements of the industry. The support to the industry for establishing a strong R and D base was given by providing incentives through tax concessions of various types. However, the industry has not responded adequately to make substantial investment on R and D for their own utilisation and instead has gone for the import of technology to meet their growing demand.

18.3.9 Significant inputs of S and T are needed in various socio-economic sectors, with R and D carried out and promoted in the concerned industry. The absence of design and engineering capabilities, the lack of linkages with and the demand from the production system, continued foreign assistance in basic engineering activities/product design and consultancy etc. have been the main constraints in the promotion of indigenous technology.

18.3.10 Mobility of scientists and technologists between the academic institutions, Government laboratories and industry has h-en emphasised repeatedly but it still largely remains unfulfilled. There are many barriers in promoting mobility and those arising from wrong administrative approaches and cadre structures can be rectified with minor modifications in procedure.

18.3.11 For the industries, the absorption and application of science and technology is inevitable. Therefore, industrial enterprises must be encouraged to support rapid absorption of technologies and their adaptation to suit varying needs of the Indian environment. This will lead to gradual introduction in the market of new or modified products that can secure their share in the world markets.

18.3.12 Industrial infrastructure specially in older industries needs to be miproved quickly by revamping and modernisation. Modernisation will have to be given priority over new investments. Textiles, jute, sugar, leather, mining, plantation crops, processed export food and spices etc. require modernisation and substantial S and T inputs.

18.3.13 While individual industries should continue to pursue their competitive roles, they should also form consortia, ;is and when necessary, to capitalise on their collective strength to ensure synergism and develop a team of small vendors around them.

18.3.14 The possibility of joint management of few educational programmes by the industry should be explored to facilitate the orientation of the educational sector to promote industrial growth.

18.3.15 There have been numerous achievements at the level of the national laboratories. However, these achievements have not been commercialised because of the absence of design and engineering capabilities and lack of linkages with the production system. Our national S and T institutions will.,there fore, have to play an increasing role in moulding the technology and adapting and interfacing it with the existing systems. A judicious mix of the indigenous and imported technology would be necessary. The Indian industry needs a technological thrust for modernisation so that it achieves self-reliance.This would imply a much greater emphasis on innovation through inhouse research and development by the industry. Major efforts are required to ensure that the technology status of the local units is brought to the level of international standards su that its products are of international standards. Thus, we must ensure that quality products are produced for internal con-'sumption as well as for export.

18.3.16 During the Eiyhtli Plan a major thrust would be made on suppurtins; and strengthening the pilot plant investigations and activities in the industry. For this, rnajur investments should be expected from the industry through soft loans. Venture capital/risk financing companies have a crucial role to play in this endeavour. Similarly, the establishment of independent pilot plant centres as a cooperative venture of several connected industries would also be a possible option. Also, a few design centres should be established with the Government support and through incentives provided by the industries.

18.3.17 There is a lot of production technology in use in the small scale and village industry sector, which provides significant and gainful employment and helps decentralised operations. Such industries with their technologies must be nurtured and supported.

(e) Science and Technology Education

18.3.18 The National Policy on Education (NPE) has been reviewed recently and a programme of education in the Eighth Plan is being sharpened. The Eighth Plan must recognise that there can be no excellence in science and technology without excellence in the S and T education. A significant portion of our support for science, therefore, must go to educational institutions. More importantly, adequate investment should be made for S and T related activities in the educational institutions so that these could contribute to their maximum to national development.

18.3.19 In the absence of adequate inforsTiation on manpower requirement, it would be difficult to indicate in reliable terms the technical manpower requirement. The establishment of Technology Information Forecasting and Assessment Council (T1FAC) is an important development. Besides, the evaluation of the existing technology and the preparation of technology forecast, it could also include manpower forecasting.

18.3.20 Many talented Indian engineers and scientists are now residing abroad and they are sngaged in a wide range of highly sophisticated technological activities. Some of them are wok-ing in institutions of excellence, sophisticated industries or in new and emerging areas of science. In the last decade many non-resident Indians (NRI) have shown interest in involving themselves actively in the industrial development of India. This interest is due to several factors in addition to desire to .clurn to India. They have acquired a high degree of technological expertise, have an in-depth experience in matters closely related to industry and commerce and have also acquired sizeable resources. Thus they would like to gainfully invest their skill and resources in their motherland.

18.3.21 The scientific manpower abroad has been often referred to as ` Brain Bank', from which India could gainfully draw for its own economic and technological development. Several studies have indicated the measures and mechanisms to facilitate a closer involvement of NRIs in Indian activities. Some of the new policies and measures announced by the Government, since July 1991, have emphasised the role of NRIs in promoting investments in India. This would lead to increasing the quality of our products and will enhance exports. Preparation of preliminary industry profiles on items of immediate interest to the Non-Resident Indians, incorporating general information on industry, technology, demands, measures and policies of the government and specific information about the product and market characteristics, would prove to be extremely helpful in setting up industrial units with the assistance of NRIs in the country.

(f) Promotion of Basic Mesearch and Exciellerce

18.3.22 Creativity and innovation are the main ingradierits for growth and development. Recognising these, the Scientific Policy Resolution emphasises the need for promoting basic research in the country as one of its main objectives. Promotion of basic research involves besides financial inputs, many other factors.

18.3.23 In certain selected areas of research, all efforts should be made to identify a few educational institutions where talented students and faculty members could be attracted for pursuing well-planned advanced courses so that these institutions become the centres of excellence for teaching and research. The selected centres of excellence should receive support, not only from the Ministry of Education anc; the UGC but also from S and T agencies.

18.3.24 The following is necessary for ensuring adequate mechanisms for supporting basic research:

i. S and T agencies and high level committees of scientists should be given the special task of identifying outstanding individual scientists or small groups in different parts of the country. Such outstanding individuals/groups should be encouraged.
ii. Efforts should be made to encourage industrial houses to support basic research in educational and other institutions.
iii. International collaboration should be more effectively utilised to give our scientists the best opportunities to interact with the best of the international talents, undertake collaborative projects of mutual interest and enable the utilisation of the best research facilities in the world where our scientists could pursue their own research ideas and research programmes further which they have undertaken in their own institutions at home.

18.3.25 Dynamic functioning of academic and professional bodies in the country can greatly help in increasing critical assessments, which are important for quality, as also for the dissemi-nation of research work within the country. Unfortunately, very few of our professional bodies and academies have been able to raise the standards of excellence of our publications to the international levels. During the last 5 years or so, increased support is being provided to the professional bodies for undertaking academic activities and this needs to be accelerated.

(g) Thrust,Prioritisation,and Areas of Special Significance

18.3.26 The Eighth Plan will have to deal broadly with four categories of programmes, each with its own distinctive features. These are:

i. basic research in frontline areas;
ii. innovative research in exploitable areas of S and T with emphasis on R and D activities in emerging technologies which provide us with an opportunity of securing a position for leadership and self-reliance;
iii. diffusion of appropriate technology and technology support for ancillaries of large units.
iv. integration of S and T in socio-economic and rural sectors to fulfil the basic needs of water, food, nutrition, health and sanitation, shelter, education, energy, clothing, employment etc.

18.3.27 Consistent with the above, the S and T should contribute to meeting the short-term and long-term needs in the priority socio-economic sectors and also in keeping the country abreast with the latest advances in science and technology in at least some of the front-line areas of research. In view of these observations, the priority areas of S and T activity would be different for the S and T agencies, for the socio-economic sectors and also for the States. While S and T agencies and academic institutions would primarily lay emphasis on programmes in categories (i) and (ii) listed above, the socio-economic ministries and States would mainly concentrate on the last two categories.

18.3.28 As regards the S and T programmes for short-term needs, priority should be given to programmes that aim at expediting the diffusion of cost-effective technologies for products and services. These programmes will be based on available knowledge and known R and D results and will be integrated with different socio-economic sectoral programmes.

18.3.29 The programmes to meet long-term needs in exploitable areas of S and T should contribute to the preparedness of the country for the future and in meeting the developmental requirements. The changing scenario, nationally and internationally, on the economic and technological fronts, requires that investments be made in those areas of science and technology that are considered as critical determinants for such changes. Self-reliance in all aspects of national and economic security, including energy, food etc. would dictate the priority in such programmes.

18.3.30 The manner of utilisation of R and D results would call for strengthening of the S and T information system, forecasting and assessment networks, data bases for management of natural resources, structures for planning and

analysis of socio-economic aspects in the application

18.3.31 Coupling between R and D capabilities and fulfilment of socio-economic needs has to be brought about through the innovation chain, which connects activities spanning research, development, design, demonstration, engineering, production and diffusion, leading to utilization of technology for production and services. Emphasis during the Eighth Plan should be on strengthening the various links in this innovation chain.

18.3.32 An important aspect to be pursued in the case of thrust areas is that of setting up national facilities in terms of highly sophisticated infrastructure, instrumentation, workshops and trained supporting manpower to be used by a large scientific community in view of the limited resources available.

(h) Science and Technology Manpower Development and Employment

18.3.33 It is well recognised that in all countries involved in social and economic development, there is a shift in the percentage of total population employed in agriculture, towards industry and services. With limitations on land and water, self-reliance and sufficiency in food, fodder and fuel can be obtained only through a substantial increase in productivity per unit of land area, with high efficiency in inputs, especially of fertilizers, agrochemicals and energy. Similarly, post-harvest treatments to avoid wastage, or contamination and to introduce processing, are all urgently needed. These call for major inputs of knowledge in S and T, special efforts in supply of high quality seeds and materials and monitoring of the quality of products. Animal productivity as well as fish and egg production can be markedly increased by S and T. Thus, S and T services in agriculture and rural industry should be specially encouraged as also in diagnostic evaluations, technical advice and the supply of vaccines, animal feeds and nutrients. This would call for a major demand on the S and T manpower.

18.3.34 These principles of inputs of high quality S and T apply to all infrastructures such as transport, communications, health, population control and nutrition. There are innumerable opportunities for the S and T services, backed by R and D and special equipment or material which can be manufactured in India. High efficiency and appropriateness must be the hallmark of these inputs and these should change with time. Training and retraining, using modern communication methods, should become essential to maintain progress. Thus, advances in R and D and their output in the areas such as electronics, new materials, computers, telecommunication, sensors, instruments, on-line analysis, diagnostics, biotechnology, genetic engineering and nutrition, when applied, will generate a large employment potential for the S and T personnel and would lead to upsurge in economic activity. This, in turn, will identify further areas for R and D and S and T inputs. Environment, ecology, recycling of resources such as water, are major needs and these call for S and T. Here again, substantial manpower can be deployed.

18.3.35 While a number of steps have been taken by the Government to increase employment opportunities, the number of scientists would fall far short of the rate at which S and T persons are needed in the country. Some of the strategies for the creation of jobs and for retaining S and T personnel are:

i. Motivating S and T personnel to capture the full potential of self-employment;
ii. Creating awareness about entrepreneurship leading to self-employment among the college and school students;
iii. Introducing greater capital investment in the areas where the outlay per work place is minimal;
iv. Restructuring government policies to minimize import of goods;
v. Creating Entrepreneurship Development Cells in all science/engineering/IITs and other academic institutions by the concerned Central/State agencies;
vi. Introducing automated techniques selectively from the viewpoint of safety, reduction of drudgery, improvements in productivity/efficiency, etc;
vii. Examining export strategy to enable ^he country to pay for imports through exports and thereby simultaneously generating greater employment;
viii. Encouraging the establishment of sophisticated industries in the emerging areas of technology as also encouraging the service sectors requiring inputs from high technology so that highly trained S and T personnel could be retained and gainfully employed;
ix. Maintaining centres of excellence in various branches of Science and Technology to retain highly trained persons within the country.
x. Providing proper working atmosphere and adequate amenities (e.g. housing in urban areas) to S and T personnel.

(i) Disseminating Scientific Temper, Science Communication

18.3.36 Efforts and activities of various types, in the cause of propagation of scientific temper and S and T popularization, by a variety of agencies and institutions, have been and are underway in the country. Some of these are quite effective. They include both the "formal"/tradi-tional sector like science museums, planetaria, exhibitions, coverage in the mass media etc., as well as the " non-formal "/non- traditional sector like work of the popular science movement groups, use of non-electronic, field media, jathas, science marches, environmental awareness camps, etc. There is a need to catalyse further the science communication activities in the States especially in the rural parts

and tribal areas.

18.3.37 Several existing impediments and hurdles in the way of popularization of science on a large-scale need to be overcome. These include according validity to observations made and the data collected by common people and voluntary scientific groups, involving and drawing upon manpower and other resources available with the adult education departments and in creating enabling mechanisms for a large number of interested scientists, technologists and teachers who could be deputed to work with scientifically and technically-oriented voluntary organisatioins engaged in S and T communication and popularization activities. Also there is a need to increase the availability of proper reading material for the children and adults.

18.3.38 While the use of mass media in the dissemination of information cannot be underestimated, it definitely needs to be supplemented for better and more lasting effect. Furthermore, voluntary groups/agencies, which have established their credibility either through field work and activities in the area of S and T communication, or otherwise, ought to be encouraged and assisted to take up innovative ideas as projects.

(j) International Cooperation

18.3.39 International linkages in S and T must be a means to assist in the implementation of national programmes, as well as to open up avenues for collaborative interaction, on the basis of mutuality, in the frontier areas, or in those sectors which lead to the acquisition of knowledge not available within the country. The overall modalities of cooperation should be such that they should ensure the enhancement of self reliance, and at the same time, avoid impingement upon considerations of security and sensitivity of the country. This window should also serve as a tool for sharing of India's experience and expertise in the S and T with the other developing nations.

18.3.40 India has arrangements for cooperation in science and technology with over 40 countries. The instruments of cooperation are mostly in the form of agreements/MOUs on a bilateral basis. This could involve Governments or Societies/Academies on the two sides. There are regional programmes with SAARC countries, programmes under India- EC Joint Commission and also S and T linkages with several countries under the umbrella of Technical Assistance Programme (TAP). Collaborative arrangements also exist with a number of international organizations including UNDP, UNESCO, UNIDO, WHO etc. Existing mechanisms of cooperation cover a wide spectrum of areas under various programmes and include exchange of scientists and research workers, training programmes for S and T personnel, joint research and R and D programmes etc.

18.3.41 The policies and approaches for evolving effective international programmes in S and T must result in strengthening the national ^ and T endeavours; harmonising the external relations defined by the Government in the areas sucR as defence, industry/trade, finance, etc. Further, these must be in tune with the defined national priorities. Major effort should be on selecting such programmes and projects which are relevant to the development needs in the Plan; developing alternate models and approaches, which enable the implementation of foreign aided projects based on indigenous resources; ensuring multiplier impact and extension mechanisms and evolving appropriate mechanisms for review; coordination/linkages of the various foreign programmes and science agreements.

18.3.42 There is a clear need for making a critical evaluation of the usefulness of the existing S and T collaborations and delineating those which are truly meaningful. In many cases, institute-to-institute linkages on a long-term basis will serve us well in comparison with the routine broad-based umbrella arrangements between the agencies. Furthermore, the present cooperations are more in the science sector than in the technology sector. Linkages of the Indian industry with corporate R and D centres abroad, for instance, can go a long way in fostering the innovative R and D through a global effort.

(k) Development and Application of S and T in the States and Union Territories

18.3.43 A large part of the activities that affect large sections of the society, such as population control, agriculture, irrigation and water management, housing and construction, urban development, education, health, energy, employment etc. are carried out at the State level using local infrastructure and resources. To ensure that these activities derive maximum benefit from the application of S and T, appropriate institutional mechanisms which have been evolved, at the State level during the last two plan periods should be fully utilized. The details of the plan outlays and the expenditures for the S and T sectors in the States and Union Territories during the past three plan periods are given in Annexure 18.2.

18.3.44 The approach and policy framework envisaged for the development of S and T in States in the Eighth Plan are as follows:

i. Long term S and T policy should be evolved and location-specific programmes in relation to the State's natural resources, skills and socio-economic conditions should be taken into consideration.
ii. The State Councils/Committees and State Departments of Science and Technology must be developed, nurtured and kept at par with the S and T organizations of the country. They should have adequate flexibility and operational freedom to establish their own professional secretariat. Linkages between them and the

academic/research/ technical institutions, as also with the other developmental departments, should then be established.

iii. There is a need for holding periodic meetings of the State S and T Councils so that the policies, programmes and the implementation strategies are approved by this apex body.

iv. A strong mandate is necessary for the Central Scientific Agencies to liaise and work with the State S and T Councils/Departments on a regular basis and they must consider ways by which they can contribute to regional development programmes through the State Councils/Departments. Efforts should be made to initiate new scientific activities in the less developed, rural/tribal regions.

v. The State S and T Councils must be actively involved in the implementation of National Technology Missions.

vi. Voluntary organizations engaged in the S and T activities must be associated in the formulation and implementation of the State S and T plans.

vii. District and village specific problems should be identified so that the challenges based on these can be thrown open tp the scientific community. These problems should be made known to R and D institutions and specific teams must be identified for solving them.

viii. Remote sensing centres should be made fully operational. The State National Informatics Centre (NIC) units, and the Natural Resources Data Management Systehi (NRDMS) programmes, wherever they ex, ist, should be integrated for evolving a S and T based information systems tor the district-level planning.

ix. Each development sector must earmark a certain percentage of its plan outlay for the S and T activities, which should be executed by the concerned development department on the basis of advice given by their standing research advisory committees/expert committees, and the State Council for S and T.

x. Funds for the S and T activities in the States/UTs should be increased in the State plans and budgets especially in the socio-economic sectors and these should be "earmarked" and not diverted/ reappropriated to any other programme.

xi. In the planning process in the States/UTs, the S and T Secretaries/Heads of State S and T organizations including the State Councils should be involved/ consulted/represented to reflect the S and T efforts in all the development sectors.

(l) Management and Administration of S and T

18.3.45 With the growing demand on the application of science and technology to the various programmes of development, the S and T activities cannot be looked at in isolation from the others. These activities cannot remain limited to research institutions alone. The effective pursuit and the use of S and T in the Government both Centre and States, industry and in socio-economic developmental programmes require a proper understanding of the management and administration of S and T in these structures. The basic requirement of having S and T personnel perform and manage these activities may be common. The expertise and skills that need to be developed and the environment in which they are applied are however widely different. The administrative practices followed in autonomous research institutions, educational institutions, industry, voluntary field groups/agencies and Government organizations are so diverse that it becomes extremely difficult to provide a flexible deployment of S and T personnel from one organization to the other. Moreover, the skills acquired by a researcher in a laboratory may have to be suitably tuned and perhaps augmented with training programmes in different facets of manpower development. These include familiarization with skills for financial management or through learning of programme planning techniques, budgeting, public relations etc. In all these, the professional background and scientific thinking, with emphasis on innovation, curiosity and creativity must remain the hallmark of S and T personnel involved in different types of S and T activities described above.

18.3.46 During the Eighth Plan, this aspect of management and administration of S and T activities has to be fully appreciated and appropriate measures should be taken to ensure that science not only becomes a rewarding career in itself but that the S and T personnel are trained and encouraged to implement a wide variety of S and T programmes which are being taken up for national development. We should not only produce outstanding scientists, engineers, technologists and technicians for our R and D programmes but also ensure that an adequate number of highly trained S and T managers and administrators and field workers are also available for performing the multifaceted programmes of national development through the application of S and T.

(m) Organizational Structures and Framework

18.3.47 The organizational structure in most of the scientific agencies and national laboratories have been autonomous and quite independent of the structures in educational institutions. However, the efforts to establish linkages between these two structures is of recent origin. In the Eighth Plan, a far more integrated approach is needed for the promotion and utilization of the wide range of national S and T efforts that exists in the country. For this to become effective, some modifications in the organizational and management systems would be necessary.

18.3.48 There is a need to set up a mechanism in the form of a forum to bring about close interaction amongst the S and T departments/ agencies and the experts from the academic institutions, industries, and socio-economic sectors and users.

Seventh Plan Review

General

18.4.1 During the Seventh Plan, major efforts were directed towards optimal utilisation of the capabilities and the infrastructure already created for scientific and technological activities in the country. Some of the existing structures have been strengthened and augmented for taking up specific programmes. New structures have also been created in the high priority areas. A Department of Biotechnology was set up in February, 1986. An Apex Body under the chairmanship of the Prime Minister and a Project Management Board were established for dealing with the newly developing field of high temperature superconductivity. A Technology Information Forecasting and Assessment Council (TIFAC) was also created. The Science Advisory Council tO the Prime Minister (SAC-PM) comprising almost entirely of scientists and technologists from outside the Government system was also set up and a Scientific Adviser to the Prime Minister was appointed.

18.4.2 A major action in the Seventh Plan involved National Technology/Societal Missions in the areas of vaccination and immunisation of vulnerable population especially children; edible oil, intensive cultivation of oil seeds and oil extraction; better communications; drinking water in every village and water management; eradication of illiteracy; dairy development and wasteland development. The responsibility for the implementation of these was assigned to the concerned nodal ministries. Nine Science and Technology projects in the mission mode were also undertaken in the areas ofimmunological approaches to fertility control; integrated vector control of malaria, filaria and other vector-borne diseases; national goitre control programme with full coverage of UP; S and T inputs for monitoring development and production of immunodiagnostics; cattle herd improvement for increased productivity using embryo transfer technology; operationalisation of National Natural Resources Management System (NNRMS) and Natural Resources Data Management System (NRDMS); setting up of a National Centre tor Medium Range Weather Forecasting and development of agrometeor-ological services; development of amorphous silicon solar cell technology; and application of technology for the welfare and rehabilitation of the handicapped. These were monitored by the Scientific Adviser to the Prime Minister.

18.4.3 Efforts were mounted to enter the newly emerging areas such as microelectronics, informatics/telematics, biotechnology, new materials, renewable energy sources, ocean sciences, and several other frontier areas of basic research. Some positive trends in the education of science and technology have emerged through programmes like COSIST. A few universities have emerged as centres where quality work in specific departments has reached a high level.

Activities of S and T Agencies

18.4.4 The Seventh Plan outlay and expenditure for the central S and T agencies and departments are given in Annexure 18.3. The expenditure during the period accounts for 1.17% of the public sector outlay.

Atomic Energy (R and D)

18.4.5 Through sustained R and D effort, capability has been developed in the field of nuclear energy. This covers the entire nuclear cycle including the exploration, mining, extraction, purification and conversion of nuclear materials, production of fuel elements for reactors, the design and construction of power reactors and their control systems for the units of 235 MWe capacity; production of heavy water; health and safety instrumentation; reprocessing of spent fuel; waste management and production and use of radio isotopes. Some of the other achievements include: operation of the 100 MWe Dhruva research reactor at full power from January 1988 and its utilisation; commissioning of the 14 MV Pelletron accelerator; the commissioning of the Fast Breeder Test Reactor; initiation of the design work on the 500 MWe Prototype Fast Breeder Reactor; development work on advanced laser systems and the synchrotron radiation light source. The neutron source reactor KAMINI at Kalpakkam was completed and zero energy reactor PURNIMA III at Trombay attained criticality in 1991. Under the atomic energy programme, there have been wide-ranging applications of radio-isotopes in medicine, agriculture and industry. The numerous spin-offs from the R and D work include: neutron activation analysis for crime detection; development of beryllium technology for space programme; design of control systems for antennas etc. The design and development of advanced instrumentation systems for scientific research like the radio-telescope, mass spectrometers, high vacuum systems, computer-controlled diffractometers and spectrometers etc. Three national programmes viz. National Centre for Characterisation of Pure Materials, Giant Meter Radio Telescope (GMRT) and a National Centre for Research in Biosciences were envisaged but except for the GMRT, the other two programmes could be initiated during the later years. The tasks of the selection and acquisition of site for the Giant Metre-Wavelengh Radio Telescope (GMRT) near Pune and also the basic design of GMRT were completed.

Biotechnology

18.4.6 An integrated programme was launched with the setting up of a Department of Biotechnology. Eleven national infrastructural facilities have been set up in various scientific institutions in the country which include germ plasm collection, animal house facilities, a centralised facility for the import and distribution of enzymes and biochemicals, protein-peptide sequencing, supply of oligoneucleotides, genetic engineering units and a network of bio-infor-matic system etc. A manpower training programme has been launched for providing the skilled manpower at various levels.

Twenty six universities have set up separate departments of biotechnology. Four S and T projects in the mission mode were undertaken in the areas of cattle herd improvement using embryo transfer technology; development and production ofimmunodiagnos-tic kits; immunological approaches to fertility control and tissue culture of cardamom. Under the vaccine programme, a new joint sector unit called the Indian Vaccine Corporation Ltd. (IVCOL) is being set up with French Collaboration in Gurgaon district in Haryana to produce vaccines for measles; vero rabies (VRV); killed polio vaccine (KPV) and a quadruple vaccine (DPTP). The other unit in the public sector viz. Bharat Immunologicals and Biologicals Corporation Ltd. (BIBCOL) is being established in Bulandshahar in Uttar Pradesh in collaboration with the Soviet Technology Consultancy Corporation under the Long-Term Programme of Cooperation in S and T between India and Russia to manufacture 100 million doses of oral polio Vaccine. The embryo transfer techniques have been standardized in cattle. The National Institute of Immunology has developed productslike animal fertility vaccine, TALSUR, immu-nodiagnostics for the early detection of pregnancy and immunodiagnostic kit for the amoebic liver abscess. Biotechnology Consortium India Limited (BCIL), a bioventure company has been set up in collaboration with industry and financial institutions with a view to facilitating commercialisation of biotechnology in India. Two major pilot plant facilities for providing a large number of planting materials at the National Chemical Laboratory (NCL), Pune and Tata Energy Research Institute (TERI), New Delhi have been set up. Major programmes were initiated on biological pest control, crop and animal biotechnology and aquaculture of fishes and prawns with specific targets and objectives.

Ocean Development

18.4.7 A first order survey of polymetallic nodules occurring in large quantities on the deep seabed in the central Indian Ocean was completed with delineation of a prospective area covering 300,000 sq. km., which formed the basis of the legislation and allotment of 150,000 sq.kms. mine site to India. Thus, India had become the first country in the world to get a mine site registered, as a Pioneer Investor, in August, 1987. Six scientific research expeditions to Antarctica have been launched since 1984. The second permanent station was established at Maitri in 1988 in the Schirmacher Hills. Two marine pollution centres were established at Bombay and Calcutta.

Science and Technology

18.4.8 In the overall promotion of Science and Technology, three new autonomous research institutions namely, the Institute for Plasma Research, Satyendra Nath Bose Centre for Basic Sciences and Jawaharlal Nehru Centre for Advanced Scientific Research as well as an autonomous body called the Technology Information Forecasting and Assessment Council (TIFAC) were set up. Through the activities of the Science and Engineering Research Council (SERC) and other specific schemes for the promotion of research, several hundred projects were supported and regularly monitored through periodic reviews and through group monitoring workshops. The engineering research and technology promotion programmes have made substantial progress in the areas of new materials such as fibres and composites, micro-hydro turbines, computer-aided ship design and power engineering. The instrument development programme has resulted in the development of some selected instruments such as: IR-Spectrophotometer, grain moisture analyser, field usable pH meters, etc. The science-and society related programmes have largely concentrated on developing technologies relevant to the improvement of living conditions for the rural population, weaker sections of the society and in particular, for the rural women. The nationally organized Bharat Jana Vigyan Jatha was a major feature of the science popularisation programme. Production of films like the Bharat Ki Chap, Ramanujan and C V Raman; publications in regional languages; introduction of courses on S and T Communication etc. are also some of the achievements. Under the S and T entrepreneurship development, 6 Science and Technology Enter-preneurship Parks (STEPs) have been set up; 20,000 S and T personnel were exposed to camps and this has resulted in 400 units, started by such entrepreneurs. To enhance our quantitative capability in the weather forecasting, a supercomputer has been commissioned and the National Centre for Medium Range Weather Forecasting (NCMRWF) has been set up as a S and T project in mission mode. Under the autonomous scientific institutions, some major facilities such as the 234 cm Vainu Bappu telescope - the largest in Asia - has been set up at Kavalur. TOKOMAK facility for plasma confinement at Gandhinagar, a large millimetre wave radio telescope at Bangalore and modern facilities for biomedical engineering at Trivan-drum have been set up.

Meteorology

18.4.9 The Indian Meterological Department has been working on the identification of high quality scientific programmes, improvement of services and removal of obsolescence. A cyclone warning centre was established on the west coast at Ahmedabad. Round-the-clock watch was introduced at the cyclone warning centres at Bhubaneshwar and Bombay. Message-switching computers were installed at Bombay, Delhi and Calcutta airports. The message-switching computer at the regional telecommunication hub was modernised. A storm detection radar, two sets of airport meteorological instruments and RTT/facsimile facilities at two centres were commissioned. Runway visual range observations were introduced at four national airports. Capabilities for advance forecasting of monsoon are being developed.

Scientific and Industrial Research

18.4.10 The schemes of the Department of Scientific and Industrial Research (DSIR) relate to National Information

System for S and T (NIS-SAT), technology utilization, NRDC and CEL. Under NISSAT, eleven sectoral centres in the areas of leather, food, machine tools etc. and hard data centres in the areas of Crystallography and advanced ceramics were established. A number of technology utilization schemes, such as National Register of Foreign Collaboration (NRFC), Technology Absorption and Adaptation Schemes (TAAS) etc. have made an impact in facilitating interactions in many areas such as industrial research, transfer of technology and related aspects and consultancy development activities. As many as 1200 in-house R and D units were recognised under the programme of promotion of research in industry and for providing support to industrial R and D projects. Towards the end of the Seventh Plan, 40 projects of 20 industrial units were supported under the Technology Absorption and Adaptation Schemes (TAAS). A Consultancy Development Centre was also set up. Under the scheme on National Register of Foreign Collaborations (NRFC), technology status studies on 83 areas/products were initiated. As a result of aggressive marketing policy, the National Research Development Corporation's lumpsum premium had increased from Rs.16.62 lakhs in 1984-85 to Rs.43 lakhs in 1989-90. It has built up a close working and policy links also with the other public sector venture capital financing companies, namely the Risk Capital and Technology Corporation ofIFCI and TDIC ofICICI. Plan support for the Central Electronics Limited (CEL) was provided initially for an R and D project on multi-crystaline silicon solar cells (MSSC). Subsequently, S and T plan programme was evolved comprising 11 projects in three thrust areas viz., solar photovoltaics, electronic components and electronic systems.

18.4.11 Most of the work on the establishment and development of a few institutions under the CSIR viz., CCMB, CFB, 1MT, Palampur Complex and RRL Bhopal, was completed by the end of the Seventh Plan. A number of new national facilities in the areas of testing of tower structures (SERC, Madras), acoustic testing (NAL), modular transfer function (CSIO), hydro-metallurgy (RRL/B) and novel drug testing on primates (CDRI), computer-aided-design (CLR1) etc. were established with inhouse capabilities. The CSIR also participated in the national societal missions, undertook work on the frontier areas in basic sciences/high technology and endeavoured to develop scientific temper in the country. Evidence of the excellence of CSIR can be found in the breakthroughs achieved such as early flowering and seeding of tissue-cultured bamboo, improved strains of yeast for fermentation of molasses to ethanol for enhanced yield/productivity, a novel catalyst for a single step process for the production of eth-ylbenzene, a bimetallic catalyst for petroleum refining, centchroman - a novel once a week non-steroidal female contraceptive, etoposide -an anti-cancer drug, azidothymidine an anti-AIDS drug, an indigenous probe for DNA finger-printing and liquid nitrogen SQUID. More importantly, some production processes were licensed to other countries such as gugulipid to France for $ 50,000; pentasil zeolite catalyst to Holland for $ 3,00,000 plus $ 6,50,000 as royalty; membranes for desalination plants to Thailand for $ 1,60,000; and azidothymidine and etoposide drugs to the Phillipines for $ 50,000. Consultancy for setting up of a Polymer Research Institute in China for a fee of $ 1,30,000 is another important landmark. Industrial production, based on CSIR knowhow/tech-nologies, has increased from Rs.650 crores in 1986-87 to Rs. 1300 crores in 1990-91. The total value of this production, over the last six years C1985-91), works out to over Rs.4500 crores.

18.4.12 On the basis of the report of a Review Committee for CSIR, several structural changes such as the reconstitution of governing body, establishment of an Advisory Board, creation of Research Councils for individual laboratories and Technical Advisory Boards for different areas, reorganisation of CSIR Headquarters etc. have been implemented. As a consequence, there has been a growing shift towards the concentration of resources in a few selected areas of high priority, encouragement to multi-laboratory and multi- agency activities and emphasis on accountability for the resources invested.

Space

18.4.13 The main thrust of the Space programme in the Seventh Plan was to rapidly realise satellite-based national systems for telecommunications, broadcasting (TV and Radio), meteorology and natural resources management on an operational basis, largely based on indigenous satellite and launch vehicle systems. A National Natural Resources Management System (NNRMS) was established in the country combining optimally the advantages of satellite remote sensing and conventional methods.The successful launch ofIRS-lA satellite on March 17, 1988 (from Russia) and its operationalisa-tion in May 1988 marked a major milestone in the remote sensing programme. IRS-1A still continues to provide excellent operational service. IRS-1B satellite, identical to IRS-1A, was successfully launched on August 29, 1991 from Russia. With both IRS-1A and IRS-1B operational, coverage of the same region is now possible once in 11 days. The data from IRS-1A and 1B, comparable with the data from contemporary international satellites, is used for operational remote sensing application projects/missions. Five Regional Remote Sensing Service Centres were set up by Department of Space with partial funding from Departments of Space, Science and Technology, Mines and Indian Council of Agricultural Research. Twenty one State Remote Sensing Application Centres are already operational. Remote sensing facilities have also been established in 14 Central Government agencies and 10 academic institutions. Application of remote sensing has been operationalised in a number of important areas such as forest vegetation cover mapping and change detection, ground water targeting, wasteland mapping, land use/land cover mapping, flood mapping, large area crop inventory, regional geological mapping and drought monitoring. A number of remote sensing application missions at national level were jointly undertaken by Department of Space and other user Departments/Agencies. Emphasis has been laid on the use of remote sensing-based information system for microlevel planning and sustainable development. Development of second generation IRS satellites namely IRS-1C and IRS-1D were initiated with their launch targetted for 1993-94 and 1996- 97

respectively. Augmentation of facilities at NRSA for reception of data from the European Microwave Remote Sensing Satellite (ERS-1) was taken up. Simultaneously, development of the aircraft version of a C-Band synthetic aperture radar (SAR) was undertaken, apart from carrying out aerial flights using the "side looking aperture radar (SLAR)". The INSAT System, a joint venture of the Department of Space, Department of Telecommunications, the India Meteorological Department, All India Radio and Doordarshan represents India's first step towards implementing operational Space Systems for identified national requirements. This multipurpose IN-SAT operation system caters to domestic long distance telecommunication, meteorological observation and data relay, nation-wide direct satellite TV broadcasting to augmented community TV receivers in rural and remote areas, nationwide radio and TV programme distribution for rebroadcasting through terrestrial transmitters, and News feed assembly from various locations. Space segment for the INSAT system was provided by the multi-purpose INSAT-1B satellite, launched in August 1983, for more than seven years successfully. INSAT-1C, launched in July 1988 by the European Launch Vehicle ARI-ANE-4 was operated with part of the payloads due to an anomaly in one of the power buses. The satellite functioned partially till November 1989. INSAT- ID.launched on July 12, 1990 onboard a US Delta Rocket, was pressed into operational service in July 1990 and all services handled by INSAT-1B till then were shifted to INSAT-ID. To augment the INSAT system, two transponders from INTELSAT and twelve transponders from ARABSAT were leased. These transponders have been put to effective use. By August 31, 1991, 123 telecommunications terminals of various sizes and capabilities (excluding NICNET and RABMN micro terminals) were operating in the INSAT telecommunication network, providing more than 4500 two-way speech circuits or equivalent over 137 routes. Over 100 additional earth stations, including 50 for the rural telegraphy networking in the north-eastern region, are being implemented. As many as 450 micro terminals are being operated for the NICNET. Apart from the National TV service, INSAT-1D is being used for providing regional TV services, and also providing nationwide operational meteorological services. The disaster warning system provided timely warning during the cyclone that hit the Andhra coast in May 1990 and helped in evacuating about 1,70,000 people. The development of INSAT-2 test satellites was initiated in 1984. Two test satellite viz. INSAT- 2A and INSAT-2B are slated for launch during 1992 and 1993 respectively. Building of three INSAT-2 satellites viz. INSAT- 2C, INSAT-2D, INSAT-2E, required for the operational INSAT-2 space segment has also been initiated. One of the major initiatives taken in the area of Satellite Communication is the satellite aided Search and Rescue. India joined the international COSPAS-SARSAT system. Two developmental flights of ASLV were carried out in 1987 and 1988, with SROSS-1 and SROSS-2 satellites onboard. While both the missions failed to accomplish the objectives, the data from the flights and subsequent analysis provided many valuable inputs. They include strapon technology, S-band telemetry and metallic bulbous heat shield technology. Additional inputs in the areas of aero-control-structure interaction, transonic buffeting, acoustic levels have also come out of these flights. All recommendations made by the Expert Review Panel and the Failure Analysis Committee have been implemented in the ASLV D-3/C1 Vehicle. Extensive independent verification of all vehicle systems and of the missions have been carried out to improve the confidence level. The flight hardware of ASLV-D3/C1 has been realised and the launch is scheduled for 1992. The primary goal of ASLV-D3/C1 is to evaluate the performance of the vehicle. It will also carry the SROSS-C satellite with a Gamma Ray Burst Detector and Retarding Potential Analyser payloads for conducting ionospheric experiments. The PSLV project entered the hardware realisation phase in 1986. The flight units are in advanced stages of completion for the first flight expected in 1992. In order to realise launch capability for INSAT-2 class satellites, several configuration studies for GSLV were carried out. The GSLV configuration was finalised after critically evaluating various options. It is configured by replacing the two upper stages of PSLV with a single cryogenic stage and by substituting the six solid strapon motors of the booster with four liquid strapon derived from PSLV second stage. One of the most important considerations in arriving at the final configuration of GSLV has been to maximally utilise the subsystems and propulsion modules deveJoped for PSLV to take full advantage of the heritage and thus ensure reliability. The Geostationary Satellite Launch Vehicle (GSLV) project to de-

Eighth Plan Programmes

Atomic Energy (R and D)

18.5.1 In the BARC, it is proposed to add a superconducting LINAC booster to the Medium Energy Heavy Ion Accelerator facility. A National Centre for the Neutron Beam Research in Trombay is also proposed. The INDUS-1 storage ring at CAT, Indore, will become operational and it will serve as a Synchrotron Radiation Source. Thrust will also be given to augmentation of water chemistry research for the nuclear energy programme, development of decontamination formulations for the Primary Heat Transport (PHT) systems and for the Pressurized Heavy Water Reactor Systems (PH-WRS) including the preparation of novel materials and a study of their physico-chemical properties. Novel methods for fuel materials and minerals would also be developed. The reactor physics design of 500 MWe PHWR and the analysis of the related safety issues would be the other main areas of thrust in the future systems. A facility for the development of specialised items needed for the high technology remote handling equipments is proposed to be set up. Efforts would be mounted in several instrumentation activities such as the Development of CAMAC and FAST BUS Instrumentation for Data Acquisition, Development of Ultrasonic Image Processing Systems for Nondestructive Testing and Image Processing Instrumentation and Development of Advanced Plasma Devices etc.

18.5.2 In the Variable Energy Cyclotron Centre, Calcutta, the emphasis would be on taking up a project on

Superconducting Cyclotron. At the Centre for Advanced Technology (CAT), Indore, major programmes would be focussed on Synchrotron Radiation utilisation, insertion devices, development of accelerators for the industrial applications and feasibility study of an advanced accelerator facility for research in nuclear physics. It is also planned to develop electron accelerators like D.C. accelerators and microtrons. At the Indira Gandhi Centre for Atomic Research, Kalpakkam (IGCAR), training simulator will be developed for Fast Breeder Test Reactor (FBTR). For the development of materials and manufacturing processes for FBR, new studies are proposed to be initiated to provide information for PFBR design in the domain of high cycle, high temperature fatigue, fracture mechanics, alloy development and corrosion studies. The mass transfer in Plutonium systems would be studied and a facility, in which scaled up equipment required for PFBR can be tested and developed, would be established. For improved instrumentation systems for FBRs, a major programme would include the Modernisation and Development of Fast Reactor Instrumentation and Control.

18.5.3 Major projects on R and D for atomic minerals include geochemical surveys and exploration, augmentation of geochronological facilities, application of remote sensing techniques and augmentation of airborne surveys.

18.5.4 At the Tata Memorial Centre, the major activity would relate to the setting up of an Advanced Centre for Training, Research and Education (ACTREC) in cancer detection at New Bombay and the establishment of a Nuclear Magnetic Resonance Unit (NMR). Two rural cancer centres, have also been proposed.

18.5.5 At the TIFR, in order to derive full benefit from the operation ofpelletron accelerator installed, a second-beam hall along with certain types of common facilities for the users such as scattering chambers, detectors, data acquisition systems have been proposed. Three more new national programmes have been suggested viz. A National facility for Neutron Beam Research, High Energy Physics Research and a National Programme on Lasers.

Biotechnology

18.5.6 The primary objective in this descipline would be to develop products and processes/technologies, whose large-scale applications would result in societal benefits in the sectors of health, agriculture, animal resources development, aquaculture, energy, environment and forests and industry. The strategy would involve the development of specialized manpower and infrastructure for these programmes and a very strong base of R and D.

18.5.7 The main activities to be undertaken would be: production of vaccines, production of immunodiagnostic kits, large scale production ofbiofertilisers, propagation of cardamom plant through tissue culture technique, pronto-tion of animal birth control vaccine (TALSUR) and the use ot'Biocide-S in controlling mosquito. Technology. These would be encouraged to take up focussed programmes for the socio-economic development of the States. It is proposed to conduct entrepreneurship awareness camps in different educational institutions and impart training in entrepreneurship. A catalytic role will be played in setting up S and T entrepreneur-ship parks (STEPs) with the support of financial institutions.

18.5.14 The broad features of the activities to be taken up through the National Council for Science and Technology Communication (NC-STC) would be: emphasis on the S and T reaching a larger number of people across the country on the lines of Bharat Jan Vigyan Jathas (BJVJ). People will be reached via all possible media, employing software in various Indian languages.

18.5.15 Under the international S and T cooperation programmes, the Intergrated Long Term Programme (ILTP) of cooperation in Science and Technology between India and Russia will be strengthened. The Indo-French Centre for the Promotion of Advanced Research (IFCPAR) has become fully functional. This will actively pursue collaborative R and D programmes. Similarly, joint projects with other developed and developing countries would be pursued further.

18.5.16 By introducing systematised marketing strategies and an appropriate network it will be possible to reach a wider spectrum of users with the production of 'client-specific' maps. Map substitutes would be the main activities of the Survey of India. National Atlas and Thematic Mapping Organization (NATMO) would enhance their capabilities for the production of various thematic maps.

18.5.17 The emphasis in the sector of meteorology research, development and operation programmes would be on: development of sophisticated numerical weather prediction models using the supercomputer for medium range weather forecasting, and the development of region- wise, crop weather relation/pattern so that research on the medium range weather forecasting reaches the farming community both at the planning and the operational levels.

18.5.18 The major thrust of the IMD's programmes would be on the improvement of forecasts by evolving new methods so that the forecasts become more accurate. Modernisation of the data management system at Pune and participation in the world climate research programmes are the other activities. Support facilities envisaged are: information dissemination system with the availability of satellite-based communication system, commissioning of ground segment of the INSAT-II, extension of Disaster Warning System to some more areas on the east coast.

Scientific *and* Industrial Research

18.5.19 The activities proposed under NIS-SAT include metropolitan library network, library automation and retrospective conversion, database development, database on CD-ROM, information referral system, INDIMARC. Under the technology utilization scheme, the National Register of Foreign Collaborations provides an opportunity for the national laboratory system to tune its activities to meet the current demands and possible future demands of technology by the industry and for preparing the technology status reports of several industries in the country. The Technology Absorption and Adaptation Scheme provides a mechanism of interaction for R and D by the companies which have imported the technology and will take advantage of the existing national infrastructure. The Transfer and Trading in the Technology Scheme provides suitable avenues for commercially viable technologies produced indigenously to be marketted in the other countries. Schemes such as the TIES scheme, Promotion of International R and D Collaboration and Promotion of Indigenous Development of Capital Goods will open up new opportunities for strengthening linkages between the R and D and industrial system in the country with their possible commercial utilization.

18.5.20 The National Research Development Corporation (NRDC) would provide techno-commercial and financial support to entrepreneurs for commercialising the indigenous technologies licensed by NRDC. The Central Electronics Limited (CEL) has drawn up a plan to induct new products such as multi-crystallirie silicon solar cells, ultra high efficiency solar cells, micro-wave ferrites, high permeability ferrites etc.

18.5.21 The CSIR's approach to the Eighth Plan would be to implement four categories of programmes, viz., "industry and economy-oriented programmes", "societal programmes", "basic research programmes" and "research support activities and technical services programme". The thrust of the industry-oriented programmes is in the areas of: Agro-chemicals/pesticides, catalysts, drugs and pharmaceu-ticals, light transport aircraft, machine-life prediction and life- extension technology, environmental impact assessment, risk and hazard studies; leather, electronics and instrumentation, post- harvest technologies etc. The societal programmes would provide S and T inputs for the benefit of economically weaker sections including women, tribal population and the handicapped. The thrust in this case would be on: safe drinking water, health care, oils and fats, housing techniques, natural hazard mitigation etc. The basic research programmes mainly pertain to modern biology (including cellular and molecular biology); organic synthesis under chemistry pertaining to drugs and pharmaceuticals; natural product chemistry; electrochemistry; earth sciences including geophysics and ocean sciences; atmospheric and space physics; material science; computer- aided studies and parallel computation and aeronautics. The external budgetary resources of CSIR are expected to reach a much higher figure during the Eighth Plan as compared to what was allocated for the Seventh Plan. The new activities proposed are the creation of data bases and data centres, technology gate-keeping, establishment of a strong monitoring group including safety monitoring, new strategy for commercializing CSIR research output and archiving and preservation technology. For effectively involving the NRI scientists in the development process, the interface for the NRI scientists and technologists (INRIST) will be strengthened.

Space

18.5.22 The basic frame-work for the Eighth Plan for Space programme is the 1990-2000 Decade Profile, which was drawn up after detailed consultations with the user community. A self-reliant and integrated programme, with indigenous building and launching of satellites with maximal utilisation of Indian industry has been envisaged in this Profile for providing and sustaining two operational space systems viz. INSAT System and IRS System for meeting the various application needs in communications, broadcasting, meteorology, disaster management and resources management. Maximam utilisation of space technology for socio-economic development of the country and the rural areas in particular, has been envisaged in this Profile.

18.5.23 In the satellite communications area, the major thrust during the Eighth Plan will be to (i) manage efficiently the operation of INSAT system for providing a multitude of national services, (ii) establish and operationalise the INSAT-2 space segment, (iii) augment the operational satellite aided search and rescue programme with a geostationary satellite component, (iv) establish an initial mobile satellite communications system including experiments with low-earth orbiting satellites for rural/mobile communications, (v) develop new and advanced satellite-based communication applications in the areas of information dissemina-tion, interactive distant education etc. including a GRAMSAT network dedicated for aiding rural development and education, (vi) conduct studies and experimentation leading to definition and initiation of programme for a direct broadcast satellite system and INSAT-3. The launch and operationalisation of INSAT-2A, 2B, 2C, *ID,* 2E satellites are envisaged during this period apart from development and launch of GRAM-SAT satellites, low-earth orbiting communication satellites and mobile satellite system.

18.5.24 The second generation Indian Remote Sensing satellites viz. IRS-1 C and IRS-1 D, planned to be launched and operational ised during the Eighth Plan period, incorporate sensors with resolutions of around 20 meters in multis-pectral bands and better than 10 meters in the panchromatic band, apart from stereo-viewing, revisit and onboard data recording capabilities. A new band in shortwave infrared is also planned with a spatial resolution of 70 meters. Also, a wide field sensor with 180 meters spatial resolution is incorporated for monitoring of vegetation. Application studies using microwave data received from the European Remote Sensing satellite ERS-1 and our own air-borne SAR are expected to yield significant advantages. A satellite system using microwave remote sensing

sensors is proposed to be initiated. The major goal of achieving an operational, Natural Resources Information System (NRIS) based on Geographic Information System (GIS) and with modelling capabilities is targetted for the Eighth Plan period. With the emphasis shifting in favour of optimal exploitation of natural resources on an environmentally benign and sustainable basis, there is need for taking a holistic approach to resource management. Towards this, integrated study of land and water resources at microlevel is envisaged at national level. These studies will help in preparing a comprehensive plan of action for sustainable development.

18.5.25 Satellite-based space science missions will be carried out using the SROSS satellites onboard ASLV, and the 1000 kg class satellite onboard PSLV. Scientific studies using the MST Radar facility and Infrared telescope, Geosphere-Biosphere programme and experiment using space stations have been envisaged during the Eighth Plan. Operationalisation of ASLV, PSLV and completion of development of GSLV are the three major milestones targetted during Eighth Plan for achieving self-reliance in the launch vehicle area. Development of a number of critical technology elements for satellite system, payloads and launch vehicles are planned. Renewal and replacement of selected in-house facilities, including major computer systems and establishment of a second launch pad at Sriharikota, which are imperative for supporting the operational satellite/launch vehicle missions, are planned. Maximal use of Indian industry for manufacturing, assembly/integration and even operation of selected in-house facilities is envisaged. Efforts are planned, in collaboration with Indian industry for the indi-genisation of strategic/critical components and materials.

18.5.26 There is export potential for providing ground systems/products, satellite and launch vehicle systems, satellite services and launch services on a commercial basis to other countries, which will make the Indian space engineering industry a more viable proposition in the years to come. The setting up of the Corporate Front, a techno-managerial corporate body will facilitate ploughing back the corporate earnings for sustained product development and market promotion efforts, besides promotion of partnership between Space Department and industries. The expertise and experience gained in carrying out complex space technology projects in academic institutions and Universities will be harnessed further for enhanced participation of these institutions in the national space effort.

Forensic Science and Police Wireless

18.5.27 The modernisation and manpower development programmes in the Central Forensic Science Laboratories and GEQDs, which were started in the Seventh Plan will continue. The research areas envisaged pertain to DNA finger printing; cadavar entomology; immuno-assay techniques; classification of handwriting characteristics; instrumental techniques for examining writing materials; computerised image processing of firearms and ammunition; development of computerised system for super-imposition; im-muno diagnostic technique, hair identification, range and time of firing and explosive analysis, etc. It is expected that rapidity and sophistication would be introduced by way of video- fit techniques, laser-tracing, holography, image processing, computer aided automatic finger print identification system and initiatives taken in new frontier areas like forensic psychology. Suitable structure and mechanism would be evolved for the formulation, implementation and monitoring of S and T schemes under the Forensic Science. In the area of police wireless, the main thrust will be to achieve communication link from the national capital upto rural police station through State Headquarters, Range Headquarters, District Headquarters. This is proposed to be achieved through the development of high speed message switch, micro processor based specifically designed computerised connectors, pocket radio system, micro earth station and secrecy devices and multiaccess radio telephone etc.

S and T Programmes in the Socio-Economic Sectors

18.5.28 Science and Technology programmes envisaged by the socio-economic sectors are given in their respective chapters.

Financing Science and Technology Plan

18.5.29 The impact of scientific innovation and technological advances in a country such as India, in its present economic situation, with a large agricultural base, and with its impending transformation to an industrial society, will ,be particularly profound. It is clear, therefore, that fullest efforts must be made to promote scientific innovations and use these, with their progressive technological advances, in all the sectors of the economy. The resources needed for this purpose will be small, compared to the benefits that the country could derive in the future. All our experience shows that, if properly managed, the multiplier effect ofS and T would be very large.

18.5.30 While investing in science and technology, we have to give a thought to the concept of Zero-Based Budgeting (ZBB). There is a dichotomy in that the non-Plan and the Plan expenditures are looked at separately, while the ZBB concept implies an integrated approach to budgeting.

18.5.31 In order to decide about the size of the total S and T outlay for the Eighth Plan, the trends in S and T outlay, as a percentage of total public sector outlay, for the three domains of S and T activities can be taken as a guide. As can be seen from the Annexure 18.2, the Plan outlay for S and T as a percentage of the total outlay of the public sector Plan has varied from 2.07% during the Fifth Plan to 1.98% in the Sixth Plan and to 2.26% in the Seventh Plan.

The Plan outlay for the Central S and T agencies, as a percentage of the total outlay of the public sector Plan, was 1.12% in the Fifth Plan; 0.83% in the Sixth Plan and 1.12% in the Seventh Plan. For the socio-economic sectors, it has varied from 0.96% in the Fifth Plan to 1.13% in the Sixth Plan and 1.09% in the Seventh Plan, while for the States it has increased from 0.02% in the Sixth Plan to 0.05% in the Seventh Plan. A large part of the present allocation for the S and T agencies is for certain specialised areas, such as atomic energy and space and this provides support for such activities, which are highly specialized. Support for these activities at the present levels, and indeed at somewhat increased levels based on the actual assessment of projects and needs, will have to continue. There is also a need to support the efforts in the newly emerging domains of high technology such as informatics, biotechnology, new materials etc.

18.5.32 With the change in the emphasis and direction enunciated in the Eighth Plan, it has become essential to provide sufficient funds to the S and T agencies and to the socio-economic sectors to carry out crucial S and T projects and bring about a major change in our attitudes and performance. Many important programmes and projects have been dropped in the past due to lack of adequate financial support. Thus, it is customary to indicate the percentage of GNP spent on S and T as a measure of the importance given by a country to the S and T sector.

18.5.33 The Plan outlay for the Central S and T Agencies / departments and for the States and Union Territories in S and T sector during the Eighth Five Year Plan (1992-97) is given in Annexure 18.6 and 18.7 respectively.

Annexure 18.1 Progress of S and T Expenditure In Different Plan Periods

(Rs. in Crores)

Five Year Plan Period	Plan	Non - Plan	Total
First Plan (1951-56)	14	6	20
Second Plan (1956-61)	33	34	67
Third Plan (1961-66)	71	73	144
Plan Holiday (1966-69)	47	83	130
Fourth Plan (1969-74)	142	231	373
Fifth Plan (1974-79)	693	688	1381
Annual Plan (1979-80)	208	222	430
Sixth Plan (1980-85)	2016	1652	3668
Seventh Plan (1985-90)	5087	3158	8245

Annexure 18.2

Plan Outlay And Expenditure For The S and T Sector And Its Relation To The Total Outlay During The Fifth, Sixth And Seventh Five Year Plans

(Rs. in Crores)

S.No Dept./ Agency	Fifth Plan (I 974-79)		Sixth Plan (1980-85)		Seventh Plan (1985-90)	
	Outlay	Exp.	Outlay	Exp.	Outlay	Exp.
1.Central S and T Agencies/Deptts (@)	438.23	384.51	808.15	990.16	2022.74	2589.14
2.S and T In Socio-economic Sectors	3'75.59	308.65	1100.91	989.66	1953.49	2408.14
3. S and T In The States/UTs And NEC	0.00	0.00	17.05	36.39	87.06	89.25
4.Total S and T(@)	813.82	693.16	1926.11	2016.21	4063.29	5086.53
5.Total Public Sector(*)	39303.00	39426.20	97500.00	109291.70	180000.00	221850.20
6.Total S and T As % Of Total Public Sector	2.07	1.76	1.98	1.84	2.26	2.29
7. Central S and T Agencies As % Of Total Public Sector	1.12	0.98	0.83	0.91	1.12	1.17
8. S and T In Socio-economic Sectors As % of Total Public Sector	0.96	0.78	1.13	0.91	1.09	1.09
9. S and T In States As % of Total Public Sector	-	-	0.02	0.03	0.05	0.04
10. Total Central Sector	19954.00	18755.00	47250.00	57825.20	95534.00	130394.82
11. Central S and T Agencies As % Of Total Central Sector	2.20	2.05	1.71	1.71	2.12	1.99
12. S and T In Socio-economic Sectors As %	1.88	1.65	2.33	1.71	2.04	1.85

of Total Central Sector						
13.Total State Sector(and)	19349.00	20671.00	50250.00	51466.50	84466.00	91455.38
14.S and T In States As % of Total State Sector	-	-	0.03	0.07	0.10	0.10

(@) Excludes Environment. ('') Includes Rs 450 crores under Hill and Tribal area Development.*

Annexure 18.3

Plan Outlay And Expenditure For The Central S and T Agencies/ Deptt. During Seventh Plan

(Rs. Crores)

Dept. / Agency	Seventh Plan (1985-90) Outlay	Actuals
I.DST	301.78	332.90
2.DSIR/CSIR	370.00	400.91
(a)S and T	355.00	382.04
(h)I and M	15.00	18.87
3.DBT	132.00	142.86
4.DOD	110.00	72.63
(a)S and T	100.00	71.80
(h)I and M	10.00	0.83
5.DOS	793.96	1364.89
(a)S and T	700.00	1098.86
(b)Operational	93.96	266.03
6.DAE(R and D)	315.00	284.86
7. Forensic Science and Police Wireless	25.00	9.79
Total S and T (Excluding I and M)	2022.74	2589.14
8. Total Public Sector	180000.00	221850.20
9. Centra! S and T Agencies As % of Total Public Sector	1.12	1.17
10. Total Central Sector	95534.00	130394.82
ll.Centrl S and T Agencies As % of Central Sector	2.12	1.99

Annexure 18.4

Annexure 18.4 Plan Outlay And Expenditure For S and T In Individual Socio-economic Ministries/ Deptts.

(Rs. Crores**)**

S.No. Socio-economic Sectors	Fifth Plan (1974-79)		Sixth Plan (1980-85)		Seventh Plan (1985-90)	
	Outlay	Exp	Outlay	Exp	Outlay	Exp.
1. Agricultural Research(ICAR)	153.56	153.37	340.00	287.10	425.00	438.15
2.Biomedical Research(ICMR)	21.32	15.99	40.00	48.08	150.00	141.57
3.Chemicals	2.35	1.74	26.03	14.76	2.59	2.83
4. Civil Aviation	19.96	19.12	46.50	52.00	3.47	1.98
(Including 1MD And Institutes)						
5.Civil Supplies	0.00	0.00	0.00	0.00	2.78	1.05
6. coal	6.39	3.85	18.00	6.15	120.00	33.19
7. Commerce	0.00	0.00	32.40	35.00	12.77	19.79
8. Communications	22.39	18.99	62.15	40.57	151.00	163.42
9.Drugs and Pharmaceuticals	Included under Chemicals				7.00	4.65
10. Education	35.50	24.42	112.00	151.00	180.00	528.74
11. Electronics	18.73	14.41	32.34	21.05	38.00	62.06

12.Fertilizers	Included under Chemicals				23.15	20.81
13.Food	3.20	2.19	8.10	3.71	13.64	6.78
14. Food Processing		Included under Food				
15.Forests and Wild Life	4.70	2.38	12.00	10.78	33.00	43.79
16.Heavy Industry	28.76	19.80	57.51	40.00	66.01	76.23
17. Industrial Development	10.74	8.05	18.80	23.73	20.95	37.43
18.Information and Broadcasting	0.77	0.18	2.50	1.80	6.25	3.97
19.Irrigation(Water Resources)	8.48	1.89	20.45	12.37	10.00	40.49
20.Labour	0.15	0.00	1.06	0.36	1.51	2.03
21.Mines	6.48	2.88	16.16	14.18	30.24	28.89
22. National Test Houses(supply)	Included under S and T Agencies		8.50	2.85 * (7.11)	14.75	8.40
23-Non-convl energy sources	0,00	0.00	50.00	44.00	130.35	162.30
24.Petro-Chemicals	Included under Chemicals				41.74	47.60
25. Petroleum and Natural Gas	12.08	8.71	37.66	67.40	150.00	212.61
26. Power	8.69	3.28	53.10	33.00	76.22	74.58
27.Railways	0.00	0.00	0.00	0.00	25.00	27.28
28.Rural Development	1.21	0.73	10.05	15.02	20.00	14.62
29. Shipping and Transport	2.98	1.98	9.75	3.50	18.17	11.98
30. Social Welfare and Nutrition	0.00	0.00	2.00	1.04	0.00	2.96
31.Steel	6.62	4.48	79.85	59.91	98.94	104.05
32.Textiles					70.95	67.36
33.Urban Development(including Housing and Water Supply)	0.53	0.21	4.00	0.30	10.01	6.93
34.Vill. and SSI	+	+	+	+	+	9.62
Total	375.59	308.65	1100.91	989.66	1953.49	2408.14

** Actual Exp. under NTH was Rs.7.11 crores. Since this was included under Agencies during Sixth Plan untill 1983-84, the exp. of Rs.2.85 crores for 1984-85 alone which was excluded under Agencies has been included under Socio-economic Sector.*
+ Included under Industrial Development

Annexure 18.5

Statewise Break Up of S and T Plan Outlay And Expenditure In States And Union Territories
(Rs in Lakhs)

S.No and States/UTs	Seventh Plan (1985-90) Outlay	Actuals
1. Andhra Pradesh	610.00	208.00
2. Arunachal Pradesh	12.00	19.92
3. Assam	300.00	376.00
4. Bihar	300.00	430.00
5. Goa	110.00	127.20
6. Gujarat	450.00	88.00
7. Harayana	165.00	310.00
8. Himachal Pradesh	100.00	79.00
9. Jammu and Kashmir	100.00	38.00
10. Kamataka	200.00	312.00
11. Kerala	1700.00	2302.00
12. Madhya Pradesh	650.00	626.00
13. Maharashtra	200.00	193.00
14. Manipur	200.00	202.00
15. Maghalaya	150.00	61.00
16. Mizoram	10.00	54.00

17. Nagaland	80.00	57.00
18. Orissa	216.00	479.00
19. Punjab	400.00	199.00
20. Rajasthan	344.00	130.00
21. Sikkim	22.00	36.00
22. Tamil Nadu	450.00	575.00
23. Tripura	200.00	208.00
24. Uttar Pradesh	1000.00	1414.00
25. West Bengal	320.00	186.00
Total States	8289.00	8710.12
1. Andaman and Nicobar Islands	26.00	58.54
2. Chandigarh	20.00	57.23
3. Dadra and Nagar Haveli	14.00	1.55
4. Delhi	56.00	10.24
5. Daman and Diu	**	
6. Lakshadweep	25.00	29.24
7. Pondicherry	36.00	1.03
Total UTs	177.00	157.83
Total(States/UTs)	8466.00	8867.95
North Eastern Council	240.00	57.19
Grand Total	8706.00	8925.14

** *Included in Goa*

Annexure 18.6

Plan Outlay For Eighth Five Year Plan For Central S and T Agencies/ Departments

(Rs. Crores)

S.No. Departments/ Ministries	8th Plan 1992-97 Outlay
I.Dept. of Science and Technology	640.00
2.Dept. of Scientific and Industrial Research	655.00
(a) CSIR	585.00
(b) DSIR(S and T)	52.00
(c) DSIR(I and M)	18.00
3.Deptt. of Biotechnology	265.00
(a) S and T	260.00
(b) I and M	5.00
4.Dept. of Ocean Development	130.00
(a) S and T	115.00
(b) I and M	15.00
5.Dept. of Space	1804.00
6.Dept. of Atomic Energy (R and D)	600.00
7.Forensic Science and Police Wireless	25.00

Annexure 18.7

S and T Plan Outlay For Eighth Five Year Plan For The States And Union Territories

(Rs. in Lakhs)

S.No and States/UTs	8TH PLAN (1992-97) Outlay
1. Andhra Pradesh	200.00*
2. Arunachal Pradesh	47.00
3. Assam	462.00
4. Bihar	782.00

5. Goa	300.00
6. Gujarat	550.00
7. Harayana	662.00
8. Himachal Pradesh	275.00
9. Jammu and Kashmir	190.00
10. Karnataka	800.00
11. Kerala	2193.00
12. Madhya Pradesh	641.00
13. Maharashtra	568.00
14. Manipur	400.00
15. Maghalaya	193.00
16 Mizoram	195.00
17. Nagaland	100.00
18. Orissa	4556.00
19. Punjab	750.00
20. Rajasthan	700.00
21. Sikkim	250.00
22. Tamil Nadu	1000.00
23. Tripura	225.00
24. Uttar Pradesh	1000.00
25. West Bengal	1833.00
Total States	18872.00
1. Andaman and Nicobar Islands	135.00
2. Chandigarh	15.00
3. Dadra and Nagar Haveli	38.00
4. Delhi	30.00
5. Daman and Diu	40.00
6. Lakshadweep	127.61*
7. Pondicherry	13.00
Total UTs	398.61
Total(States/UTs)	19270.61

* *Includes Environment*

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