Planning without the spirit and the determination

Perspectives in Science and Planning, two volumes. Published for the Department of Science and Technology, Government of India, by Vikas Publishing House, New Delhi. 1990. pp. 807. Rs 750.

In the mid-eighties Indian polity passed through a short spell of unusual frankness and honest introspection. This period lasted no more than a couple of years. But during those two precious years an atmosphere was generated in which it became possible to undertake a proper assessment of our achievements in various fields of national endeavour, and to make efforts to set new pragmatic goals, without being bound by the moralistic rhetoric and empty daydreaming that had marked much of Indian planning till then. The series of technical reports prepared by the Science Advisory Council to the Prime Minister (SAC-PM), and collected in these two volumes, are a product of the efforts initiated in that phase.

SAC-PM was constituted in 1986, and it had formulated its approach to the role of science and technology in the future plans for India by July 1988. This approach paper, which appears as the first document in these volumes, is marked to some extent by the spirit of those times.

Pragmatism is the keynote of this approach to S&T planning. It is taken for granted that the major emphasis of S&T in India shall be on helping in solving the basic day-to-day problems of India: S&T shall be geared to providing more food, better health, better housing and so on; S&T effort shall also be directed at upgrading primary services, like transport and communications, and at enhancing the quantity and quality of energy and basic materials available in India; and while the bulk of S&T effort shall primarily be aimed at these basic sectors, certain carefully selected areas, identified on the basis of our special geographical, historical and material strengths, shall be taken up for intensive effort so as to achieve a position of world leadership in at least some fields of S&T; similarly, S&T shall be pursued selectively to achieve international superiority in selected areas of industrial production.

This approach is clearly spelt out in the first few pages of the approach paper, and seems to have followed from the very clear policy directives emanating from the political leadership of the time. Those were the days when the talk all round was about walking with both feet firmly on the ground, and limiting our flights of fancy into the 'blue skies' to certain well-defined areas where we have an obvious potential of making a mark.

Keeping this approach in view, the detailed reports in these volumes have been divided into two distinct groups. The first volume contains seven reports on what are termed 'frontier areas of research and development'. The second volume has eight reports on 'areas of socioeconomic relevance'. The first set perhaps belongs to the so-called blue-skies areas in which SAC-PM believed Indian scientists can become world leaders. The second set is concerned with application of S&T to problems of mundane day-to-day living in India.

From a realistic approach ...

The clarity of approach spelt out at the beginning of this exercise in S&T planning builds up certain expectations from the detailed reports that follow. One expects that each of these reports offers a precise review of the situation of Indian S&T efforts in its area and places these within the perspective of the situation worldwide. One also expects an incisive assessment of our strengths and weaknesses in the particular field, and an estimation of the level of demands likely to be put on S&T in that area within the Indian context. And, finally, one expects an analysis of the directions we propose to follow within that field of S&T activity either to make a mark in the world or to make a dent in the wall of our own problems.

The first report, 'Advanced materials: national priorities', fulfils all these expectations. The report starts by presenting a brief overview of the status of advanced materials in the world and then presents a more detailed review of their status in India, giving a fairly complete picture of the facilities available and capabilities achieved so far. The report goes on to discuss the evolving technologies for processing of materials. Having thus surveyed the technological aspects, the report takes a look at the organizational and policy issues involved. Through an analysis of the experience in indigenous development of maraging steel and zircaloy, the report attempts to identify the fiscal, technological and organizational arrangements that must be made for successful development of a particular material. Finally the report identifies the areas in which intensive research effort must be made, and recommends five or six materials that can be taken up for concentrated indigenous development.

This way of selecting specific areas for intense work, while maintaining an overview of the whole scene, is perhaps the best way of going about the business of making our presence felt in the field of advanced materials. This approach of informed selectivity also ensures that we shall be able to take steps to foresee and plan for the fulfilment of our strategic requirements, which also the report attempts to do. One only wishes that the same care and attention was bestowed upon a plan for development of ordinary materials, like iron and steel for ordinary tools, stainless steels and alloys for cooking and serving vessels, plastics for toys, and similar other ordinary needs, for all of which we just do not seem to be producing sufficiently good materials.

... to vague pronouncements

Unfortunately, none of the other detailed reports in these volumes displays the clarity of purpose and comprehension of the realities seen in the report on advanced materials. The next report, on photonics, in fact comes as an anticlimax. Noting the large amounts of investment being made in the photonics industry in Japan and in the West, the report cavalierly recommends that all national communication systems switch to fully photonic mode within 10 years. The report also recommends that the country concentrate on development of

'all important known lasers' and develop 'all related materials and components', that all major institutions of the country get together to form a group that shall concentrate on photonic computing, and that they produce a prototype photonic computer by the year 1995. All this is excellent science fiction, but can hardly be termed planning. It is possible that the working group on photonics seriously thought that the country can benefit by going into the emerging technology of photonics in a big way, and thus make up for our backwardness in the field of electronics. But then they should have made a serious effort to spell out the path through which they plan to take the country from a state that they recognize to be dismal by world standards to a level of ascendancy that can make us world leaders in photonics.

The report on lasers, one of the older application areas of photonics, makes a much more sober assessment of the Indian scene and Indian potential in this area. Making an extensive review of the development of lasers in India, the report notes that Indian efforts in this field have been 'very modest' in comparison with similar efforts in Western countries, or even in China. More ominously the report finds that the few lasers that were developed up to production stage within India were found lacking in one way or another and their production was discontinued after the manufacture and sale of not more than five units in any case. It further points out that many of the critical components and most of the materials for making lasers have not been developed in India, and the US, which alone seems to be in a position to supply these, has banned their export to India. In the prevailing situation the report tentatively suggests the establishment of two new laboratories to undertake development and limited production of important lasers, and another to pursue programmes related to optical data transmission, processing and storage. These suggestions are aimed at merely keeping in touch with developments in photonics. The subcommittee on lasers, having looked at the laser scene in India in some detail, does not seem to share the optimism or the bravado of the subcommittee on photonics.

The technical report on parallel computing and the one on robotics and manufacturing automation also do not seem to foresee any major role for India in these fields, and propose only modest plans for making an entry and keeping in touch with developments. The report on parallel computing stresses that development of algorithms and software for using parallel computing systems optimally is going to become a multi-billion-dollar business in the next decade. To ensure that India is in a position to get a share in this business, the report recommends identification of a few numeric-intensive research areas in science and engineering. The report suggests that groups working in these areas be provided with imported parallel processing computers and advised to undertake research with the specific goal of creating algorithms and programs appropriate to the parallel computers.

Similarly the report on robotics recommends the establishment of an advanced automated machine-tooling facility and another automated facility for electronic assembly, based on imported computers, machines and know-how. The purpose of these pilot projects is essentially to familiarize ourselves with these new technologies. In an area as sensitive as this, which is going to have an effect on all facets of engineering activities, one expected a detailed analysis of the relative advantages and disadvantages of manual and automated technologies, and some reflections on ways of making manual technologies competitive with robots. Alternatively, the subcommittee on robotics should have evolved a serious plan for automating much of the engineering activities in the country within a reasonable time.

The recommendations of the report 'Priorities of genetic research in India' are also primarily aimed at acquiring basic capabilities and making organizational and legal arrangements for some level of participation in the developing new technologies in genetic engineering. The report however makes the sensible suggestion that, before we go into these areas in a big way, we must undertake a thorough conventional genetic analysis of the plants and other organisms that are of interest to us. The report points out that we do not even have basic gene maps for the oilseeds and minor cereals that form such important components of Indian agriculture. The report therefore places high priority on classical genetic research, and draws up lists of plants and microbes that must be studied. The report also identifies priorities in the application of the new genetic technologies.

What path to self-reliance?

The report on instrumentation makes the sensible suggestion that we should take up a crash programme to manufacture a dozen or so instruments that are widely used in different sectors of industry. The strategy suggested seems to be that of importing the assembled instruments to begin with and then reverse engineering step by step up to the level of full indigenization. But the report does not go into the details of the technologies required and the possibilities of indigenously developing them. Instead the report goes into long discourses on the need to remove unnecessary curbs on the Indian instrumentation industry, and gives rather detailed plans for liberalizing the excise and customs regime for the industry. The subcommittee on instrumentation takes this aspect so seriously that in an appendix running into full seven pages it reproduces a pamphlet of some international custom clearance agency issued by the London Chamber of Commerce and suggests that Indian industry be allowed to take the services of this agency. This report makes strange reading. Written in the style of an angry young man, the report is full of jargon, which, though probably common in certain levels of the electronics and instrumentation industry, is normally avoided in any serious writing. The report also offers a large number of unsubstantiated generalizations, including one that the Indian science establishment is superior to that of China and that the latter's technological strengths are suspect.

The pragmatic mood of the mid-eighties that we mentioned at the beginning of this review implied that there would be a certain flexibility about our approach to self-reliance. Pragmatism demands that in an area that we determine to be of importance to us we take all steps to move ahead, even if it implies importing certain

products for some time. However, in some circles this pragmatism was interpreted as a license for propagating the idea of complete liberalization of our policies of self-reliance. This is the interpretation that the subcommittee on instrumentation has chosen to follow. It is possible that this liberalization was the essence of the dynamism seen in the Indian polity for a couple of years during the mid-eighties. Perhaps in the name of a fresh pragmatic approach to India's problems, the rulers of the time were merely creating an appropriate atmosphere for taking steps to make India an integral part of the world market. However, even then the mandate of the various scientific and technical subcommittees of SAC-PM, as defined in the approach paper, was only to suggest directions in which Indian science and technology can make a mark, and not to discover ways of liberalizing the customs and excise regime in general.

Socioeconomic relevance

Four of the eight reports in the second volume, concerned with 'areas of socioeconomic relevance', are in the nature of standard perspective-planning exercises undertaken on behalf of the concerned ministry and within the parameters defined by the ministry. These four deal with long-term planning for use of fertilizers, for development of the chemical industry, for exploitation and export of minerals, and for evolution of water transport in India.

Of these the report on minerals development is the most professional, and makes clear and workable recommendations, which can be important inputs in formulating policies for development and export of various minerals. However, it would have been useful if the subcommittee on minerals had also gone into the suitability of the criteria adopted for deciding on large-scale exports of certain unprocessed minerals instead of merely working out the recommended amounts of exports on the basis of a rational application of predetermined criteria.

The report on water transport in India sounds a little futuristic, considering that, till now, almost nothing has been done to develop inland water transport channels, and coastal traffic has been only declining since the fifties. If this traffic has picked up somewhat during the eighties, it is only to cater to the coal requirements of the coastal thermal power stations in South India, and almost all of this traffic is limited to carrying coal and petroleum products. It will be fortunate if this report generates some interest in the development of this neglected mode of transport in India.

The report on chemical industry is a quick survey of the chemicals scene, which may probably form the basis for a serious exercise in perspective planning for the chemical industry.

The report on fertilizer use presents an overview of the fertilizer-use pattern in the country, discusses the various problems related to dose determination, application and distribution of fertilizers, and presents estimates of projected fertilizer requirements of the country at the end of the century. The report also makes a number of useful suggestions for rationalizing the marketing of fertilizers and their use. Given the serious strains that are likely to appear in the availability of petroleum-based fertilizers in the future, the rising costs of this route of yield enhancement, and the persistent apprehensions about the depletion of soil fertility caused by them, it would have been useful if the subcommittee on fertilizer use had also looked into possible alternatives to the use of increasingly high doses of chemical fertilizers. The long history of the practice of high-yield agriculture by Indian farmers, and the diversity of crops, soils and seasons available in India, puts us in a uniquely advantageous position for pursuing research in new agronomical practices that do not depend crucially upon expensive and potentially hazardous chemical fertilizers, especially when the continued availability of these fertilizers at reasonable cost seems suspect.

The big problems

The remaining four reports in the second volume deal with housing, environment, health and food. The situation in India in all these areas is precarious, and these are the areas in urgent need of judicious technological inputs and concerted research effort. Given the perspective of concentrating much of our S&T effort on solving problems of day-to-day living that is supposed to inform this extensive exercise in science planning, we should have expected SAC-PM and the concerned subcommittees to pay the most serious attention to these four aspects of Indian life, and come up with well-defined plans for gearing the S&T establishment towards amelioration of the current situation. But the detailed reports on these aspects do not seem to measure up to the expectations. Perhaps, given the immensity of the tasks involved, no effort in these directions can look big enough.

The report on building materials presents a brief but clear picture of the precariousness of the housing situation in the country, and of the extreme scarcity of building materials. It seems that, except for cement, all building materials are in short supply and are going to remain so in the future. The report also makes a survey of the isolated efforts at development of non-conventional building materials being undertaken in various institutions in the country, and makes a number of detailed recommendations for improving the availability of various building materials and for reducing the energy requirements and environmental load arising from this sector. All this, however, does not seriously address the vast dimensions of the problem of housing, and seems to be merely in the nature of a holding operation to keep things going till a more effective strategy to solve the housing problem is evolved.

The report 'Management of renewable materials' deals with the problem of environmental degradation in the country. This is another area where urgent large-scale action is required if the situation is to be ameliorated. With our indiscriminate exploitation of natural resources, through technologies that were evolved for entirely different geographical and human settings than those prevailing in India, we have put our essential natural resources under great strain. Our forests, land, water and genetic resources are all getting degraded, and consequently ordinary life is becoming more and more difficult.

The report on renewable resources recognizes the problem, though it does tend to distribute the blame equally among the modern industrial operations; the activities of subsistence farmers, who barely make a living from

their small bits of not-so-fertile lands without realizing the environmental costs of their actions; and the large number of Indian cattle, which keep on indulging in the luxury of grazing without a care for the havoc this wreaks on vegetation, on soils and on underground waters. But the surprising part of this report is the method it prescribes for dealing with the environmental crisis. The report suggests that the whole country be divided into a large number of small catchments, each extending over no more than a few hundred hectares of area: each of these catchments shall have a team of about six science workers, operating under the guidance of the science establishment of the country; these workers shall collect detailed data about the availability and dynamics of resources in the catchment, and work out ways for the best possible deployment of these resources. The report also suggests that all the developmental funds, estimated at 250 rupees per person per annum, be put at the disposal of the science establishment, to be used according to the plans worked out by the microlevel science teams.

The recommendation in short is that the role of the development administrator should be taken over by scientists, who presumably will prove much better at it than the civil servants. The recommendation suffers from the classic fallacy of the colonial administrator in believing that the people of India are suffering because they do not know how best to harness their own resources, and their problems will be solved if they can be paternally guided into appropriately organizing their locality and their lives. The report does suggest that, after the science teams have worked out the available options, these be put before the people of the locality and the people be given the freedom to choose the option they prefer. But this, as even an uneducated Indian farmer knows, is no real choice.

The subcommittee on the management of renewable resources has failed to notice the fact that if the natural resources of the country are under such strain today it is not because of the failure of the local communities to harness their resource base properly. The resources of various Indian localities have been deteriorating through the action of forces beyond them and of which they have no comprehension. A dam on a river high up in the hills completely changes the ecology of a large number of localities lying downstream and exposes them to unknown risks. What can those localities do about it, except take it in the spirit in which they take natural disasters? Scientists and technologists should perhaps focus their efforts on ensuring that we do not keep manufacturing these natural disasters through our careless interventions into the natural environment without properly working out the implications of such interventions in the geographical and human context of India. The local communities only need assurance of the stability of their environment, they know how to live best within it. But the subcommittee on management of resources seems to have no faith in the capability of local communities to care for their own locality without the guiding hands of administrators and technologists. The committee feels so strongly about the need of this guidance that, while commenting on the pioneering efforts of a community in the Himalayas to preserve their own resources, it regrets the failure of that community to tie up with technical experts or government machinery.

The scientist again appears in the role of administrator in the report on health care. This report has almost no scientific or technical content. The subcommittee on health seems to be preoccupied with administrative aspects of the health-care-delivery system and service conditions of medical professionals, about which they have made a number of detailed, and often trivial, recommendations.

Incidentally, the report touches on two important aspects of health-policy planning, on which a clear technical opinion of the committee would have been valuable. One, the report notices that there are some 45,000 drug formulations being sold in India, while the opinion of World Health Organization (WHO) is that only 258 drugs can meet essentially all requirements of the country. The committee, however, dismisses this problem of drug policy formulation in two brief paragraphs and does not make any recommendation of its own. Again, the committee notices that large numbers of Indians still suffer from ordinary diseases like tuberculosis, malaria, filaria, kala-azar, leprosy, diarrhoea and respiratory infections, while the so-called diseases of development, like cancer, heart disease, strokes and traffic accidents, are also on the increase. In this situation, any planning for health care requires the evolution of a clear policy on the relative emphasis to be placed on the two types of diseases in our health-care-delivery system and health-related R&D. The committee does not address this question at all.

The report 'Future food needs' relates to the most crucial of socioeconomic concerns of India today. It is known that, in spite of all our efforts in this area, large sections of our population still do not get the minimum amount of nutrition and energy. The approach paper itself notices that, if this situation is to be improved, we must almost double our food production in the near future. Given this assessment of the food situation, it was expected that the detailed report on food needs would work out a comprehensive plan for achieving the target of raising annual production of grains to 300 million tonnes.

The subcommittee on food, however, does not seem to have taken this task with any degree of seriousness. Its report talks randomly about all issues that may be related to agriculture, directly or indirectly. In places the report is not even talking about India in particular, and it seems as if bits and pieces of papers prepared for some international conferences on ecology or agriculture, perhaps even tourism, have found their way into the report. At one point the report refers to the need of providing freedom of movement for scientists to keep abreast with scientific developments by personal contacts and attendance at international seminars. At another point it gives details of how credit fairs can be organized to eliminate red tape and corruption. There is a recommendation for developing the Andaman and Nicobar Islands as centres of 'eco-tourism'. There is also a project proposal aimed at increasing export of meat to 5000 million rupees in five years. There are reflections on the possibilities of quantifying the concept of sustainability in agriculture. There is also the concern that rice paddies, ruminant cattle and ordinary human activities produce large amounts of 'greenhouse' gases, and that we should

make efforts to estimate the greenhouse gases contributed by developing nations, particularly India, China and the South-East Asian countries.

All this must be of great interest to agricultural scientists and development experts, but it seems to have no connection with the problem of producing 300 million tonnes of food grains per year from cultivated lands in India. That problem, which should have been the object of this exercise in agricultural planning, has somehow been lost in the maze of the wide-ranging concerns of the subcommittee on food.

A fundamental ill

The detailed report on food acutely epitomizes a lacuna that plagues almost all the reports collected in these two volumes. The exercise was initiated at a time when the political leadership had thrown up a challenge to the scientists to come up with a well-defined plan for making science and technology relevant to the more pressing problems of day-to-day living on the one hand and for putting India in the lead in at least a few areas of international S&T effort on the other. Such planning required the important scientists of India to come out of their limited areas of specialization, form an overview of the situation in the world, and of India within it, and carefully delineate areas in which intensive efforts might lead to visible results within a defined time. The scientists, it seems from the detailed reports, have failed to take the challenge seriously enough. For the most part they have been unable to come out of their special fields, and have generally iterated the desirability of continuing with what they have themselves been doing; at many places they have even advised that the particular projects they are doing should be made national missions, or they have simply indulged in some wide-ranging loud thinking. In almost no case have they come up with a plan to which they can be held responsible.

This lack of seriousness probably arose because, by the time the detailed reports were worked out, the political climate of pragmatism had already evaporated and the possibility of any radical initiatives in any field had become remote. But that should not have been a sufficient reason for the galaxy of scientists involved in this exercise not to take this task seriously. Perhaps the reasons for this failure to form a serious plan, and thereby bind the Indian S&T community to a certain level of accountability, have to do with the nature of this community itself. It may be that we have not yet evolved an S&T community that is willing to take itself seriously and hold itself accountable to a set of clearly defined goals. If we were to go only by the detailed reports collected in these two volumes it would seem that our S&T community does not yet have the confidence and commitment to plan for and undertake the task of nation-building.

The example of Japan

In this context it may be appropriate to recall the experience of Japan. After the conversion of half a million of its people to Christianity by the Jesuits in the late sixteenth and early seventeenth centuries, Japan closed its frontiers to people from Europe for over two centuries. It was only around 1860 that it reopened itself to the Western world. It is said that in the intervening two hundred years Japan kept a very limited contact with the Dutch, which served as a sort of photographic camera aperture through which Japan could, with concentration, take note of what interested it and yet not be distracted by being exposed to what did not concern it.

Soon after Japan resumed links with the West in 1860, it sent some of its young men to the countries of the West. One of them was Maeda Masana. He went to France in 1869, and, on seeing the splendour of Paris, felt very depressed for months, believing that Japan would never be able to match France. But soon after the Franco-German war, France seemed to be in a shambles and had to rebuild itself again. While the event itself must have saddened Masana, somehow his spirits picked up from then on, and he could write, 'I felt confidence in our ability to achieve what the West achieved.'

Maeda Masana returned to Japan in 1878 and became one of the major architects of *Kogyo Iken*, Japan's ten-year plan. The plan was completed in 1884 in thirty volumes. Discussing the various constituents required to make a country functional, the plan stated:

> Which requirement should be considered as most important in the present efforts of our government in building Japanese industries? It can be neither capital, nor law and regulations, because both are dead things in themselves and totally ineffective. The spirit/willingness sets both capital and regulations in motion.... If we assign to these three factors with respect to their effectiveness, spirit/willingness should be assigned five parts, laws and regulation four, and capital no more than one part.

What Japan managed to achieve through its spirit and willingness, and its detailed planning of national goals, is now apparent to the world. But even in the early twenties, less than forty years after the launching of its ten-year plan, the impression that Japan made on visiting Western inventors and engineers was that of an industrial giant, fast waking up to technological excellence and maturity.

This spirit and willingness are the key to all planning. The scientists who were given the task of planning for S&T in India do not seem to have taken into account what spirit and willingness can achieve. Consequently their detailed reports do not have the grandeur of vision, and lack the sense of urgency of a people getting ready to get on with the task of nation-building. Our scientists, it seems, have once again missed an opportunity to plan a course that may have made them relevant to the Indian situation and earned a place in the sun for Indian S&T.

But we should remember that, in spite of her lackadaisical ways, India, during the last forty years, must have produced a large number of young men and women who have the same sense of confidence and dedication that Maeda Masana felt at his time. We should find ways of letting these young people of India take over the task of planning for the future.

ACKNOWLEDGEMENT. The Maeda Masana episode and the details of *Kogyo Iken* are taken from a paper of Dharampal, to whom we are deeply indebted.

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