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MOBILIZATION OF NATIONAL RESOURCES AND PLANNING OF INDUSTRIAL RESEARCH AND DEVELOPMENT 1/

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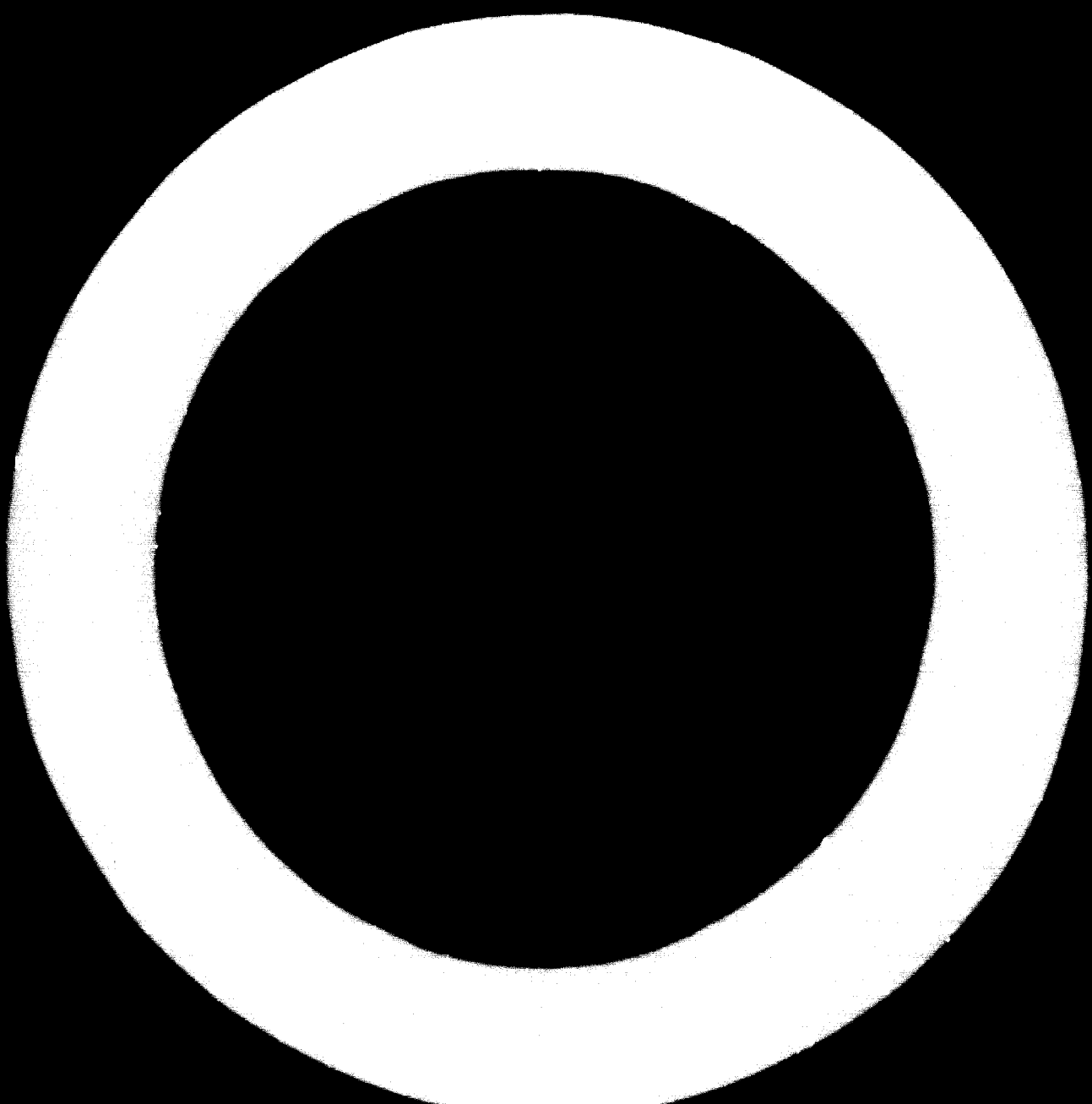

MOBILIZATION OF NATIONAL RESOURCES AND PLANNING OF INDUSTRIAL RESEARCH AND DEVELOPMENT

(Some observations on the problem in respect of India)*

S.R. Vallury**

The Science Policy Resolution which was adopted in 1958 by the Government of India is an eloquent expression of the faith of a relatively young nation that extensive application of science to technology offers the basis for increasing the standard of living of its people. This resolution is an acknowledgement of the fact that while the indian economy is basically an agricultural economy, a decent standard of living can only be obtained for its people by the recognition of the place of science in the indian educational system and the application of scientific methods to solve the multitude of problems that are of relevance to the national growth. However, as Prime Minister Gandhi pointed out in her inaugural address of the 3rd Conference of Scientists, Technologists and Educationists#, it was not a blue print of a well defined programme for implementation but only the Government's resolution to provide continuous support for science.

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*The opinions expressed here are those of the author in his individual capacity. They do not necessarily reflect or represent the views of the Council of Scientific and Industrial Research or Government of India.

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#Proceedings of the Third National Conference of Scientists, Technologists & Educationists; Committee on Science and Technology, Government of India, Cabinet Secretariat, Department of Cabinet Affairs, New Delhi, November 28-30, 1970, Vol.I.

Support for science in India during all these years was based more on faith than on any well defined plan. It was essentially a faith that somehow support for science will yield benefits to the growth of technology in the country. It is this faith, that has given rise over the years, to more than 250 institutions of higher learning and research and development in the country. They comprise of academic institutions; research laboratories under the ministries of defence, atomic energy, agriculture, Health; laboratories of the Council of Scientific & Industrial Research, cooperative research associations etc. A substantial number of these have been created and work in the older institutions in general was intensified after the Science Policy Resolution was adopted by the government. Whereas the expenditure in 1958-59 for research and development both by the centre and the states was about Rs.277 million; by the year 1970-71, it amounted to about Rs.1450 million - thus reflecting a five-fold increase. The major portion of this expenditure was covered by central government funding. Significant as the increase may appear to be, it should be noted that it forms only about 0.48 per cent (1970-71) of the total Gross National Product (GNP)*. The Annual Report on Science and Technology (1969-70) gives the corresponding figures of 3.4 per cent for the United States (1965), 2.5 per cent for the Soviet Union (1964) and 1.3 per cent for China (1965). Based upon the similarity of Gross National Product, ($43.47 billion (1965) for India and $49.58 billion (1963) for Italy)

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*Annual Report on Science and Technology 1969-70 prepared by the Committee on Science and Technology, Cabinet Secretariat, Government of India, New Delhi.

the percentages are .34 and .6 respectively for these two countries. On a per capita basis, expenditure in India in 1965 was $0.3 as against $5.7 in Italy (1963), $111 in the United States (1965) and $25.2 in the Soviet Union (1964). The picture that emerges from these figures is that while there has been a substantial increase in the inputs to research and development in India during the preceding 10 to 15 years or so, when we compare it with inputs elsewhere, the expenditure is significantly lower than in the developed countries. We therefore have to conclude that the threshold inputs in R&D have not really been reached in India and perhaps more importantly, in view of the number of institutions in which the investment and expenditure are made; the threshold is probably not reached in many institutions even individually. The result is that except in a few institutions, which are perhaps notable in themselves, it cannot be said that all this investment has given rise to benefits commensurate with the investment, the single important cause for this being that what may be called the critical mass which would make them self generating has not been achieved individually in the laboratories let alone collectively in the country. It cannot also be said that the planning for research and development and the investments therein have been systemacically integrated into the national plans. It is only now this exercise is being seriously looked into at the national level. For example, if we examine the fourth five-year plan proposals of India, planning for science and technology is shown as a chapter in the plan proposals without an indication as to how it was proposed to be integrated with the rest of the planning.

Herein, therefore, lies the central problem that India faces in its efforts towards mobilization of resources and planning for industrial research and development. Given a developing country which is committed to the concept of a welfare state, with modest financial resources but with fairly large natural resources, how can the country mobilize these resources in its planning and relate the industrial research and development activity to the plans in order that inputs into science and technology can materially help the national planning as a whole. While it is perhaps easy to state the problem, the solution does not appear to be either simple or straight forward.

To examine this problem in its proper perspective, it is desirable to bear the following facts in mind. Indian economy is primarily an agricultural economy with a substantial majority of its people depending upon agriculture and a significant amount of its GNP coming from agriculture. It would therefore appear that capital production in the country is intimately related to the state of health of this sector of the economy.

The indian economy is also a mixed economy in the sense that there are both private and public sectors functioning side by side. The government has freely licensed many industries for import of know how from abroad. While the import of know how has materially helped the country obtaining the many benefits of an industrial society immediately, the nature of the import of know how has been such that it has not enabled the establishment of a base for subsequent indigenous growth of the technology in the fields in which the know how has been imported. By

and large, indian industry has been conspicuous by its lack of commitment to growth of indigenous research and development capability. It has more often than not taken the easy way out of buying the know how from abroad and using it for creating new products. No serious attempt has been made by the indian industrialists to undertake indigenous development and improvement of the products which were in the first instance produced from imported know how. The above situation appears to be equally true of public sector undertakings which in a welfare state could have been expected to take advantage of the indigenous capability for improvement and development of new products. In the absence of the interest by the industrial sector in establishing an indigenous research and development base, the research and development laboratories set up by the Government have, more often than not, tended to take up open ended research problems; the choice of the problems being primarily determined by the interests of the directors and the senior staff members of the laboratories. Some notable exceptions to this example are however to be found. The Indian Council of Agriculture Research has actively fostered the green revolution by importing new varieties of seeds from abroad and undertaking the development of new seed varieties for increased production. A similar situation also is obtained in the Department of Atomic Energy where efforts have been made to relate the research and development activity in a concrete manner to the growth of indigenous capability for nuclear power generation. One would tend to believe that if only the laboratories are associated with the user ministries, perhaps the utilisation of the research and development capability developed in the laboratories would be more certainly utilised by the appropriate

ministries. Analysis of the facts does not support this view point. In many instances, laboratories associated with the user ministries are found to be no more effective than the laboratories associated with bodies like the Council of Scientific and Industrial Research which is an autonomous research organisation. I tend to believe that the real problem here is a lack of sufficient clarity about the research and development capability build up and the manner of its utilisation to help the growth of the industrial base.

As the perspective plans for the fifth five-year plans are evolved, India faces the following situation.

(1) An assessment of agricultural, chemical, mineral, energy and manpower resources;

(2) An assessment of the current standards of living of the people and the standard of living proposed to be obtained by the end of the fifth five-year plan;

(3) An assessment of the funds available including foreign exchange for the exploitation of these resources;

(4) Deciding the inputs based upon the sectoral priorities to be defined by the Government.

It is clear that one of the important criteria for inputs into research and development must be maximising of the benefits for the given inputs. It is to be noted from an analysis of the american data that the ratios on expenditure on fundamental and applied research to developmental research are different for different sectors of research.

For some individual areas, the proportions are given below:*

Agriculture	9.7 : 1
Meteorology	2 : 1
Aeronautics & Missiles	1 : 5.6
Drugs & Medicines	1.9 : 1
Electronics & Communication equipment	1 : 3.5

Fields like aeronautics and missiles and electronics and communication equipment require substantial amount of funds for developmental research as compared to fields like agriculture. In a country like India which has an agriculture based economy, to maximise the benefits, it would therefore appear that inputs into agricultural research would maximise the benefits to a much greater extent than inputs into research in fields such as aeronautics and electronics. It is also to be noted that the employment potential is also correspondingly high in the field of agriculture than in the other two. However, an important point that is not taken into account in such a statement is the fact that the national defence posture and strengthening communications are largely determined by inputs in aeronautics and electronics. The definition of specific inputs into these various fields in the country must, therefore, necessarily depend upon a detailed and careful analysis of the fields in which inputs are desired and an assessment of relative national priorities to maximise the benefits.

However, certain aspects are clear. Although the green revolution has been ushered and the nation can look forward to substantial

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*A frame work for drawing up a plan for science & technology - draft for discussion; CSIR internal report.

self-sufficiency in the production of food grains, the indian farmer still uses primitive tools and is not really well acquainted with modern techniques of agriculture. A prime pre-requisite for further increase in food production appears to be an extensive communication network whereby people can be taught about modern developments. Radio and television may therefore be expected to play a crucial role in India in the years to come. Therefore, although the cost of developmental research in communication may be considered somewhat higher, it would appear that the Government of India will have to spend substantial amounts of money in research and development related to electronics and communication. Assessment of priorities in other fields of industrial endeavour does not appear to be so clear or straight forward. It would appear, however, that India should obtain self-sufficiency in fertilisers; and substantial improvement in the power generation without which ushering an industrial based economy is impossible. India is already facing a critical power shortage.

In suggesting a frame work for drawing up a plan for science and technology, CSIR has suggested three alternative methods*. They are :

(a) Social Merit Matrix Model for sectoral ranking in planning for science and technology;

(b) National Projects - Discipline Matrix Model;

(c) Invoilable Core Projects - Sectoral Emphasis Matrix Model.

In the sectoral extrapolation method, assuming a policy decision

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*A frame work for drawing up a plan for science & technology -, draft for discussion; CSIR internal report.

that Government's expenditure on research and development should reach one per cent of the GNP by the end of the fifth five-year plan*, the Committee on Science and Technology document used extrapolation techniques with considerable adjustments to arrive at resources allocation for different sectors of research.

In the national projects identification method, major national projects could be identified on the basis of social, economic and political considerations.

In the invoilable core method, national, social and security requirements form the basis for determining the core programmes and requirements for these programmes can then be worked out in detail. The allocation of research and development resources in any one of these methods is closely related to the weightage factors proposed to be assigned to the socio economic factors in one form or the other to these various activities. These with suitable normalisation procedures would then define the quantum of money that is proposed to be invested in the various sectors of research and development. It would appear there are no simple methods or procedures available at present to determine these weightage factors. These to a very significant extent are based upon political philosophy and strategy for the economic growth of the country.

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*The National Council for Science and Technology has assumed that expenditure on research and development in government research institutions, private industries, will continue to grow at the same rate as in the past. Based upon this assumption NCST projected a 1% GNP as expenditure on research and development. This amounts to about Rs.25000 million during the V plan period - The Hindu, October 25, 1972.

There are gaps in the technological capability of the country* Gaps exist between the research undertaken in the laboratory and industrial utilisation. There are gaps in the information available for R&D planning, evaluation of technologies and about the general pattern of research and development in the country. These are all problems to be rectified before R&D activity can be effectively integrated into national planning. The Working Group* concluded that it is generally recognised that research and development should be treated as a total concept with each industrial unit having a strong inhouse research and development activity in order that it may absorb the imported technology and use it as a base for subsequent growth. Build up of inhouse R&D capability would also enable the industry to hold dialogue with the R&D establishments existing in the country in a meaningful manner to fully exploit the capability of these organisations. It is suggested that for encouraging research and development within the industry specific incentives should be provided after examining the manner in which the existing incentives have been utilised by the industry. Some of the incentives suggested were, liberal import of equipment and raw materials by industrial units for research and pilot plant work; concessional import duty on capital equipment for scientific research; development rebates on expenses on scientific research; special consideration for know how developed by companies through inhouse R&D; government funding for research in the private industry etc.

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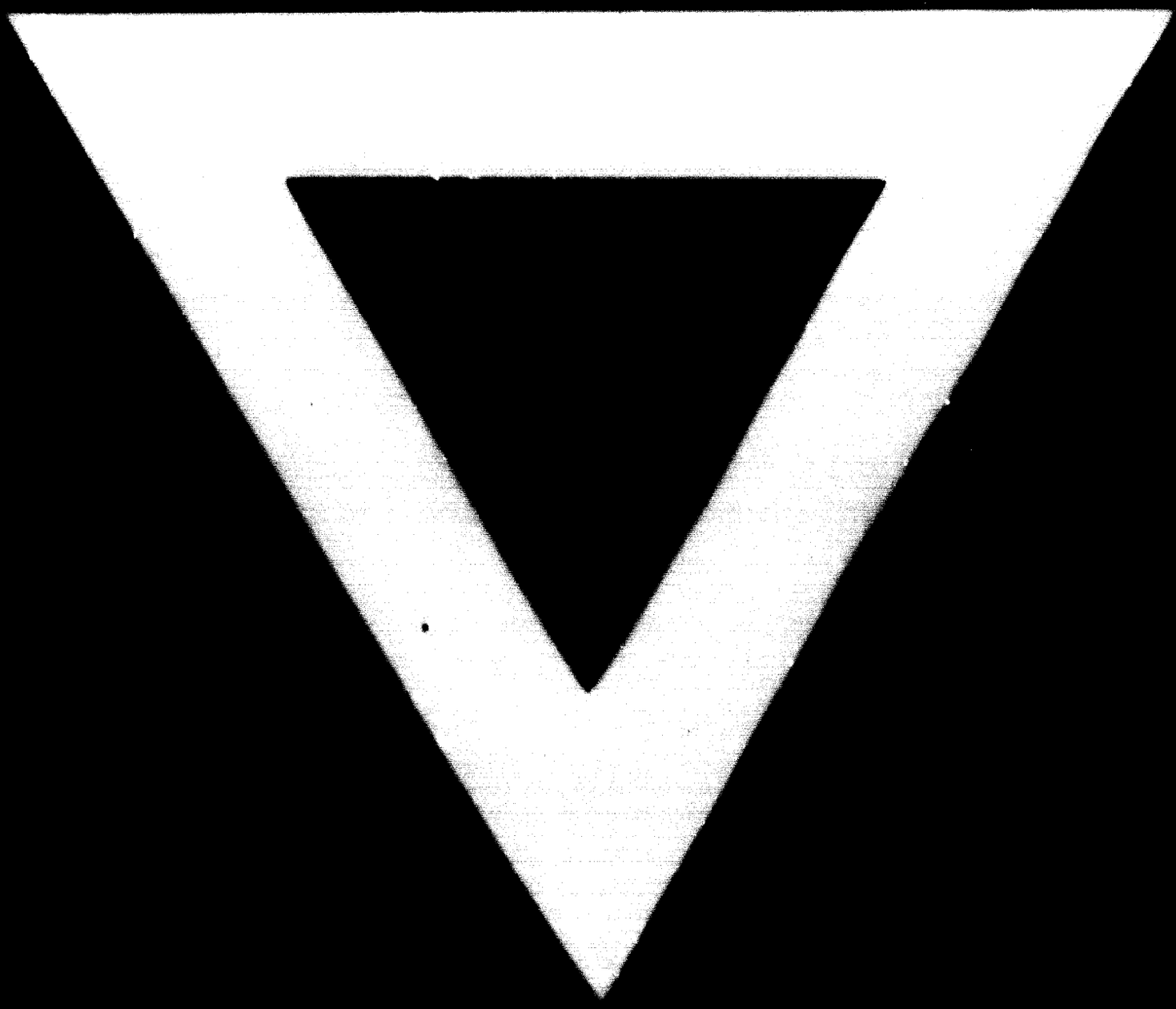
* Proceedings of the Third National Conference of Scientists, Technologists, and Educationists, Committee on Science and Technology, Government of India, Cabinet Secretariat, Dept. of Cabinet Affairs, New Delhi, November 28-30, 1970, Vol.I - Report of the Working Groups, I. R&D and Industrial Development, pps 25-31.

All these various problems are under study by the Government of India. Meanwhile the Government of India has created a National Council for Science and Technology based upon the recommendations of the Third National Conference of Scientists, Technologists and Educationists. It is premature to review the functioning of this committee which has come into existance only recently. Its primary effort at present seems to be to draw up perspective plans for integrating research and development effort to underpin the technological growth of the country and identify major research and development fields which should be supported by the Government.

In summary it is to be stated that as the fifth five-year plan proposals are being prepared, India has come to recognise that the mobilisation of resources and planning for industrial research and development should become an integral part of the national planning if research and development activity is to contribute in a meaningful manner to establishing a strong technological base and increase the standard of living of its people.



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