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Research, Science and Technology

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Indonesia's Development Pattern

Indonesia's future development depends critically on its ability to make the best possible use of its natural resources, in perpetuity with a minimum of waste and for the benefit of the greatest number of people. It can only be done by broadening the scope of human activities and by raising the quality of human resources. It is in connection with the development of our natural and human resources that the role of research, science and technology comes to the fore.

With regard to Indonesia's resource base and potential for economic growth, until recently the bulk of production and export comprised mainly of agricultural commodities. A shift is now taking place which is structural in nature and with important ramifications for future developments. It opens up greater possibilities for growth and for the strengthening of our balance of payments, but it poses riddles from the viewpoint of population and employment. The leading growth sector are now and will be the "new", i.e. non-traditional sectors connected with the extractive industries: oil, minerals and timber. These are capital intensive and dependent on high technology. They are not very labour absorptive until the stage will be reached when the secondary effects of forward and backward linkages of industrial activities generate sufficient results. This takes a decade and longer, perhaps for the greater part of the 1980's. In the meanwhile the larger number of the population find their livelihood in the traditional sectors of agricultural production. Here technology is often too simple and the increase in productivity can barely keep up with population growth. Such a situation of "technological dualism" creates social tensions leading to serious frictions if it is not mitigated by appropriate policies. The answer is or should be to reinvest rapidly adequate ratios of the incremental benefits from the growth resources to broaden our economic basis, in other words to diversify in a "horizontal" sense by expanding the range of agricultural activities (with increasing

emphasis on food production) and equally in a "vertical" sense to accelerate the processing of commodities and to engage in "downstream" operations within the country. This can subsequently contribute to self-generating forces in the manufacturing sector.

Research Policies and Programmes

Research programmes under the general direction and co-ordination of the Minister of State for Research are grouped in two broad categories: the short/medium term programmes and those concerned with longer term problems. The first category is directly connected with the operational objectives of the present Second Five Year Development Plan (covering the period 1974/75—1978/79) and thus also includes those activities which are expected to be of importance in the next 5 year sequel. Simultaneously the research and studies of a longer term nature relate to problems concerning the role and significance of and the relations between natural resources, population and technology, their interaction and likely impact on "long-term growth perspectives". There is of course an intertwined relationship between the problems and research programmes being categorized respectively as "short/medium term" and "longer term".

Current policies and programmes influence the distant future to an important degree. Our present decisions and actions inevitably affect the course and pattern of our society through the next decades. It is therefore pertinent to ask ourselves continuously what the major implications are of current policies.

Conversely, longer term studies designed to provide us with perspectives of the future help us to envisage some of the requirements that it will pose in the course of time. Such perspectives give additional dimensions to the context within which we must take action now or in the intermediate term to ensure that future requirements can be met.

For the purpose of determining research priorities in agriculture, industry and mining with their cross-sectoral linkages, panels were set up in 1974 and continued this year, comprising research workers from national institutes and government laboratories, from various universities, and representatives from ministries and industry. The results of the panels' workings and procedures will be used and tested for the direction and budget allocations of programmes and projects in the coming fiscal years. Particular attention will be given to the existing capacity for conducting research and to the monitoring aspects of research activities and their results.

The nature and scope of longer term research and studies were mentioned earlier. They focus on the workings of long-term dynamics of population growth, natural resources and technology in their interaction and with special regard to their impact on ecology and environment.

* The various parts and 'components" of each programme can be and are in effect implemented by different institutions. They are, however co-ordinated and supervised by the office of the Minister of State for Research, who determines their scope and terms of reference and allocates their respective budgets.

The following programmes have been designated as national priorities and are being implemented under the direction of the Minister of State for Research:*

1. a comprehensive inventory and evaluation of natural resources,
2. a study on long term growth perspectives,
3. an assessment of requirements for scientific and technical manpower for the period 1975—1985
4. the development of a natural network system of scientific documentation and information,
5. the development of a national system for standardization and for calibration and instrumentation.

The first three programmes are of course inter-related. Studies on longer term perspectives will gain in substance and significance as guide posts for policy, when more and better basic data resources become available.

In conjunction with the on-going population studies, the research programmes should provide us with more specific indications as to the future manpower requirements in the scientific and technical fields. The last two mentioned of the above programmes are connected with the servicing functions of research, science and technology. Their importance will increase as progress is made in research and industrial development.

Within the scope of this discourse I would like to draw particular attention to the importance and urgent relevance of a comprehensive inventory and a proper evaluation of natural resources. Our knowledge and understanding of existing global resources are at best very hazy. That pertains in particular to the situation in developing countries. Yet, in the coming decades the political economy of international relations will centre on the role and relative importance of materials resources. Considerations of resource policy and resource management will largely determine the behaviour of nation states on the domestic level and in external affairs. The big and powerful nations and the small and weak alike, the industrially advanced and the developing countries, the resource rich and the resource poor,—we see all of them engaged in ceaseless exhortations for a "rational approach" to resource policies. Without fail, each of them is prone to give a different interpretation of what such a rationality entails. It would seem to me that the undertaking of a comprehensive inventory of resources and a detached impartial evaluation of their future potential constitute a field where international co-operation is urgently required. The advanced technologies developed by the industrial societies can be of invaluable assistance to governments of developing countries in their efforts to ascertain their resource potential on a more factual basis, provided always that such assistance is designed to develop and improve the national capabilities of developing countries to conduct and extend their own resource inventory. In such a context the results of co-operative endeavours, reinforced and supplemented by regional arrangements, will generate a shared knowledge and enhance a better understanding of the world's resource potential. Both the developing and the developed nations stand to gain. This in turn may

contribute to some workable consensus as to the desired rationality in resource policy. Appropriate modalities for collaborative arrangements in resource inventory could mitigate the acrimonious postures of confrontation between resource-owning and resource-searching countries. Hopefully in the little time left to mankind, inclinations towards confrontation (ever latent where resources are concerned) may give way to accommodation on mutually acceptable terms of equity.

The Indonesian programme for resource inventory is divided into four interrelated sub-groups:

1. land and water resources,
2. vegetation, i.e. crops and trees, with emphasis on the central role of forestry resources,
3. aquatic resources, viz. the marine environment as well as the conditions influencing inland fisheries,
4. energy and mineral resources.

Having outlined Indonesia's development pattern in the light of her natural and human resources, I would like now to refer to the Indonesian Government's explicit concern regarding the serious problems of soil erosion, water conservation and water management. The Indonesian Government has recently made a major policy decision designed to intensify and multiply under a co-ordinated and integrated approach the current programmes for the prevention of further soil deterioration and for soil regeneration, land reclamation, reforestation as well as for research and technology application pertinent to existing and potential water resources.

With regard to forest resources, the countries of Southeast Asia specifically the member countries of ASEAN— have probably the world's last highly economic reserves of tropical hardwood timber. This refers in particular to the species belonging to the dipterocarpa family. There are in effect three tropical hardwood zones: the Amazon basin, West Central Africa and Southeast Asia (West Malaysia Serawak, Sabah, part of the Philippines and where Indonesia is concerned mostly in Kalimantan and Sumatra west of the so-called "Wallace-line"). Southeast Asia's forests are of higher economic value by far as they comprise homogeneous timber areas, while those in the Amazon Basin and in West Central Africa contain variegated wood species per given acreages. The dipterocarpa species are very suitable for mass production of plywood and veneer. They can float, are resitant to damage by insects or fungi and can be transported in bulk.

Here too, a comprehensive forest-inventory as the basis for intelligent forest management is long overdue. Factual information in this important sector is inadequate and part of what is available is already dated. We can already witness some specific cases where at certain points sustainable timber output declines as harvesting efforts increase. Even more crucial is the environmental impact of expanding output. In addition to the decline in the sustainable output of timber, if harvesting is too intensive, there can be serious adverse effects on agricultural production outside the timber sector and on human settlements in view of our transmigration programmes, if failure to observe sound silviculture practice leads to continued soil erosion and flooding.

Therefore, in the light of what is currently being done to forest resources in tropical zones by the combined effect of modern technologies applied by transnational enterprises engaged in forest exploitation and too primitive techniques of shifting crop cultivation by local populace, I do not hesitate to classify the forest reserves of developing countries as depletable resources if only to maintain a persistent policy alert of the dangers (social, economic and political) of ecological overstress in an environment where human life is already caught in the maelstrom of mass poverty and malnutrition.

National Programmes for Mapping and Survey

This programme has recently been reformulated for implementation in the immediate future. It is designed to extend the whole of the Indonesian territory by updated maps than can meet the standards of present and future requirements. The programme is considered an integral part of national policies on research, science and technology, and is therefore also placed under the supervision and direction of the Minister of State for Research. Comprehensive mapping and surveys are in fact a prerequisite to the proper implementation of an inventory and evaluation of Indonesian natural resources. Negotiations are in an advanced stage with the World Bank and the Governments of Australia and Canada for assistance in carrying out coordinated mapping and survey activities. If the programme can be started in 1976, as it is hoped, then by 1980 the entire territory of Indonesia will be covered by modern updated basic (planimetric) maps on the scale of 1: 100,000. These can then serve as a more reliable foundation for the preparation of thematic maps in connection with the requirements of topography and hydrography, geologic surveys land use and socio-economic studies.

The mapping programme is to include the use and application of modern remote sensing techniques entailing satellite imagery (E.R.T.S.), high altitude aerophotography and photogrammetry in order to reinforce and to facilitate field surveys and ground truth investigation and interpretation. As part of the preparations and in anticipation of the full implementation of our mapping programmes, the I.T.C. of the Netherlands is currently rendering assistance of great value related to training programmes in the fields of geodesy and cartography.

The Choice of Technologies.

The scope and need for developing and selecting technologies must be viewed in connection with the problem areas, the short and medium term policy objectives and the long term goals such as identified in the foregoing observations. It is a fallacy to assume that we can do without some of the latest advances in technology. Developing nations, such as Indonesia, need to further their capa-

bility in advanced research and science and to adopt advanced technology, at least in selected areas. For certain productive sectors, vitally important to growth acceleration, there are in fact no alternatives. In concrete terms let me only mention geology, geophysics, and geochemistry, biology and biochemistry, metallurgy and mineral technology; the application of space technology to assess vegetation, earth, water and marine resources; research in the climatological aspects of meteorology as there seems to be ongoing atmospheric changes of a structural nature in monsoon areas, thus directly affecting food and other crops as well as habitation.

In a great number of cases, of course, scientific research and technology originating in advanced countries need to be adapted to prevailing conditions and requirements. Adaptive technology must take into particular consideration the quantity and quality of available labour, the need to use local materials, and the likely effects on the balance of external payments, while aiming at the adherence to standards of quantity and quality of output.

Again, as an illustration of the Indonesian case, research and adaptive technology involve post-harvest activities in the agricultural sector (storage, processing, distribution), agro-based industrial development, the development of suitable building material for cheap housing, and the like.

In view of what has been said about the natural resources, attention must be given to the adoption and the application of what may be called "protective" technology in order to conserve natural resources and restore and regenerate to the extent feasible the resources already depleted.

Institutional Framework

Scientific research and technological development in Indonesia have in the past suffered from fragmentation of research organizations and duplication of activities. Many of the institutions were really not viable through lack of qualified research workers more than anything else. Even within individual government departments (ministries) there was a proliferation of research institutes engaged in unrelated programmes of activities.

In the absence of coherent policies and priorities, not much could be done for the systematic development of scientific research personnel. With the formation of the Second Development Cabinet a beginning has been made with more systematic efforts to rectify the situation.

All research financed with public funds, i.e. research by government departments, universities and national institutions (not connected with departments or universities) has been placed under the co-ordination and supervision of the Minister of State for Research, who designates the scope and nature of programmes related to development objectives and stipulates the relative sets of priorities. Since the beginning of 1975 all institutions and agencies within any one department have been brought under one co-ordinating centre within that department with budgetary control of its research and development activities. Most recently the government has taken a major policy decision amounting to a fundamental re-organization of the institutional framework on the national level. The several national institutions concerned with research, science and technology which hitherto operated fairly independently under separate charters are to be brought under one National Centre or Agency for Research, Science and Technology and their activities to be gradually integrated in accordance with the research programmes specifically designated as national priorities.

The National Centre is also intended to be the focal point for the further development of an effective scientific research community. It was emphasized at the outset that this should be for some time to come the over-riding priority consideration in our science policies. The Centre would be charged with monitoring international developments of scientific research and technology, with a view to those considered suitable for adoption, adaptation and application. It is to serve furthermore as a clearing house for documentation and scientific information as well as for consultations in order to assess the needs for research and technological development felt by social and business groups within our society. Finally it should support and reinforce research programmes carried out by department units or university centres.