

# Science in a Third World Country

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*Science in undeveloped countries is underdeveloped. And the underdevelopment of many a country is due to its underdeveloped science, a vicious circle with no way out. Or is it? In this article Dr. Osmund Jayaratne, Chairman of the National Science Council, analyses some of the depressing reasons for underdeveloped science in a developing country, namely Sri Lanka.*

The ancient civilisations of the East and the Middle East—particularly those of China and India—demonstrate the fact that science and technology played an important role in the life of these countries once upon a time. May be the scientific methodology in those days was not of the same character and quality as that we employ today. May be empirical techniques played a greater part. Man first distinguished himself from his anthropoid ancestors when he began to use tools to produce the necessities of life. Thereafter, as his needs began to expand, he looked for more efficient and easier means of fulfilling them. Certain historians have even suggested, in a dialectical sense, that perhaps it was human inertia itself that accelerated the development of tools and technology.

Be that as it may, the fantastic achievements of ancient man—his public works, buildings and irrigation systems—could not have been the result of pure empirical knowledge. Certain generalisations must have accompanied these feats—early germs of the scientific methods we utilise today. Significantly, the cradle of science and technology lay mostly in those countries we now characterise as under-developed. Science in the presently advanced countries took off during later periods of time, partly utilising and building upon the achievements of the ancient East. With the industrial revolution in Europe, a qualitative change occurred in international relations as well as in the status of science and technology between East and West. In the new industrialised countries, scientific theory and practice overtook mere empiricism as well as the pure logic

of the ancient Greek philosophers. The modern scientific age was born.

The advancement of science in the West was accompanied by the stagnation, if not decline, of science and technology in the early birth places of human civilisation—now suffering from poverty and under-development. Thus, it was not only indigenous technology that suffered decline in the so-called Third World (to use yet another synonym), but also economic standards of living, economic patterns of production, cultural traditions and customs in general.

The development and flowering of science requires a thriving industrial foundation. Even in essentially agricultural countries, the biological sciences, for instance cannot thrive in isolation from discipline such as chemistry. The whole living body of modern science develops in an industrial milieu. Here, we have a situation of interaction, of action and of reaction of the productive processes supplying the impetus and the ideas for scientific progress and a science in turn helping to solve the more basic difficulties that inevitably arise in the processes of production.

## Pure and Applied Sciences

Perhaps it is opportune at this stage to dispel what I consider a sad misconception in the minds of the powers that be. I refer to the artificial dichotomy between the so-called pure and applied sciences, and the attempt to emphasise the latter at the expense of the former. Undoubtedly one does have research directed to very specific practical goals. One can speak of socially relevant research. But while

it is necessary to realise the economic limitations of our country and the futility of trying to compete with the more advanced countries, there is an unfortunate tendency here to look down upon scientific research that does not promise direct and early advantages. To take just one example, Sri Lanka's geographical location is such, with the geomagnetic equator almost bisecting the Island, that unique observations pertaining to the magnetism can be made in this country, which cannot be easily re-located elsewhere. Even though the geomagnetic equator runs through the southern tip of India, our country has the unique advantage of being located such that the nearest land mass in a southerly direction is Antarctica. Some of our scientists are already working in this field and even at this early stage, some of their results could well be of international importance. Are we to sponsor such research, or are we to isolate ourselves from world science on the grounds of deploying our limited resources solely to research that brings immediate practical results? In my view, applied research cannot thrive and develop without a supporting framework constituted of the basic sciences, without men trained in fundamental research.

## Legacies of Colonialism

The problem of the poverty of scientific research in Sri Lanka and countries like ours, in my opinion is that this is one of the sad legacies of colonialism. Western imperialism, for obvious reasons refrained from industrialising its former colonies. The latter were retained as sources of raw materials and commercial agricultural products. The colonial markets, on the other hand, were flooded with industrial products from the West. The milieu of our country was in no way conducive to the growth of science and scientific research. It is significant that the earliest research institutes that came up in this country were those associated with our colonial agricultural crops. Even the limited education imparted to our English speaking, westernised elite was oriented towards the liberal arts. Science was hardly heard of in our schools. Just as God created man in his own image, the British tried to create a native elite in their

own image—anti-national, loyal to the colonial power and western-oriented in their attitudes. Till recently, and in certain respects even now some in our scientific community belong to this category. Good science according to them emanates almost exclusively from the West, and until Britain fell into a third rate status, almost exclusively from that country. Even attitudes to scientific research and education were coloured by this colonial background. Problems analysed and studied had to be of an "international" level, and scientific education was directed more to providing research workers for the West, than those willing, capable and humble enough to tackle the hundred and one outstanding problems overwhelming an under-developed country like Sri Lanka.

Fortunately these attitudes are fast dying. Among the younger scientists in this country, those who have resisted the lure of the brain drain, there is a greater awareness of the problems of our own country and a desire to direct their research activities to such problems. It is possible at this stage to draw attention to some of the valuable research work done by our scientists which have been of immense economic benefit to the country, ranging from the development of new and varied strains of rice to the elimination of the coconut pest.

### **The Absence of a Scientific Atmosphere**

And yet, in spite of the presence of talented scientists in our midst, Sri Lanka science suffers from many disabilities, which contribute partly to the drain of talent from the country, which is depleting us of our scientific skills even faster than we can produce them. This drain of talent is in itself creating a serious problem for science in this country. Science can never be a viable activity unless there exists an indigenous scientific community large enough in numbers to provide research teams of a critical size so necessary if a worthwhile research output is to come from our Institutes and Universities. Today, working teams of scientists are rare in Sri Lanka. Most research has resulted from the enthusiasm and devotion of a few individual scientists. Science

cannot produce results in the absence of a scientific atmosphere, and a scientific atmosphere cannot exist where in most institutions, researchers do not even have colleagues to discuss their problems with.

### **Need for Government Patronage**

Secondly, a scientific capacity can never be built up in a country without the understanding and sympathy and encouragement of the Government. If science in India has forged ahead rapidly this is entirely the long-term outcome of the foresight of Jawaharlal Nehru and the wisdom of the late Homi Bhabha. In bringing science and planning bodies of science directly under him as Prime Minister and in closely associating science and scientists with the processes of national planning, Nehru gave to Indian science a place and a role. The results are to be seen now.

In Sri Lanka, unfortunately, the situation has been the reverse as science has received only step-motherly treatment from successive governments. There has seldom been shown an understanding of the importance of science—basic or applied to the development of technology, be it urban or at the village level. All encouragement has been given to institutions expected to produce quick results. Short-term necessities. Permit me to refer at this stage to an interesting personal experience of mine. Several years ago the newspapers carried headlines to the effect that a certain Minister (now no longer living) was planning to produce artificial rain over the NCP. Since I myself happened to have dabbled in Cloud Physics, I was invited to a meeting at the Ministry, where representatives of the Department of Meteorology, the Water Resources Board and the Air Force were present. The Minister explained to us his hopes and plans. He informed us that the Air Force was at our disposal and any other chemicals and equipment needed. Would we go ahead and produce rain? Much to his dismay we had to explain to him that a considerable volume of weather data had to be collected before embarking on such a venture. Otherwise seeding clouds over the NCP could very well produce rain over the Indian Ocean. Of course we informed him that it would be

valuable to make preliminary studies which might take a couple of years. The group never met again!

In the present Minister of Industries and Scientific Affairs we do have a friend of the scientific community and one who also understands some of the problems of science in this country. However, with all due respect to the Minister, in my opinion he too is a victim of the system, hamstrung at every turn by the bureaucracy and the organisation.

### **A Place for Science**

Science I believe must firstly be planned on a national scale. Secondly it should be consciously brought in as an active factor in the country's developmental processes. For this we need a planning and directing agency for science which should be closely linked with the National Planners. After much agitation by the scientists through the Sri Lanka Association for the Advancement of Science, we now have a National Science Council. Unfortunately, despite all assistance and co-operation from the Minister, this Council is buried in one Ministry under a heap of industrial corporations, some of which are perhaps even unaware of the Council's existence. Through the Council we have and are carrying out certain important surveys which are necessary for the formulation of any kind of National Science Policy. However, outside the Ministry of Industries and Scientific Affairs, we have to depend on the goodwill of individual scientists in research institutes to collect the necessary information. As for the Planning Ministry I personally know that a certain high-level planner in that institution was unaware of the existence of the National Science Council only last year.

The problems of science in an under-developed country are legion. We are certainly not alone in this sad situation. It is my personal opinion that perhaps we will have to limp along in this manner, doing the best we can, until some day we achieve a basic change in the social framework which will give to science its due place in the nation's life and activity.

# Scientific and Technological Manpower Engaged in Research and Development

## Sri Lanka

In any country the spectrum of scientific manpower, that is which scientific sectors are well represented and which are not, are strongly indicative of the nature of its science capa-

city. Similarly in research, who funds the research in a country and who gets the research funds are equally important. In the table and diagram here we see the picture for Sri Lanka.

SCIENTIFIC AND TECHNOLOGICAL PERSONNEL IN SRI LANKA

Level of Training	Scientists & Engineers		Technicians		Total
	Full-time	Part-time	Full-time	Part-time	
Natural Sciences ...	683	2	976	—	1,651
Engineering Sciences and Industrial Technology ...	1,726	1	9,727	—	11,454
Medical Sciences					
University Teachers ...	213	1	28	—	242
Medical Officers** ...	2,200	—	1,572	3	3,775
Agricultural Sciences ...	174	—	334	—	508
Social Sciences ...	684	8	241	—	933
<b>TOTAL</b> ...	<b>5,680</b>	<b>12</b>	<b>12,878</b>	<b>3</b>	<b>18,573</b>

Sources: Survey of Scientific & Technological Potential of Sri Lanka, National Science Council, 1972/74

\*\*Ministry of Health

Sri Lanka, on a rough estimate expends 0.25% of its G.N.P. on Research and Development. In the U.S.A., U.S.S.R. and France in 1970 approximately 2.8%, 2.3% and 2.1%, respectively were expended on R.&D

while the corresponding figures for Ghana, Philippines and Pakistan were 0.2%, 0.1% and 0.1%. The underdevelopment of Science in the Third World is undoubtedly linked with the causes of under-development in general.

## The Case of Africa

### Distribution of R & D Personnel

Higher education in Africa is the most important employer of scientists and engineers for R & D work—about 55% of the total stock of R & D workers being employed in this sector.

In most of the African countries the ratio between the number of R & D scientists and engineers and the total national stock of scientists and engineers rarely exceeds 10% being about the same as the ratios for Asian and European countries as well.

In the region, only in Mauritius does the number of R & D scientists/technologists per million inhabitants exceed 100 and only in five countries does the actual number of scientific R & D workers exceed 1000 (Algeria, Arab Republic of Egypt, Kenya and Nigeria). Natural Sciences are the most important R & D sector accounting for 37% on the average of total scientists and engineers engaged in R & D; agriculture come next averaging 33%; medical sciences 17% and engineering 9%. This low figure for engineering is accounted for by the fact that in 16 countries there appears to be not even one R & D worker in this field.

### Technicians

55% of the stock of technicians are employed in the productive sector, as against 31% for the higher education sector.

### R & D Funding

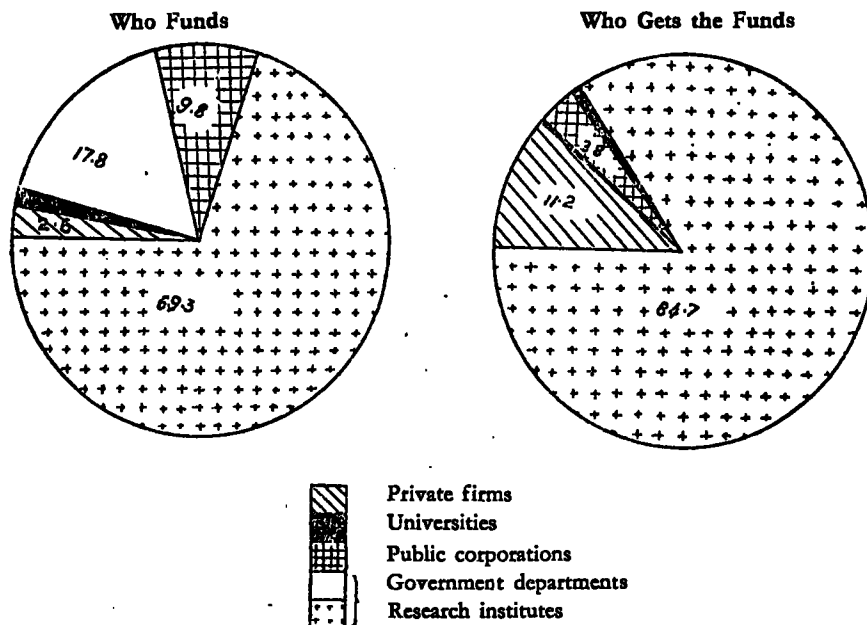
Most of the countries of the African region have made a great deal of effort to meet the recommendations of the Lagos Conference which recommended that 0.5% of the G.N.P. be allocated to the R & D sector. A few have surpassed the target.

In most African countries government funds constitute the main source of R & D financing. Productive enterprise funds are relatively important in Kenya with 18.4% of the total and 22.6% of current R & D expenditure and in Mauritius with 53.2% of the total and 56.5% of the current expenditure.

Foreign funds are an important supplement to national financing for R & D in most African countries except in Mauritius and Nigeria, where this source of financing is relatively unimportant representing 33% or less of the total funds.

Applied research takes the largest share of amount in R & D expenditure, and is particularly high for Chad 80% in Madagascar 74% and Mauritius 95%—Funding for fundamental research it ranges from 1.7% for Kenya to 34.4% for the Ivory coasts. On the average 95% of the total expenditure for R & D, in the region is utilized for current expenditure implying that non-recurrent capital investment in durable R & D equipment, installations, buildings etc. are difficult for the African countries to finance.

## RESEARCH AND FUNDING



Source: Marina de Silva  
National Science Council