

21 years of Service to Science and Industry*

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The World Bank Technical Mission in its report dated June 1952 presented to the Government on the Economic Development of Ceylon stressed the need for an autonomous Applied Scientific Institute as part of the infrastructure necessary for industrial development.

At the time of the studies by the World Bank Mission, the Industrial Research Laboratory and the Rubber Ser-

* The Ceylon Institute of Scientific and Industrial Research celebrated its 21st anniversary in May 1976 with a 3-day Seminar and an Exhibition.

vice Laboratory of the Department of Industries were operative and were under the purview of the Ministry of Industries, Industrial Research and Fisheries. What presumably prompted the World Bank Mission to recommend the creation of an autonomous Applied Research Institute was that the output of the existing research organisation had little or no effect on the pace of industrial development or on the strengthening of existing industry nor did it originate proposals for new industries.

What followed was a firm recommendation by the Mission that Ceylon immediately establish an Institute for Applied Research. With acceptance of the proposal by Government and with legal sanction of an Act of Parliament, the Ceylon Institute of Scientific and Industrial Research, without any fan fare, opened its doors for service to industry, through applied scientific research and development, both in the public and private sector, on 1st May, 1955. The Act provided for a Government donation of Rs. 5 million payable to the Institute in annual instalments of Rs. one million with provision for further financial support after the first five year period. The Act also permitted the Institute to charge its clients for services rendered.

Under the Act, the management of the Institute was entrusted to a Governing Board. The majority of the members of the Governing Board were appointed by the Minister in charge of the Institute and other members were appointed by the Prime Minister and the Minister of Finance. The Minister in charge of the Institute at the present moment is the Minister of Industries and Scientific Affairs.

At the beginning of operations in May 1955, the combined staff with the Director, numbered 23. This number included a Chief Research Officer, 8 Senior Research Officers, 9 skilled Assistants and 4 supporting personnel. At the close of the year, the staff had increased to 37.

The Institute commenced its activities in rented out premises of approximately 5,000 sq. ft.* In addition, Government permitted the Institute to use part of the workshop of the Industrial Research Laboratory and the Rubber Services Laboratory at Kalutara. In 1957, the Institute moved to its own buildings which provided for a working area of 48,850 sq. ft. Equipment for the laboratories, pilot plant and workshop was obtained as a gift from the United Kingdom under the Colombo Plan as well as from other aid sources, such as the I.C.A. of the U.S.A. and the Asia Foundation. The biggest donor was the United Kingdom which gifted unit process equipment, workshop machinery and laboratory equipment valued at Rs. 1,120,000/-.

Today, twenty one years later, the Institute has a total staff of 237. Of this number 71 are in the scientific officer grade of whom 14 have had post-graduate training abroad and 13 are currently undergoing training abroad. Due to circumstances beyond our control, the Institute until very recently could not embark on a phased developmental programme of training for its staff. To CISIR this is a big handicap as we believe that the standing of a research institute depends on the reputation of its staff. It follows then that an industrial research and development institute must be staffed at all levels with the best qualified people available and must remain so in the environment of rapid technological change. Hence the continuing need for upgrading of staff at all levels, a deficiency which is only now being gradually overcome.

* In area converted to its use largely through the efforts of its own staff.

The Institute is now organised into functional groups by process and product, and by scientific specialities. There are 14 technical groups as well as the library, providing a range of disciplines, skills and services under one roof, which is difficult to duplicate or come by anywhere else in Sri Lanka. This juxtaposition of different disciplines makes it simple for CISIR to harness a multi-disciplinary team for investigation of a problem as and when necessary.

Over this last period of six years, we have been given increasing financial support by Government on a continuing basis (this year's budgeted financial provision is in an amount of Rs. 6.05 million) which has enabled CISIR to formulate a long-term programme of work as well as recruitment, training of personnel, expansion of working space and purchase of equipment to meet with the requirements of our programme of work. However, with non-availability of foreign exchange, CISIR has to depend for its training programme on the availability of scholarships awarded by outside agencies.

Our Objectives

It has been said and is still being said that CISIR has been specifically set up by Government for carrying out applied research having a bearing on the problems of local industry. CISIR should also provide the base for the industrial exploitation of locally available raw materials by way of new manufacture or as substitutes for imported raw materials. As such, CISIR should concentrate all its energies and funds on mission-oriented research, preferably over a three or four year life expectancy at most, for realisation of targets. However, too strong an insistence on short-term considerations has its own pitfalls.

We can do so and we do so by investigating problems of a basic nature with no prospects of immediate application or even of application in the foreseeable future.

CISIR has all along held that such long-term basic studies are necessary, within limits, as they add to the status of the Institute and to the prestige of our scientists among their peers and remove that sense of isolation so common among scientists in the Third World. Success in such studies is also a source of satisfaction to the individual scientists in that he has made a worthwhile contribution to the existing store of knowledge in that particular field.

Besides such theoretical studies provide us with an opportunity of training our young scientists which is an objective of the Institute. The results of these studies are published in scientific journals both local and foreign and serve as one of the recognised means of communication between our scientists and those working in the same areas in other laboratories.

Coming back to the main activities of the Institute which account for the major proportion of our expenditure—these are directed towards carrying out investigation and research into available raw materials, improvement of existing technology, and working on product development

from new or existing raw materials. These are obviously of importance to a developing country as such investigations may result in development of a new technology or in upgrading the quality of products or may bring about a reduction in the cost of production.

At times, it may be just a change of technique that is required to serve the same ends. Equally important is the maintenance of quality of industrial products as well as that of the raw materials which are transformed into finished products. This requires testing for conformity to standards or specifications.

Tea Industry

As benefits the importance of tea, coconut and rubber to the economy of this country, CISIR has devoted a considerable amount of time and funds to investigations into the technology of these primary products with a view to increasing their value added component. Not many of the members of the general public would be familiar with Ceytea. This is an instant tea powder manufactured in Sri Lanka solely for export.

CISIR was commissioned by T.R.I. in 1958 to investigate the process of manufacture of Instant Tea from green leaf, in contrast to instant teas on the market which are prepared from black tea. Almost three years and hundreds of experimental runs later, we were able to present a final report to the T.R.I. giving details of process equipment and conditions of operation required for the production of good quality instant tea from green leaf. Today's production of Ceytea is based on the process developed by CISIR which was handed over by T.R.I. to CeyTea Company for commercial exploitation.

Another new product, a tea drink, has been developed by CISIR for distribution in the form of a bottled product. The distinctive feature of the product is that it can be chilled without the onset of creaming and sedimentation which is a feature of a normally brewed cup of tea. The product is now being manufactured by the Ceylon Breweries under license from CISIR.

CISIR has been successful in formulating a blend of aromatic oils for use with black tea to give a product comparable with the well-known scented teas such as Earl Grey. This is now at the stage where commercial production is awaited.

The Coconut Industry

Our studies into coconut and by-products with the same endview have resulted in marketable products derived from the coconut sap. Investigations into the sterilizing and bottling of toddy were undertaken way back in 1956 and by 1960, CISIR had worked out the process details, equipment and operating conditions for this process.

Today, every producer of bottled toddy, coconut or palmyrah, is using the CISIR process for manufacture

and, according to information we have received, Malaya too is using this process for production of bottled toddy. Over the last five years, this product had a sale turn-over of approximately Rs. 8 million bringing in an excise revenue to Government of over one million rupees. A similar process for bottling young coconut—thambili and kurumba water has also been successfully worked out.

With the current increase in the price of sugar, many District Development Councils as well as Co-operative Organisations have set up units for the production of sugar and treacle from both coconut and palmyrah saps. In 1957, CISIR set up a station at Kakkapalliya with the aid of special funding from Government for investigation into the processing of coconut toddy for the production of sugar and treacle. At the time of completion of our work, the economic of production of sugar from palm-sap was not favourable to the potential producers and this work was not exploited.

Almost fifteen years later with the astronomical hike in sugar prices, the manufacture has proved attractive to the small producer and numerous units have been set up and are in operation.

CISIR has now developed a heat-sterilized bottled Coconut Cream as an answer to the enormous waste of oil that occurs with the use of coconuts in the household when coconut milk is extracted for use in cooking. The amount of oil that is now wasted in the residue has been estimated at 30,400 tons annually which is a sizable quantity in relation to the exports of coconut oil. With central processing, residual oil of good quality could be extracted by further processing of the residue.

Pilot plant trials for production of bottled coconut cream have been carried out in collaboration with the Coconut Processing Board at their Mirigama Mills. Consumer acceptance trials, which have been completed, indicate a favourable response to this product. A decision is awaited from the Coconut Development Authority as to the future of this product.

CISIR has also investigated the possibilities of extracting oil and edible protein from the wet processing of coconut. Similar investigations have been mounted in other countries, including U.K., America, Germany and India. There is no question but that this separation is technologically feasible. It is the economic feasibility that is in doubt.

The Rubber Industry

The main interest of our rubber technologists and scientists has been to increase the use of rubber in the manufacture of rubber goods both for local use and for export. With this end in view, CISIR provided local manufacture with a compounding and testing service. The objective was to provide formulations for new products hitherto not manufactured in Sri Lanka, to undertake experimental compounding followed by testing, to improve the quality

of the products manufactured, and to test the products of local manufacture for conformity to predetermined high quality standard.

CISIR was closely involved with the formulation of the proposals for setting up the first bicycle tyre and tube factory in this country. The Institute was requested to prepare the project report setting out the technical requirements and economic prospects for such manufacture. CISIR was associated with company staff in the commissioning and handing over of plant and equipment. This assignment was again in recognition of the skills available with CISIR in the field of rubber technology.

In view of the need to remove or minimise our dependence on imported rubber rollers for use with our rice hullers, CISIR experimented with various formulations for the production of rubber rollers. A formulation which resulted in a rubber roller comparable in performance to the imported product was finally evolved.

Work continues at CISIR in the area of rubber technology—both on rubber latex and dry rubber. Suitability of latex for sizing paper has been investigated as well as for bonding plywood.

Minor Crops

Besides our investigations into these major plantation crops, CISIR has also taken up for study the minor export crops i.e. essential oils and spices, under the sponsorship of the Ministry of Plantation Industries and the Ministry of Planning. Our main objective was to effect improvement in the technology now existing in the spice and essential oil industries. CISIR was successful in designing a still for the leaf grasses embodying many departures from the existing stills. The innovative features were the incorporation of a latent heat-exchanger between the vapour outlet of the still and vapour inlet to the condenser, and an air-cooled aluminium tube condenser. This in effect minimised the dependence of the distillation operation on the availability of large quantities of water—which could be critical in times of prolonged drought. A further advantage was the reduced capital cost of the still. These stills are now in operation in the field.

Another still has been designed and tested for the distillation of spices such as nutmeg, pepper, cloves and cardamom. These spices contain a comparatively large proportion of fixed oils and the still has been found to be extremely efficient on these materials.

CISIR is studying the chemistry of these spices and essential oils. Methods have been developed which give more accurate and more reliable data on the major constituents of oils such as cardamom, citronella, clove, fennel and cinnamon leaf and bark than was possible with the usual wet chemical methods. CISIR has now the expertise required for the assessment of quality in essential oils and the ability to monitor the performance of clients pro-

ducing these oils for export and indicate to them methods of improving their products to the level laid down by the export standards.

The upgrading of essential oils and the production of aromatic flavour chemicals from such oils is engaging the attention of CISIR scientists. A variety of aromatic chemicals have been prepared from the major constituents of cinnamon leaf oil, but this work as yet is at bench scale. In this area, CISIR is endeavouring to provide a research base in the country for developing new products with emphasis on their quality.

Sereh, the name by which lemon grass is known, is indigenous to Sri Lanka, but no organised attempt to grow and harvest this grass for extraction of the oil had been made. In November, 1962, CISIR in collaboration with the Department of Agriculture undertook an agronomic study of the crop together with bulk scale distillation of the grass at the Dry Zone Research Station at Maha Illuppalam. CISIR fabricated the still for distillation of the grass and the first crop was harvested in May 1963 and distilled. The quality and quantity of oil recovered indicated the commercial potential of this grass. Continuing studies over a period of approximately three years provided sufficient data to establish lemon grass as a cultivable crop and lemon-grass oil as a 'new' essential oil for local use and export.

A considerable amount of time and money has gone into the study of de-toxification of cassava and the development of products such as starch, sago, glucose, dextrans from cassava. For the record, an information bulletin on the production of starch and sago from cassava was put together by CISIR in 1957. The District Development Councils have taken the responsibility of progressing our production data on glucose and sago to the stage of small scale production. The process for the preparation of de-toxified starch and flour has now been firmly established and is available to interested parties. CISIR has shown that incorporation of cassava starch and sorghum flour at a level of 10% into wheat flour for bread making is quite feasible and the product is acceptable. Were this to be followed up, the savings in foreign exchange on the import of wheat and wheat flour would be a sizable rupees seventy million.

Miscellaneous Products

There are many other products which owe their genesis to work done at CISIR. To name but a few, Cancellling Ink for use of the post-offices, Wire Drawing Lubricant for use by the Steel Corporation, Grafted Latex-emulsion Paints, Arc Welding Rods, Duplicating Ink and Turkey Red Oil. These latter are all manufactured under license by the private sector and substitute for imported products using locally available raw materials. The Industrial Development Board is setting up the plant for production of Turkey red oil as a proto-type for subsequent release to the small industrialists.

Service to State Corporations.

No account of CISIR work would be complete without reference to the assistance rendered by us to the public industrial corporations.

Paranthan Chemicals benefitted from the expertise of CISIR rubber technologists who assisted them by formulating a suitable Ebonite Compound and establishing the conditions of re-lining these electrolytic cells with this compound. Were it not for this, the Corporation would have been compelled to send these cells abroad for re-lining at considerable cost in foreign exchange as well as production loss through down-time. The re-lining of cells is now done at Paranthan using the know-how developed at CISIR.

CISIR scientists and technical assistants together with chemical engineers from Paranthan investigated the conditions for manufacture of potassium chlorate using the excess chlorine produced at Paranthan. After a study of the systems, CISIR and Paranthan staff fabricated the equipment required for this conversion, carried out trials and successfully established a process for production of potassium chlorate.

The Tyre Corporation leaned heavily on the rubber technologists of CISIR right through the formulation and the planning stages of the project. CISIR staff participated in all aspects of the preparation of manufacturing specifications and actively participated in tyre testing work carried out locally by Soviet technical personnel.

CISIR has been interested in the possibilities of rubber wood pulp for production of paper. CISIR had investigated this raw material rather extensively in its laboratories and had established the quantities of chemicals, the physical conditions for effective pulping and tested the quality of the paper produced from rubber wood pulp. Even though the available literature carried reference to the use of rubber wood for production of pulp for paper manufacture and the laboratory work at CISIR also supported the published information, rubber wood was still suspect. It appeared that nothing short of large scale mill trials would be necessary to assess the potential of rubber wood as a source of paper pulp. 23 tons of rubber wood chips were transported to Valachchenai. 4.5 tons of rubber wood chips were pulped in each digester and paper using 100% rubber wood pulp was formed on the paper machine after a number of adjustments were made on the machine. The interpretation of the results has brought out views which would require further clarification, but the main issue that unmixed rubber wood pulp could produce an acceptable paper on mill scale equipment has been proved technologically possible.

It would be of interest here to mention another instance of CISIR work lying fallow for a number of years. We commenced investigations into the extraction and concentration of local vegetable tannin materials as a substitute for the imported wattle extracts. These inves-

tigations culminated in a final report in which we put forward concrete proposals for extraction of tannin from local materials. We are now informed that the Leather Corporation is planning to undertake extraction of tannin material on a commercial scale.

Other Services

Two other very useful services made available to the country by CISIR are the testing of raw materials and products for conformity, and the technical Library Services. The latter is much in demand by members of the public as it provides many entrepreneurs with advice and technical information and also the use of library facilities.

The standards for manufactured products are formulated for Sri Lanka by the Bureau of Ceylon Standards (an organisation which came into being following on a CISIR report and which draws heavily on CISIR expertise for assistance), but CISIR provides the testing services. In cases where no proper standards exist or where no proper testing methods are laid down even these have to be devised by CISIR. In 1975, more than 1,550 test reports were furnished by the CISIR. This service is of great assistance to small industrialists.

Over the years CISIR has built up a considerable body of expertise in electronic instrumentation largely as a "fall-out" of the on-going research programme of the section. There is now a steady increasing influx of electronic instruments into the country for use in laboratories, hospitals and industry. CISIR gets frequent calls for assistance for the repair and maintenance of these instruments—including S.O.S. calls from the hospitals.

CISIR is the only Institute which has available standard equipment for use in the calibration of electronic measuring instruments.

In May 1960, CISIR successfully launched the Productivity Association of Ceylon as a necessary factor of industrial development. CISIR along with the Productivity Association organised two management seminars, one conducted by a team from Stanford University and the other from Israel. Both were well supported by local industrialists and added to the stature of the Productivity Association. Here again, the Productivity Association is now a fully fledged body, and is making a valuable contribution to the industrial sector.

Support for science is at best given grudgingly, because most countries are not sure in measurable terms as to what extent scientific achievement and the country's development can be correlated. The difficulties and at times disappointments at the 'small' returns from the country's investment in science and technology have to be faced in increasing measure by developing countries and at times the experience can be frustrating. This shows up in the allocation of funds for science in national budgets of developing countries.

Our preoccupation with Government support is understandable because this is our main source of funds. Over the period of 20 years, Government provided approximately Rs. 31.2 million for both operational and capital expenditure i.e. as 0.018% of the G.N.P. of the country, at factor cost price for the years 1955—1974. Our operational expenditure for this 20 years period amounted to approximately Rs. 27 million. Over the past 20 years, the annual government contribution to the Institute at constant prices increased from Rs. 1 million in 1956 to Rs. 2.3 million in 1974. i.e. 2.3 times, while its operational expenditure increased 5 times. In any scientific activity, there is a determinant of productivity known as a "critical mass." Below this level, it is quite likely that any research group would be sterile, and unless adequate support is forthcoming to maintain our strength above this critical mass, we may end up by being non-productive.

A strong scientific and technical base is one of the

staging areas for national development and growth. Public resources are indispensable in achieving that strength. We appreciate that in the context of more pressing social needs expenditure on research and development is now looked on as a discretionary category of public investment as, by and large, research and development does not play a highly visible role in the process of economic development. It is for this reason that research and development require very strong advocacy to win out in the competition for resources and what greater measure of advocacy can we urge than our record of achievements.

We are using this occasion and we take this opportunity to place before the country our record of service in relation to the funds made available to us by Government, in other words, investment utility. What transpires from all this is that we can only give service to the extent that Government and industry appreciate our services and support our activities. Need we stress the obvious, or to put it in another way, can we be more obvious?