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United Nations Industrial Development Organization

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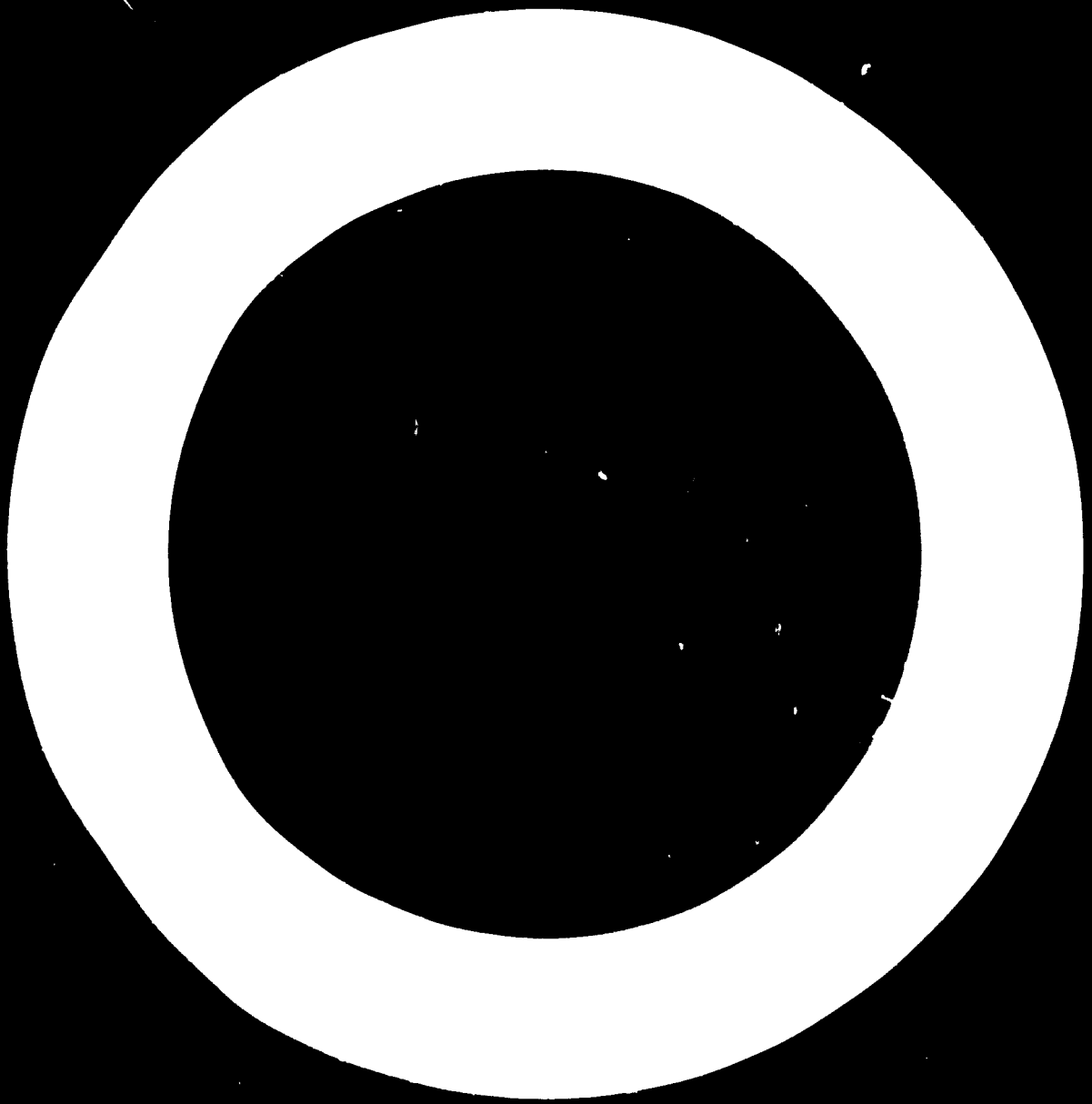

Summary

Three case histories demonstrate how cooperative industrial research at the East African Industrial Research Organization has helped to develop the industries of Kenya, Uganda and Tanzania. These are

(A) Drying of mild arabica coffees.
(B) Development of widely acceptable sorghum foodstuffs.
(C) Extraction of hecogenin from sisal waste.

The projects also developed expertise within the Organization that has also been useful in other fields of its work.

International cooperative research requires prior agreement between governments and/or government agencies on objectives, scope, apportioning of costs and prospective benefits. The participation of industrially advanced countries is necessary for sophisticated projects while cooperation between developing nations can provide more relevant experience in such areas as rural industrial development.

The promotion of cooperative research projects requires knowledge of both problems and available resources. World wide meetings, exchange visits and correspondence between senior research personnel supplement the technological literature in formulating international research projects. International organizations play an important part in arranging these contacts.

The training of personnel from developing countries is necessary to obtain an effective transference of technology and provide a foundation for further technical development. Experience of conditions in developing countries also develops technologists from industrialised regions.

International cooperation between countries having different political systems and ideological philosophies often encounters conflicting objectives. Scientific and technological research is practically immune from such forces as it deals with demonstrable facts and processes. This field of endeavour offers an excellent forum in which mutual understanding between the partners can be fostered.

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INTRODUCTION

The East African Industrial Research Organization (EAIRO) has been used as a source of examples (case studies) of cooperative industrial research because its activities are most familiar to the author. The EAIRO exists to provide scientific and technological backing for the expansion and development of industry in the three Partner States of the East African Community: Kenya, Uganda and Tanzania. The policies for industrialization of these states provide guidelines for its work: import substitution, the maintenance and development of exports, provision of employment and the utilisation of local resources for example. The Partners also determine the major areas of its work by agreement.

Funded by the three Partner States, the Organization experiences various forces of common interest, and of competition as might be expected with an international body. At one level, immediate trouble-shooting and advice of a technological nature is given directly to industrial concerns, on a fee-paying basis at a nominal rate, on all topics within our competence. Outside our existing experience the fact that we have technologists trained in a range of disciplines often enables adequate consultations to be made with experts abroad without engaging them to come to the country.

At a higher level of cooperation the Organization provides a nucleus on which bilateral and multilateral aid projects can be based to benefit the region. Existing facilities for laboratory and field work, contacts with industrialists and government departments and scientifically trained personnel give a running start to such projects. The Organization also provides a framework within which skilled counterpart staff can be trained to ensure that successful projects are applied and a back-up force is available in East Africa to iron-out snags in any newly introduced technology.

[illegible] work [illegible] concert with appropriate [illegible] facilities as well as its [illegible] of work.

[illegible] with experts [illegible] Universities [illegible] can be [illegible] work.

I. CASE STUDIES

Three case studies are given, the first concerning cooperation between the Organization and Coffee growers in the three Partner States. At this level we deal primarily direct with the people who are concerned with implementing the procedures and technology under investigation. The governments and administrations of the countries are involved to a minor extent but general regulations, such as controls on currency movements, can interfere with the research although technologically they are peripheral considerations.

The second study deals with the development of methods of improving the acceptability of sorghum as a staple foodstuff in cooperation with the United States Agency for International Development (USAID). In this kind of cooperative research government policies play a major role. A donor government provides expertise, training and equipment aimed at solving a regional problem which the recipient Organization agrees to service and maintain after the project. A transfer and development of technologies takes place on the one hand, and a long term committment to implementation on the other.

The third study is concerned with the extraction of hecogenin from sisal waste. At this level of cooperation local assistance was given to an overseas governmental organization to identify a raw material required for sophisticated processing into a pharmaceutical product. Techniques for economical extraction under local conditions were developed. The result was the production of a valuable by-product by an existing industry.

A. Coffee Research

The coffee growing industry in East Africa started with both individual planters and managed company estates. In each country development boards were formed to face and combat the common problems of growing coffee. These ranged from the fiscal interests of Governments, the combating of diseases, the promotion of profitable varieties and joint and cooperative marketing. Experimental stations were set up and staffed with agronomists to conduct trials of varieties, methods of pest-control, fertiliser application, cultivation and the like. These boards also operated common processing, grading and quality control facilities aimed at protecting the status of the crop in international markets. They still do.

Occasionally problems arose outside the expertise of their research stations. The Boards would then commission a consultant to make an investigation and report back with recommendations.

The KAIRO was asked in this fashion by the Kenya Coffee Board in 1954 to investigate coffee processing with particular reference to the drying of pulped, washed coffee and its effect on quality.

A scheme of investigation for the project was worked out in which the course of drying of coffee under natural and forced drying would be followed. The action of various types of dryer, already installed on estates, would be studied with a view to identifying desirable and undesirable features and making recommendations on drying procedures to growers. At this stage KAIRO suggested that the coffee boards of Tanganyika and Uganda should be asked to participate in the investigation. The relevance to Tanganyika coffee was evident and their participation followed, Ugandan coffee, however, is largely prepared without the fermentation and washing of the bean, so they did not come into the investigation.

The investigation was undertaken with Kenyan and Tanganyikan participation and identified fundamental stages in the removal of water from the wet coffee beans. The examination of installed drying machines revealed their desirable and undesirable features in relation to the understanding of coffee drying that had been acquired. These results were presented in a report which was widely distributed by the Coffee Boards to interested parties in all parts of the world.

As a result of this communication of the results extensive discussions were held with other researchers and machinery manufacturers which helped in the planning of further research. The data collected during the investigation also proved to be useful in providing advice to Uganda growers, [illegible] their different methods. This led Uganda growers to join the other [illegible] in forming the East African Coffee Processing Research [illegible]

[illegible]

B. Sorghum Processing

With increasing population, East Africa's self-sufficiency in food production depends upon the possibility of extending cultivation to increasing the number of crops. This can be done by the introduction of high-yielding varieties and the bringing of new areas into production. The former is being tackled by plant breeders all over the world with a good measure of success. Bringing new areas into production is an agro-economic problem which is based fundamentally on the fact that the most productive and most easily cultivated land is already in use. Robust crops that require lower rainfalls and resist droughty periods are clearly advantageous. Sorghum is such a crop. The East African Agriculture and Forestry Research Organization of the East African Community (EAAFRO) has worked to characterise varieties of sorghum and increase its robustness and yield. For it to give most benefit to the region its acceptability as a foodstuff needs to be more widespread.

A proposal to the United States Agency for International Development (USAID) by the plant breeders and agronomists of EAAFRO suggested that the problems of wider acceptability should be studied on a cooperative basis. A sorghum processing project was defined jointly between the EAAFRO, USAID and the EAIRO as participating bodies and in consultation with the authorities of the Partner States of East Africa. This project was led by a Cereal Specialist from the U.S. Department of Agriculture and supported by a trainee Research Officer of EAIRO designated to the project, the services of the EAIRO Food Processing technologist and the general facilities of its laboratory.

The project established at EAIRO the necessary facilities for screening sorghum varieties for their nutritional value by analysis of their ash, fat, fibre, protein and amino acid values. The Research Officer has gained expertise in handling grain products and tackling the scientific problems which arise in this type of work such that he is now competent to lead and is heading the further development of the project. Satisfactory ways of processing sorghums to produce widely acceptable foodstuffs have been found and are currently being introduced into East Africa. This work has assisted plant breeders in selecting and developing new varieties for promotion. A firm foundation has been laid on which the widespread use of sorghum as a staple foodstuff will be developed. As its acceptability is more generally recognised it is expected that land presently used to grow, for example, maize crops of maize will be used for growing sorghum. Such a change can of itself give notable increases in total cereal production.

2. Hecogenin from sisal leaf waste

Just about 25 years ago the use of steroid compounds in medicine was making great progress. Existing supplies were not adequate but were foreseen to be limited and likely to restrict the availability of treatment for those who could benefit from it. Accordingly a search was mounted in many parts of the world for naturally occurring raw materials from which pharmacologically useful steroids could be synthesised. One such material was hecogenin which can be converted into cortisone and used in the treatment of, for example, the crippling disease of rheumatoid arthritis.

In 1943 the occurrence in several species of Agave was noted but its extraction did not appear to be a commercially rewarding proposition. But as Agave Sisalana was cultivated on estates in East Africa for the production of sisal fibre, the EAIRO was asked by the British Medical Research Council (MRC) initially to collect and provide waste flesh of sisal leaves to be tested for the presence of hecogenin. This was found in sufficient quantities for the Medical Research Council to second one of their staff to East Africa to work with the staff of the Organization in developing a method of extraction suitable for operation on estates.

The juice beaten out from the leaves was soon identified as the preferred source material rather than the flesh. Variability of concentration and purity of the hecogenin in the juice were studied as functions of, age of leaf, type of sisal and region in which grown. EAIRO provided expertise on the translation of laboratory findings to practicable pilot scale commercial production of a concentrated raw hecogenin and pilot scale extraction of this concentrate. The MRC contributed the expertise of their staff on separation, purification and identification of the plant steroids.

This cooperation between laboratories of greatly different levels of sophistication proved to be ideal for the initiation of a new product for East Africa. The establishment of the presence, methods for extraction and separation of product [illegible] the laboratory of the MRC. The EAIRO modified the [illegible] and scale-up the processes to give the [illegible] The MRC and commercial [illegible] of viable routes for the

D. Discussion

These case studies of cooperative research projects carried out at EAIRO [illegible] wide range of levels of technical expertise that can be deployed.

In the case of [illegible], where the cooperating bodies are in Kenya, Uganda and Tanzania, the discovery and employment of first-rate, experienced personnel was necessary to make full use of the scientific literature, personal professional contacts and sophisticated apparatus.

The international cooperative effort to introduce new processing methods for sorghum required laboratory facilities to be set up at EAIRO and personnel with the capacity to continue the work after a course of technical training and a period of practical experience. The equipment and training was a part of the package transferring the technology to EAIRO and reduced the duration of our direct dependence upon expatriate officers. It also ensured effective implementation of the results and a local back-up facility should any snags develop.

A low level of resident expertise was required in the case of hecogenin from sisal. In the event EAIRO provided significant expertise in the development of pilot scale plant for the extraction of the raw hecogenin concentrate. As part of the overall development of a new source of corticosteroids the project was vital in bringing down the cost and increasing the availability of the drug. Commercial exploitation of the processes was left in the hands of the pharmaceutical companies and sisal estates.

At each of these levels of cooperation the Organization has been in a good position to uphold its part using its existing facilities and informal connections with laboratories and governmental agencies abroad, as well as its special relations with the Partner States of the East African Community.

II. ASPECTS OF CO-OPERATION

International cooperation in industrial research requires agreement between two or more laboratories and sometimes governments, that a particular problem or group of problems should be tackled and that they should do so. To examine in detail the reasons for arriving at such agreement is beyond the scope of this paper. No doubt common interest, desire to acquire experience for personnel, commercial interest and so on all play a part. As technologists it is sufficient for us to note that agreement can often be reached. Commonly we initiate the process ourselves by first recognising a problem, next finding ways in which it might be tackled, demonstrating the likelihood of success and the benefits that would accrue. Finally a proposal is prepared for a formal project. This proposal then forms the basis of a search for sufficient funds, personnel and apparatus for carrying out the research.

The preparation of a proposal and following it up successfully through the 'corridors of power' of governments is a delicate task. Support from an industry or agency that would eventually benefit is a great help at this stage. In our case the provision of a broad basic capability, in the form of personnel and facilities, is seen as a continuing contribution of the Partner States. Industry gives support when a particular topic of research is of interest to it.

With broader international cooperation we rely to a large extent on finding out what resources exist in other countries that might be committed to a project. This information is gathered, to a large extent, from visiting experts or by visits to other institutes. Casual contact with technological V.I.P's making fact-finding tours or discussion with the expatriate staff of our laboratories are further sources of relevant information. If an approach seems to offer promise then a similar process of proposal, governmental approval, negotiation and so on is followed as in the case for a purely East African supported project.

A. RURAL INDUSTRY

An area of potentially fruitful cooperation between developing countries at similar stages of industrialisation is the problem of rural industrialisation. Often single individuals or a very small group make articles for the local or even a wider market. Usually their goods could be improved by the application of scientific and technological knowledge two major difficulties have to be overcome. One is that technically educated and skilled personnel are rarely able to [illegible] the minimum of equipment

for their implementation. The other is that in the event of a difficulty arising in the absence of a technician, the manufacturer is likely to revert to traditional methods and consider that he has proved the new-fangled process to be unreliable. To tackle problems in this area an industrial research institute requires specialists who on the one hand can understand the terminology of the technologist and pose problems to him, yet on the other hand are able to reach and communicate with the villager effectively. The problem exists in one form or another in all developing countries and could usefully be tackled by a collaborating group of industrial research laboratories in the countries concerned. Experience and thorough comprehension of the conditions in the village are in this area more valuable than technological virtuosity.

B. FORMAL STRUCTURE

In principle it would appear to be a good idea if the above fairly informal way of setting up a cooperative project could be formalised. The objective would be to assemble a list of problems and a list of facilities and try to match the two. Of course it can not be quite as simple as that because a problem may often be tackled only after re-defining its scope to fit available facilities. Alternatively a new development may be announced as being available for a range of problems and a trial case might be sought to test it.

In sponsoring the present meeting UNIDO is promoting the prospect of these present finding cooperative solutions to their problems. The formal sessions, informal discussions and industrial visits will provide ideas and opportunities for the participants to set up cooperative projects to attack problems. Regular consultations of this nature might be developed as a continuing formal scheme to exchange visits, problems and knowledge of research.

Another approach to the development of a more formal structure for developing cooperative research projects is the publication of Handbook of Technical Information Sources by WAITRO and the contacts that can be made through it.

III. TRAINING

After completion of a course of academic study the new graduate of a scientific discipline has learnt a large number of basic facts and laws or relationships. He is learned but not skilled in science, he has still to learn how the knowledge can be applied and to make the approximations necessary to describe real manufacturing plant and actual raw materials in quantitative terms. The development of a scientist into a technologist is achieved in an industrial country by a process of selection. The selection is carried out by observation of the budding technologist during his employment on industrial tasks and promoting the most able. Others are redirected to other fields of employment. In a developing country there is neither an adequate supply of scientifically qualified personnel nor the background of technical employment for this kind of selection process to be feasible.

We look, therefore, to a course of training to enable the scientifically qualified person to benefit from a relatively short period of experience and become an effective technologist. Such a scheme is seen as being a rapid route for the acquisition of technological expertise and reorientation from academic to technological ways of research and development.

The reorientation is carried out best by acquiring experience from close association with a practising technologist working on actual industrial problems. Cooperation between research institutes of a developing country and an institute with an established reputation in the appropriate technology is the best way of meeting the requirement.

In any cooperative research project involving what may be for us a new technology we always like therefore to see a component of technical training for our personnel. The long-term success of a programme is also favoured by such training as our personnel have a commitment to both the region and the project. They will remain as a back-up force familiar with the technology after completion of the project itself, even if their expertise is re-deployed in other directions. The participation of our personnel in the project is also [illegible] as it is seen as useful when there is the need if no local expertise [illegible]

[illegible]

industrial processes have to operate differ and the extension of a technologists' experience to [illegible] to our labour intensive and less [illegible]. An exchange of personnel between research institutes serving similar branches of industry would therefore [illegible] development. Such exchanges set up informal channels for the exchange of information and advice between technologists by expanding their circle of qualified acquaintances and correspondents.

IV. DIFFICULTIES ASSOCIATED WITH INTERNATIONAL COOPERATIVE RESEARCH

In the earlier sections this paper has concentrated on the aspirations of the partners engaging in international cooperative research and the benefits which follow. There are difficulties that can arise during cooperative endeavours which need to be stated in order to present a reasonably balanced picture.

The first of these is the need to balance the costs and benefits between the partners. It is only human nature for each partner to be fully aware of the costs which he is bearing whereas the benefits that have been gained in the past have been assimilated, and the benefits which are to come are just promises. The difficulty is especially acute where single projects are concerned. When the topic of research is of an open-ended nature the partners can agree that temporary imbalances will be ironed out over a period of time.

In the case of the partners being departments or agencies of governments the administrators concerned may have little contact with manufacturers or technologists at a practical level. They have, however, the final fiscal authority and a less than firm grasp of the responsibility this carries can wreck the cooperation. The formation of a steering committee to supervise the project can help solve this difficulty. The members of the committee will comprise the administrators directly concerned and representatives of the industry from the participating countries.

Difficulties can also arise from differing political and ideological philosophies among the cooperating partners. These difficulties may not become explicit or their sources accessible to the research institute so that they may be resolved. Indeed where the area of cooperation of the participating engineers extends to other fields than industrial research, conflicts in those areas can spill-over and affect the institute. A wider cooperative basis involving several countries can minimize the effects of the above kinds of problems. Technological research per se should experience little incongruence of [illegible] differences in policy between countries. The problems arise when methods and ways of implementation are considered.

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