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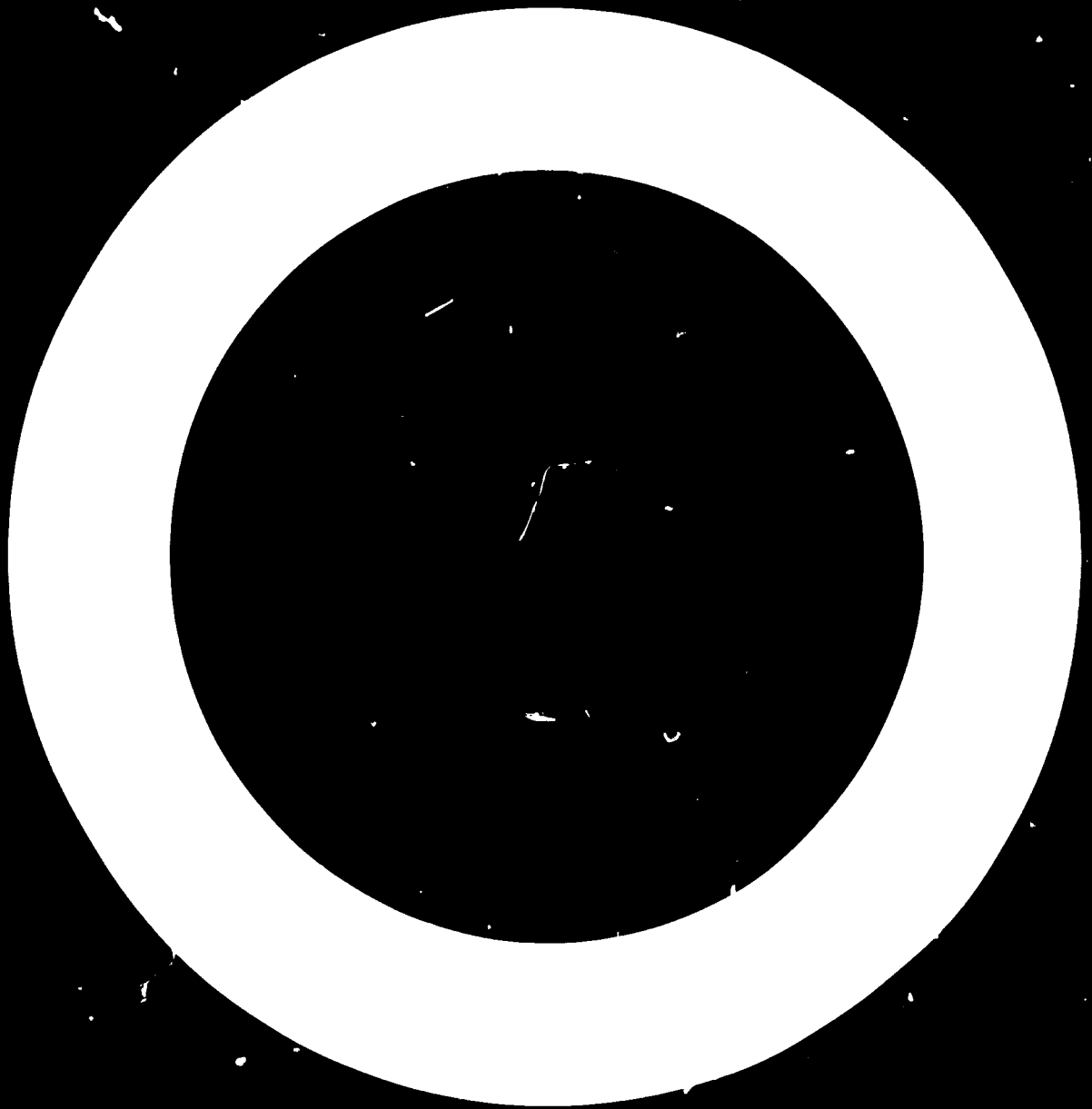
United Nations Industrial Development Organization

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FORMATION OF INDUSTRIAL RESEARCH  
AND SERVICES IN AFRICA

Report of a Joint Consultation  
Lagos, Nigeria  
15 - 19 September 1973



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Explanatory note

The value of the Nigerian nira (N) in relation to the United States dollar (S) is \$US 1 = N 0.615 (September 1975 rate of exchange).

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## INTRODUCTION

While the activities of the United Nations Industrial Development Organization (UNIDO) in industrial and technological research, standardization and quality control, and particularly in the establishment and strengthening of institutions for these activities, have developed significantly in Asia and Latin America, they are still very much at the conceptual stage in most countries of Africa. The importance of developing research activities was stressed at both the first and the second Conference of African Ministers of Industry organized by UNIDO at, respectively, Addis Ababa, May, 1971 and Cairo, December, 1973. The Ministers advocated, inter alia, the creation of institutions for industrial research, standardization and quality control and the training of managers and operatives for technological development. This recommendation was further strengthened at the Conference of Ministers of African Member States Responsible for the Application of Science and Technology to Development organized by UNESCO/ECA at Dakar, January 1974. At a meeting of the Follow-up Committee of the Second Conference (Cairo) of African Ministers of Industry, which took place at Addis Ababa in September, 1974, UNIDO was urged to intensify its programmes of assistance and to collaborate with the Economic Commission for Africa (ECA) and the Organization of African Unity (OAU) in facilitating the development of those activities in Africa.

In the light of these recommendations, UNIDO, in co-operation with the Government of Nigeria, through the Federal Institute of Industrial Research (FIIR) and the World Association of Industrial and Technological Research Organizations (WAITRO), organized a Joint Consultation on the Promotion of Industrial Research and Services in Africa.

The purpose of the Consultation was to bring together senior officials from African countries involved with the development and implementation of industrial and technological research policies and programmes, and the utilisation of industrial research results and services, to exchange ideas

on the one hand, and the development of the latter, and the  
improvement of existing, activities in industrial research and

development. Any such study would have to take into account the  
need to coordinate activities and resources among government and industrial  
personnel of the different structures of these institutions, to in-  
crease the efficiency of the latter.



## I. ORGANIZATION OF THE CONSULTATION

The Joint Consultation on the Promotion of Industrial Research and Services in Africa was held at Lagos, Nigeria, from 15 - 19 September 1975. It was attended by 31 delegates representing 19 African countries, 7 consultants selected by UNIDO (mainly from Africa), and observers representing the Economic Commission for Africa (ECA), the Food and Agricultural Organization of the United Nations (FAO), United Nations Development Programme (UNDP), UN Information Service and the United Nations Education, Scientific and Cultural Organization (UNESCO) and several organizations in Nigeria. The participants included senior officials from industrial research institutes; public and private industry; universities; public industrial organizations; and financing institutions. They also included high Government officials involved in planning and implementing industrial research policies and programmes. ( A list of the participants is given in annex I ).

### Inauguration

The inaugural ceremony was attended, in addition to the above, by dignitaries of the Nigerian Government and industry. After a brief statement by I.A. Akinrele, Director of FIIR, M.I. Wushishi, Nigerian Federal Commissioner for Industries, presented the opening address. S.N. Ndam (UNIDO), Director of the Conference and L. Larte, President of WAITRO, also made short remarks on behalf of their organizations.

Mr. Akinrele, in his address, said that industrialization had become the cantilever for economic survival in the modern world and Africa, being a significant component of this body, must have a rightful share in industrialization. Science and technology provided the fulcrum for industrial success and any meaningful participation in success must reckon with this fact. Scientific and technological knowledge was not restrictive; what was restrictive was the capability of discovering the knowledge and adapting it to a given socio-economic situation. Thus, the promotion and utilization of industrial research services were basic to the healthy development of a dynamic and prosperous industrial economy.

Mr. Wushishi described the development of FIIR and spoke of the urgent need to intensify industrial research activities in Africa. One of the problems currently faced by African countries in their efforts to industrialize was the problem of the transfer of foreign technology appropriate to their present level of development. The fact that a processing plant worked well in a European country did not necessarily mean that the operation of such a plant in an African country would be as successful, given the substantially different social and economic environment. There was now a definite need for industrial research institutes in Africa to evaluate technologies developed in foreign countries so as to determine their suitability to the local environment. In order to derive maximum benefit from industrial research activities, the results of research should be integrated into the productive process.

The industrial base in the host country, Nigeria, was rapidly expanding and industrialization was becoming increasingly sophisticated. There were, nevertheless, noticeable imbalances in this development. For example, certain processing plants were engaged in the processing of vegetable oils; the products of these plants were usually exported and processed further in foreign factories only to be re-imported as final consumer goods. The largest proportion of value added in this business is made in the final processing and marketing operations. Industrialization efforts in Nigeria were therefore designed to ensure that most of the final stages of production and sophisticated processing were undertaken in the country so as to secure the maximum benefit for the Nigerian economy. Over the years, a variety of simple local technologies such as the processing of cassava into a staple food, and the manufacture of dyes from vegetable sources, had been developed. These initial efforts had been upgraded through research work at the FIIR and they had now become viable modern industrial operations that could be undertaken on a small or large scale.

Mr. Ndam, in his address, spoke of the importance which UNIDO placed on its programme of industrial research and described assistance being given

by UNIDO to developing countries in this field. Although the part played by industrial research institutes varied from country to country, depending on national targets, the degree of industrial advancement, the size of local firms, and various other conditions, many common features could be identified. Likewise, it was possible to identify a number of elements essential to the successful operation of research institutes everywhere. These included: a suitable industrial and governmental environment conscious of the usefulness of industrial research; a practical national industrial research policy and programme; adequate funds and incentives for research work; professional managerial and technical personnel; and suitable buildings, facilities and equipment.

Mr. Lartey said that one of the prime objectives of his organization was to foster and promote industrial growth, and that all activities related to industrial research and its role in the industrial development of Africa was of special interest to WAITRO. Participants from the various countries of Africa were all witnesses of the pace of industrial development in their countries. It could rightly be said that all over Africa an industrial revolution was taking place. If this revolution were to yield positive results, however, the need for industrial research could not be overestimated. There was need for guidance at all stages, from pre-feasibility, through planning, studies and design to implementation. Industrial research could provide the tools for the required guidance at all these stages.

#### Election of officers

I.A. Akinrele, leader of the host country delegation, was elected Chairman of the Consultation. L.G. Djigo (Senegal) was elected Vice-Chairman. K.A. Ng'Eny (Kenya) was elected Rapporteur, and J. Kamsu Kom (Cameroon) was elected Assistant Rapporteur.

#### Organization of discussions

The Provisional Agenda and Schedule of Work were adopted without

The first session was devoted to the presentation of country briefs. Some of the participants highlighted the situation in their countries as regards industrial research and development. This session was chaired by the Vice-Chairman.

### Country briefs

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### Country briefs

One of the main topics related to the presentation of country briefs. Some of the participants highlighted the situation in their countries as regards industrial research and development. This session was chaired by the Vice-Chairman.

Study tours

Study tours were undertaken to FIIR; West African Thread Company; Lever Brothers; Nigerian Breweries; Lisabi Mills; Vegetable Oils Limited; Cocoa Industries; and Cadbury (Nigeria) Limited. (Summary information on these plants is given in Annex III).

Closing Session

At the Consultation's closing session, on 19 September, the report of the Rapporteur was unanimously approved. The resolution and recommendations formulated by the participants were discussed and adopted by acclamation. The FIIR was designated to undertake the necessary follow-up preparatory work with the assistance of UNIDO for the implementation of the resolution.

## II. RECOMMENDATIONS

### A. The Consultation recommended that the Governments of the African countries:

1. Foster close and active involvement between economic planners and technologists in planning for national economic development and for more effective utilization of available resources, both at Government and industry levels, in order that scientists and technologists become more intimately involved in decision-making and national economic planning;
2. Establish national policies, machineries and programmes, where these do not exist, for the development and implementation of industrial research activities. (In doing this, efforts should be made to avoid undue duplication of available resources and facilities, particularly financial and human resources and equipment). They should be aligned with national development objectives by integrating them with national industrial, economic and social development strategies, policies and plans. The industrial sector should be fully associated, at all levels, with these developments;
3. Encourage the development of industrial and technological capabilities in their countries by, inter alia:
  - (a) Allocating adequate funds for industrial research and development programmes, at both the national and the institute level. The application of a special tax on industrial production for this purpose should be considered;
  - (b) Adopting policies and providing incentives to encourage the development of a sound industrial environment;
  - (c) Applying tax exemptions to expenses in industry incurred in research and development;
  - (d) Urging transnational corporations, through legislation and appropriate provisions in joint ventures or transfer-of-technology agreements, to utilize available local industrial research services, where these have been developed to a suitable level;

(e) Establishing adequate conditions and compensation schemes to attract and retain competent personnel, at all levels, in industrial research;

4. Establish new industrial research institutes and strengthen existing ones for the effective implementation of national industrial research policies and programmes. These institutes should initially be established on a modest scale, and then expanded in line with the level of industrial development of the country. Emphasis should be laid on multi-purpose research institutes in developing countries, without prejudice to single-purpose institutes when warranted by specific needs. The institutes should be accorded the highest possible administrative and financial autonomy with accountability. Governments should avoid establishing institutes as departments of Government ministries, even though they could be located under the aegis of the appropriate ministries. The industrial sector should be fully associated with the establishment of their institutes. Special attention should be accorded to the planning and programming of buildings, facilities, and equipment.

5. Avoid indiscriminate application of imported technologies without taking economic and social factors into consideration;

6. Consider establishing national machineries and institutions, where these do not already exist, to assist in regulating and supervising foreign investments and obtaining better terms for the acquisition of foreign technologies, experts (know-how) and licences;

7. Provide incentives for the commercialization of viable research results, and take adequate steps for protecting industrial property rights. Appropriate national machineries, such as industrial research and development corporations, should be set up, as required, in order to help translate industrial research results into commercial operations;

8. Provide a conducive milieu when establishing economic co-operation arrangements, for practical co-operation and exchange of experience among relevant governments in industrial and technological activities;

6. Evaluate, periodically, national industrial research policies with a view to re-aligning them with the changing industrial, economic and social needs of the country. The participation of experts from other countries in such evaluations may be considered.

B. The consultation recommended that industry and other users of industrial research services:

1. Participate fully in the development of national industrial research policies, strategies and programmes, through their appropriate national representatives, such as associations of manufacturers and Chambers of industry;
2. Should associate themselves with the determination of the policies and programmes of industrial research institutes by being effectively represented on the management boards of industrial research institutes;
3. Should encourage the development of national industrial research activities by, inter alia,
  - (a) Contributing towards financing research programmes at both the laboratory and pilot plant levels;
  - (b) Utilizing more fully the extension services of research institutes, as required;
  - (c) Providing opportunities in their industrial plants for practical training of personnel involved in industrial research;
  - (d) Employing technologists, as necessary, in their enterprises to cater for the technological aspects of the company's operations and to act as liaison officers between companies and industrial research institutes;



- (e) Establishing quality control laboratories in their industrial plants;
- (f) Referring technical problems to industrial research institutes;
- (g) Establishing regular contacts with research institutes in order to acquaint the institutes with their needs and requirements;

4. Be encouraged to support, financially or otherwise, the establishment of research institutes or the extension of departments of existing ones devoted to their specific needs.

C. The Consultation recommended that industrial research institutes:

1. Establish appropriate mechanisms for making contacts with industry by, inter alia,
  - (a) Incorporating representatives of industry in their boards of management;
  - (b) Paying regular well-planned visits arranged by staff of the institute designated to maintain contacts with industry;
  - (c) Undertaking public relations-type activities including preparing and circulating newsletters and information on the institute;
  - (d) Appointing staff members of industrial enterprises for which the institute is doing work as members of the project teams;
2. Establish close working relationships with pertinent bodies such as universities, productivity centres, development banks and industrial organizations in order to minimise undue duplication of efforts and to maximise the utilization of local resources;
3. Adopt a multi-disciplinary approach in the execution of industrial research projects. A suitable staff member from the client's organization should be fully associated with its project at all stages of implementation;

4. Gear their industrial extension services to the solution of practical industrial problems. These services should include industrial management; testing and analysis; quality control and standardization; process and technology development and modification; trouble shooting; marketing and market research; preparation of techno-economic studies; environmental studies; evaluation of alternative technologies; and industrial training in the above areas;
5. Accord particular attention to their industrial information and enquiry services, which should be co-ordinated (preferably) by a technologist. Flexibility should be exercised in the approach to providing industrial information services;
6. Base the development of their projects on the practical needs of industry and the community at large. The projects should also be based on well defined priorities, taking into account the use of new technologies particularly those developed locally. Efforts should be made to identify a sponsor as soon as positive results are visible. The presentation of such projects to clients should include information on both technological and commercial aspects;
7. Accord high priority to the development of their managerial skills and the training of their technicians. This should be done through practical industry-oriented programmes co-ordinated by an appropriate staff member of the institute. Appropriate recognition should be accorded to personnel participation in order to facilitate their advancement in the institute;
8. Endeavour to handle industrial problems speedily and efficiently in order to capture the confidence of industry;
9. Accord special attention in their development schemes to planning and programming of buildings, facilities and equipment;
10. Actively consider the establishment of instrument repair and maintenance workshops at the institute, if not already available, taking into account any efforts being made at the national level;

11. Establish a system for the continuous evaluation of their on-going projects. Programmes of institutes should be reviewed from time to time, say every three years, in the light of the changing industrial and economic requirements of the community.

D. The Consultation recommended, with respect to international co-operation in industrial research, that:

1. Regular contacts be established among research institutes in Africa. Such contacts could be effected through exchange of visits by directors and research staff, and exchange of annual reports, research programmes and, where feasible, information on on-going research projects. UNIDO, it was suggested, should assist in these efforts.

2. An association of organizations involved with industrial research in Africa be established, with the present African members of WAITRO as the nucleus. One of the aims of this association would be to promote contacts and exchange of experience, capabilities and expertise among African institutes. The association should organize meetings annually, at both regional and sub-regional levels, on general and selected technical aspects of industrial research. It should seek the collaboration of universities and the industrial sector, as need be, in the organization of these meetings. (UNIDO, it was suggested, should assist the African organizations in this effort);

3. African countries establish regional activities in industrial research so that the experiences of one country may be shared by others. ( In this connexion, it was suggested , African Governments should give their full support to the efforts already initiated by UNIDO, in consultation with ECA, to establish a "Regional Integrated Programme for the Design, Development Adaptation and Transfer of Industrial Technology", which has been proposed to UNDP for financing;

1. Relevant international agencies assist the African countries in the establishment and/or strengthening of:

(a) Industrial and patent information networks at the regional and national levels;

(b) National industrial research policies, programmes and machineries, particularly for industrial research institutes for their implementation;

(c) Mechanisms at the national and regional levels for the financing and commercialization of industrial research results;

(d) Linkages between developing and more advanced institutes both within and outside Africa. These linkages should be extended to cover university/research-institute/industry co-operation;

(e) Training programmes, at both the national and the regional levels, for various categories of personnel involved in industrial research, emphasis being placed on the development of management skills;

(f) Regional and national machineries for the negotiation of industrial licensing and joint venture agreements for the transfer of industrial technology;

(g) A roster of African experts in industrial and technological research.

III. RESOLUTION ON THE ESTABLISHMENT OF AN ASSOCIATION OF  
AFRICAN ORGANIZATIONS INVOLVED IN INDUSTRIAL RESEARCH

The Joint Consultation on the Promotion of Industrial Research and Services in Africa which took place at Lagos, Nigeria from 15 - 19 September 1975 and was attended by 31 delegates representing 19 countries of Africa, 7 consultants selected by UNIDO (mainly from Africa) and observers representing international and Nigerian organizations, consisting of senior executives of industrial research institutes, government, public and private industries, universities, industrial organizations and financing institutions;

Stressing the need for:

- (a) Government, industry and technologists to work as a team in the development of national policies and programmes for economic and industrial development as well as for industrial research policies and programmes both at the national and at the institute levels;
- (b) Adequate funds and facilities to be allocated for industrial research and development, both at the national and at the institute level;
- (c) Establishing suitable and adequate remunerations and incentives to attract and retain competent persons in industrial research;
- (d) Establishing appropriate policies and incentives to encourage the development of a sound industrial environment;
- (e) Trans-national corporations, through legislation and appropriate provisions in transfer-of-technology agreements, to increase their utilization of available local industrial research services;
- (f) The establishment of incentives and machineries for the commercialization of industrial research;
- (g) Avoiding indiscriminate application of imported technologies without taking economic and social factors into consideration;

(h) The establishment of periodic evaluation of industrial research policies and programmes at both national and institute levels.

Noting that for the effective operation and utilization of industrial research and services it was imperative for:

(a) The industrial sector to be well represented in the operations of industrial research institutes and to participate fully in their boards of management;

(b) Industrial enterprises to encourage the development of national industrial research activities, both financially and by greater utilization of the services of research institutes;

(c) Regular working links to be established between research institutes and the industrial sector;

Conscious of the need for industrial research institutes to:

(a) Be accorded the greatest possible financial and administrative autonomy;

(b) Establish close working relations with other relevant development agencies in order to avoid undue duplication of efforts and local resources;

(c) Ensure that their needs, particularly extension services, are oriented to meet the practical needs of the community;

(d) Accord high priority in the development of managerial and other skills necessary for industrial research operations and to develop an efficient system of operation;

Further stressing the need to take action for the implementation of industrial research programmes at both the national and regional levels:

1. Agrees to establish an Association of African Organizations Involved In Industrial Research, for the purpose of:  
of:

(a) Promoting contacts and exchange of experience and capabilities among relevant African organizations;

(b) Organizing meetings on regional and sub-regional levels, on general and selected technical aspects of industrial research;

(c) Establishing links and co-operative programmes between research institutes, universities and the organized industrial sector; and

(d) Representing Africa's point of view wherever joint action is required on industrial and technological matters;

2. Calls upon the Governments of the African countries to lend their full support to the establishment of the Association;

3. Requests the Federal Institute of Industrial Research (FIIR) to co-ordinate the preparatory work for the establishment of said Association; and

4. Requests the United Nations Industrial Development Organization to help the African countries further in their attempts to develop their industrial research potential by, inter alia, assisting FIIR to fulfil its mandate

#### IV. SUMMARY OF DISCUSSIONS

##### Adaptation of technologies for developing countries

Industrial technology is a process of industrial production which should respond to the needs of a particular environment. This environment differs from one country to another. The indiscriminate importation of sophisticated technology into developing countries without regard to local economic and social factors should therefore be avoided. One factor which is of paramount importance in the process of technology transfer is the capability of a particular country to build its capacity for this purpose. This includes, in particular, the development of the appropriate manpower, the engineers and technicians required in various fields of technology, which means, in effect, the step-by-step planning of relevant institutions, including research institutes, for the purpose.

Developing countries in general and African countries in particular should encourage and support industrial research institutions with a view to adapting various technologies to their particular environment. It is necessary for Governments to plan and control technology transfer activities at the national level and to allocate sufficient finance and manpower for this purpose. Manpower is one of the most essential ingredients in the overall development and transfer of technology.

Transnational corporations seldom utilize the services of industrial research institutes in developing countries; in most cases, they refer their industrial research problems to the parent company. There is, therefore, no point in relying on the transnational corporations to contribute to the development of industrial and technological capacities in the developing countries. Furthermore, because of inherent political, economic and other considerations, these corporations are not generally interested in evolving a national capability for adapting new technologies suitable for developing countries because these would, in effect, mean the establishment of other primary criteria for maximising profit. In this connexion, the more industrially advanced of the developing countries (India, Mexico, Brazil) could be of great assistance to the less developed ones.



### Planning of National Industrial Research Activities

The planning of national industrial research activities must take into consideration the overall economic and social development strategies in the country. These strategies usually include decentralization of industry to the rural areas; development of heavy, light, small or medium-scale industries; development of export oriented and/or import substitution industries; and the establishment of priority industrial sectors for development. This is essential in order to orient national industrial research policies and programmes towards goals consonant with particular national needs.

It is essential to develop an appropriate industrial environment so that industrial research policies and programmes may be effectively implemented. This includes the provision of the necessary basic industrial infrastructures such as water, electricity and means of communication; the institution of a system of fiscal, financial and investment incentives for industrialists; the establishment of appropriate national policies for the acquisition and transfer of technologies (through joint ventures or trans-national corporations); and the establishment of a sound industrial development strategy and plan with clearly identified priorities.

The formulation of national industrial research policies and programmes should involve the participation of the relevant parties through a well constituted national council. These parties include government ministries, industrial enterprises, industrial research institutes (if they already exist), universities and development banks. The role of the industrial sector is to be emphasized since industrial research implies research on the one hand and industry on the other. It should be recognized that in several developing countries industry and Government cannot be distinctly separated. Whether the industry is government or privately operated, industrial research policies and programmes must aim at meeting the practical needs of industry and the community at large.

In planning national industrial research activities, it is essential to provide a broad base of technical personnel at all levels. This requires

the establishment of conditions that will attract and retain competent personnel for industrial research work. A country without an indigenous scientific and technological capacity is unable to utilize science and technology to serve its particular developmental needs. Several requirements must be met before this capacity can begin to bear fruit. The most important of these is manpower skilled in one or more of the following: management ability; technological expertise; technical proficiency.

It is essential to develop good and pragmatic management for industrial research. While machinery can be replaced or scrapped, the wrong choice of personnel, particularly at the management level, is much more difficult to correct. It is important, therefore, to develop the mental attitude necessary for good management. Management is important in so far as it plays a direct role in the establishment of priorities, the planning of programmes conforming to national development objectives and the co-ordination of individual and team work.

The financing of industrial research activities would initially be borne almost entirely by the Government. As the activities develop, however, other financing sources, such as industry and development banks, may appear, depending upon the nature and effectiveness of the research programmes. In some developing countries the Governments impose taxes on industrial production, specifically for the purpose of financing industrial research activities. In others, negotiations with foreign companies include provisions for such companies to assist in financing industrial research. Some development banks have also earmarked certain percentages of their loans on industrial projects as fees to research institutes evaluating or preparing the project proposals.

As the level of industrial research activities rises, the institutes established to carry out such activities may earn some of their income from fees charged for services.

From time to time national industrial research policies, objectives

and programmes should be evaluated in the light of changing national and industrial needs. In addition, every five years or so an independent assessment of the implementation of the programme should be made by a small team of experts, possibly with suitable foreign participation. This assessment should determine how effective the national programmes have been and identify areas in which they need strengthening. The evaluation should also take into consideration the national industrial and financial structure.

#### The Role of the University in Industrial Research

The role of universities in the development and transfer of technology has so far been minimal. This is partly because universities have traditionally not been geared to the carrying out of such activities. There is in many quarters, however, a feeling that universities in developing countries should participate just like any other public institution in national development and in the transfer and adaptation of technology.

While it is recognized that most universities in developing countries suffer from the lack of adequate manpower, some could, however, develop special activities related to the transfer of technology to industry. Those that have launched such programmes need to have them properly coordinated and publicised in order to steer them towards the actual needs of industry and to create a greater awareness among industrialists of the facilities and services they are offering.

International organizations such as UNIDO and UNESCO could assist universities in developing countries in evolving suitable systems for the transfer and adaptation of technology to serve the community. Like industrial research institutes, however, universities must treat as confidential work done for industry. This will enhance industrial security and encourage industry to approach the universities for assistance.

Functions and organization of industrial  
research institutes

Technology may be cautiously and broadly defined as the application of science to industrial development. Since the subject covers a wide area, there is no place for dogmatism in its definition.<sup>1/</sup> Most of the technologies transferred to the developing countries so far have been largely concerned with the agro-based or food industries, sound technological advancement must therefore keep pace with agricultural development. Since industrialization depends on technological advancement, each country should have, for successful industrialization, a well developed national technological capacity.

The economic situation in each country must be taken into consideration in the organization and implementation of industrial research programmes. In some countries, industrial research programmes are aimed at producing import substitutes and exportable products. The activities of the industrial research institutes should be programmed according to these declared policies. The activities should emphasize the provision of technical services to industry, research projects being accorded priority only when they relate to the practical needs of the society in general and of industry in particular. Although the problems to be solved in the technical service programme may appear to be quite rudimentary, they may be vital to the survival of the industries concerned. Industrial research activities geared to the expansion of the frontiers of knowledge should be left to the universities.

The main objectives of industrial research are: the development of technology; the adaptation of foreign technology; and the maintenance of processes in industry for more effective utilization of industrial raw materials and by-products. Industrial research enables industries to improve their operation. It provides the information needed for the establishment of new industries. It also enables a regular and systematic survey of local materials to be carried out and provides technical assistance to industries. The national machinery for the implementation of industrial research policies and programmes requires the setting up of an industrial research institute.

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<sup>1/</sup> See Manual on the Management of Industrial Research Institutes in Developing Countries (United Nations publication, Sales No. 66.II.B.3), which outlines the peculiar characteristics of developing countries in the organization and operation of industrial research.

The term "industrial research institute" is often a misnomer; what developing countries need in the first instance is an institute for acquiring and applying technological knowledge in order to make a direct and immediate contribution to their industrial development. There is little need for sophisticated research, but there is a widespread need for technological assistance such as industrial information, testing and analysis, quality control, instrumentation, and engineering design. By providing techno-commercial services such as economic and market surveys, feasibility studies, industrial cost accounting, trouble-shooting, advising on contracts, and marketing, the institute can also make a positive contribution to the welfare of a country.

It has been found preferable to concentrate the functions and activities of research institutes, at least during their early years, on industrial extension services. Concentration on these services need not, however, preclude the development of research and development projects; in fact, the two are often inter-related. Several useful innovations have resulted from the solution of specific problems through industrial extension services.

It is advisable that an institute be set up in the first instance on a modest scale, perhaps providing only routine services. As its contact with the industrial community develops, matters on which it can provide technical assistance become clearer and its structure and organization can be enlarged and strengthened accordingly. It might even become necessary to detach a department of the institute and develop it into a full-fledged organization devoted entirely to one specific area of the institute's operations.

An institute needs, therefore, to be established along flexible lines as regards personnel, buildings, equipment and organization. Although institutes are usually entirely government financed at first, it has been found best to establish them as autonomous bodies, with well constituted boards of management, traditional civil service rules and financial administration are too stultifying to enable industrial research institutes to operate with flexibility and originality.

The clients of the institute are likely to be not only industrial enterprises, but government departments and agencies, development banks, consumer associations, associations of manufacturers and chambers of commerce. Contacts with potential industrial clients should be arranged on a systematic basis and should include

visits by the appropriate officers of the institute. A permanently manned enquiry service at the institute through which all clients can obtain quick answers, or leads towards obtaining answers, to their questions is extremely useful. The institute must have comprehensive, up-to-date industrial, technological and commercial information, and the capacity to readily retrieve it and disseminate it to clients.

When first setting up industrial research programmes, it is preferable to do so in a multi-purpose organization designed to provide several types of assistance to a number of industrial sectors. Then, usually at a later stage of industrial development, mono-purpose institutes may be set up to cater for the needs of individual sectors. The establishment of such specialized institutes should be treated with the utmost caution in view of the limited financial and human resources available in most developing countries. At the outset, if it is to provide truly comprehensive technical assistance to industry, the institute should cover all aspects of industrialization. Later, if some of the functions can be satisfactorily undertaken by another agency, or if specialized agencies are set up to deal with them, the range of activities undertaken by the institute may be narrowed.

A multi-purpose institute has several advantages. The major ones include: the common use of specialized equipment and general services; lower overhead costs; and flexibility in the deployment of staff, e.g. by moving them on to programmes of the highest priority, irrespective of the technology involved.

It is not advisable to set up an industrial research institute as a government department or as part of a government department. By the nature of its work, an institute has to be both original and flexible. Traditional civil services rules and financial administration are too frustrating. It must be possible for the director of the institute, with the approval of the board of management, to hire staff temporarily and rapidly, to reward achievement, and even to discharge unsuitable staff.

Without question, the most satisfactory arrangement is an autonomous, state-financed body administered by a board of management. This board should be given full authority to establish policy guidelines, salary scales and other compensation schemes and to approve the annual work programme and budget of the institute. The director should be solely responsible to the board for all

executive functions. As the board must represent a variety of interests, it should include competent persons representing relevant government departments; outstanding, university-trained technologists; representatives of private industry; representatives of the business community, including industrial development banks or their equivalent, chambers of commerce and associations of manufacturers; and other public industrial or commercial organizations. This would also ensure the proper co-ordination of the institute's activities with those of other relevant organizations, avoid undue duplication and maximise the use of local resources, particularly human and financial.

It is essential for the smooth operation of an institute that its organizational structure be as simple as possible and that the responsibilities of sections and individuals be clearly defined and understood. Problems must be handled **speedily** and efficiently if the institute is to attain a good reputation in industrial circles; a simple and well understood organization is essential in this respect. Experience has shown that an institute functions best if its research staff concentrate solely on **technical work** and are not distracted by administrative matters.

As the work of an industrial research institute varies considerably in nature from time to time, it is important that buildings and allied facilities be set up in such a way that they can easily be adapted to meet changing needs. Technologists should be consulted at the planning stage. In the design and layout of the buildings, emphasis must be placed on adaptability, at any rate to the extent that changes can be expected. The building design and the construction materials should be selected taking into account features that are peculiar to laboratory work, such as the need to control temperature, humidity, vibration and noise; to provide suitable lighting and furniture; and to limit fires, fumes and other potential hazards. Materials should be used that are hard, easy to clean and easily repaired or replaced. As far as possible they should be indigenous rather than imported.

The procurement of research and development equipment should be well programmed. Their selection must take into consideration their frequency of use, the availability of service facilities, the training of staff for their proper use and maintenance

and the availability of similar equipment in the country. In this connexion, the duplication of equipment should be avoided, although planned duplication is often necessary.

The objectives, plans and performance of an industrial research institute should be periodically evaluated in the light of changing national and industrial needs. In addition, an independent assessment of the work of the institute should be made, say every three years, by a team of experts, possibly with foreign participation. This assessment should determine how effective the institute has been, and identify areas in which it needs **strengthening**. It should cover structure, operation, finance and utilization of work.

#### Needs of Industry

The major task of an industrial research institute in any country is to provide its clients - the Government, private and public industry and the organized business community - with practical technological and technical services. Whether an industry be privately or governmentally owned, the sole objective of the institute should be to produce results of commercial value. The institute's success would be judged largely by this criterion. Much of the work should consist of providing immediate assistance to the client. In some African countries, particularly in countries where most industrial activity is managed by the Government, either directly or through its established public organizations, the Government is the main client. The number of private industrial enterprises requiring research services is increasing, however.

It is essential that suitable communications be developed between industrialist, research institutions, governments and other national agencies. Industry has been recognized as a culture in itself. Indigenous people should therefore be taught to appreciate the complexities and peculiarities of this culture which they aspire to attain. This is essential since most indigenous potential industrialists are used to commercial activities where profit can be made quickly with little risk on the investment. Governments can assist in protecting small industrial units, particularly those based on traditional methods of operation, by providing financial guarantees and subventions for these operations. Generally speaking, industry in African countries can be divided into indigenous firms



and transnational companies. Indigenous firms are rarely large, sometimes of medium size, but frequently small or very small (e.g., cottage industries). If a large firm has begun its operations by purchasing know-how from abroad, it will usually have made some arrangements for continuing technological support. Such firms can be placed, from the point of view of the industrial research institute, in the same category as the transnational companies. Many indigenous manufacturing companies, especially the small and very small ones, are craft-based. These crafts are quite old and the companies may not feel that there is any need for technological support. Indeed, it may seem to them that old established processes cannot be improved upon.

The technological work required by industry may include: testing and analysis of raw materials and intermediate products; testing and analysis of finished products for standardization, quality control and certification; provision of specific information on the industrial, technological and techno-commercial fields; carrying out instrument repair, maintenance and calibration; trouble-shooting in plants; investigation of the possibility of improving the quality of finished products and increasing process efficiency; development of new and identification of available processes for current or new products, at both the laboratory and the pilot plant levels; adaptation of foreign technologies; and carrying out of techno-economic studies; and engineering design work. These services should be provided in accordance with the practical needs of industry.

Feasibility studies should be prepared in the shortest possible time, and as completely as possible. They should contain technological information and market and economic data. With regard to small enterprises, the need for the provision of technical services is considered urgent because in most cases the entrepreneur is the sole manager, administrator, accountant and production manager.

Rapid changes are taking place in technology and it is necessary to assist industries, particularly those operated by indigenous people, to keep abreast of developments. Research programmes should not be based on academic considerations, but be directed towards assisting in solving practical production problems in local industry. Innovation by local researchers should be tailored to meet local industrial requirements.

It should concentrate on the development of new products with less complicated technology and on the design of new processes and machines. Such research programmes and services, if they are effective, must be based on well defined priorities, particularly in respect of the use of new techniques developed by local talents. In this connexion, co-operation should be established among the African countries in the field of industrial research, including the rationalization of raw materials and improvement of processes.

Sometimes there is a lack of communication between the user of research findings and the researcher. Many entrepreneurs are often not aware of the facilities that are available in research institutes. Research institutes should therefore take the initiative in approaching industrialists about their needs and requirements. In this way they will stimulate and encourage industries to utilise their research findings and services more fully.

#### Industrial Extension and Information Services of Research Institutes

The industrial services of a research institute should not be confined to one particular activity. Numerous problems that cannot be anticipated beforehand arise in industry and require the services of the institute. It is necessary, therefore, to have flexibility in the approach to organizing and providing services. The need for industrial services, which is very much dictated by the industrial environment, differs from one country to another, from industry to industry and even from time to time.

Industrial services should be selective in their approach, taking into account national industrial strategies, policies and programmes. In fact, national development objectives should be one of the paramount considerations in the development of industrial extension services. In one country the national policy may be to place emphasis on developing the agro-based industries; in another, emphasis might be on the promotion of industries based on local resources or the development of import substitution industries. Whatever the declared strategy, each country should endeavour to select the most appropriate type and mode of technologies to be employed.

Quite often, technologies are imported into developing countries without due regard being given to the various factors influencing the overall development of the country, in particular the value added to the manufacturing of any particular item. The industrial extension services of research institutes should aim at assisting industry in the adaptation of such technologies.

The extension services could include the selection of local raw materials; standardization and quality control; innovation of new processes and modification of existing ones; provision of pilot schemes and selection of new equipment; trouble shooting; engineering design; industrial information; techno-economic studies; and training of industrial personnel. Industrial extension services could also be directed towards upgrading the level of technology in craft industries, particularly the traditional ones.

Local branches of transnational corporations seldom make use of the services and facilities offered by national research institutes. They tend to accord low credibility to such institutes, preferring to obtain information from sister companies or from the parent company. Governments should consider applying fiscal and other legislative measures to remedy this situation. Transnational corporations should be urged to encourage the development of national industrial research capabilities by utilizing the industrial research services provided locally. This, of course, presumes that the local research institutes would have reached a level of capability in terms of equipment and staff to enable them to successfully undertake various research tasks. Technologists and national research institutes should also take part in negotiations with transnational corporations.

Industrial research institutes should carry out extensive public relations activities to promote the services they offer, particularly to indigenous enterprises where there is need for assistance in the field of management, in such areas as organization, accounting, costing, and quality

and stock control. Research institutes could organize industrial clinics on this subject for personnel from indigenous industries. Some of the problems encountered in the management of indigenous industries arise from the local academic background of the owners. Governments might consider taking steps to remedy the situation by, for example, encouraging more highly educated entrepreneurs to undertake industrial projects. International agencies should intensify their technical assistance programmes to the African countries in the development of industrial extension and information services, capabilities and activities at the national, sub-regional and regional levels.

In connexion with the above, special attention should be accorded to industrial information. The establishment of a regional industrial information network linking national industrial information centres and cooperating with research institutes in collecting, analysing, storing and disseminating industrial information to users, should be given priority.

While industrial information services should be co-ordinated at the national level, separate units should be established at each institute. These units would act as industrial middlemen between industrial research institutes and the users. It is essential that competent, technologically-trained or oriented persons be recruited for industrial information work and that suitable equipment be provided in order to make the service effective.

#### International Co-operation in Industrial Research

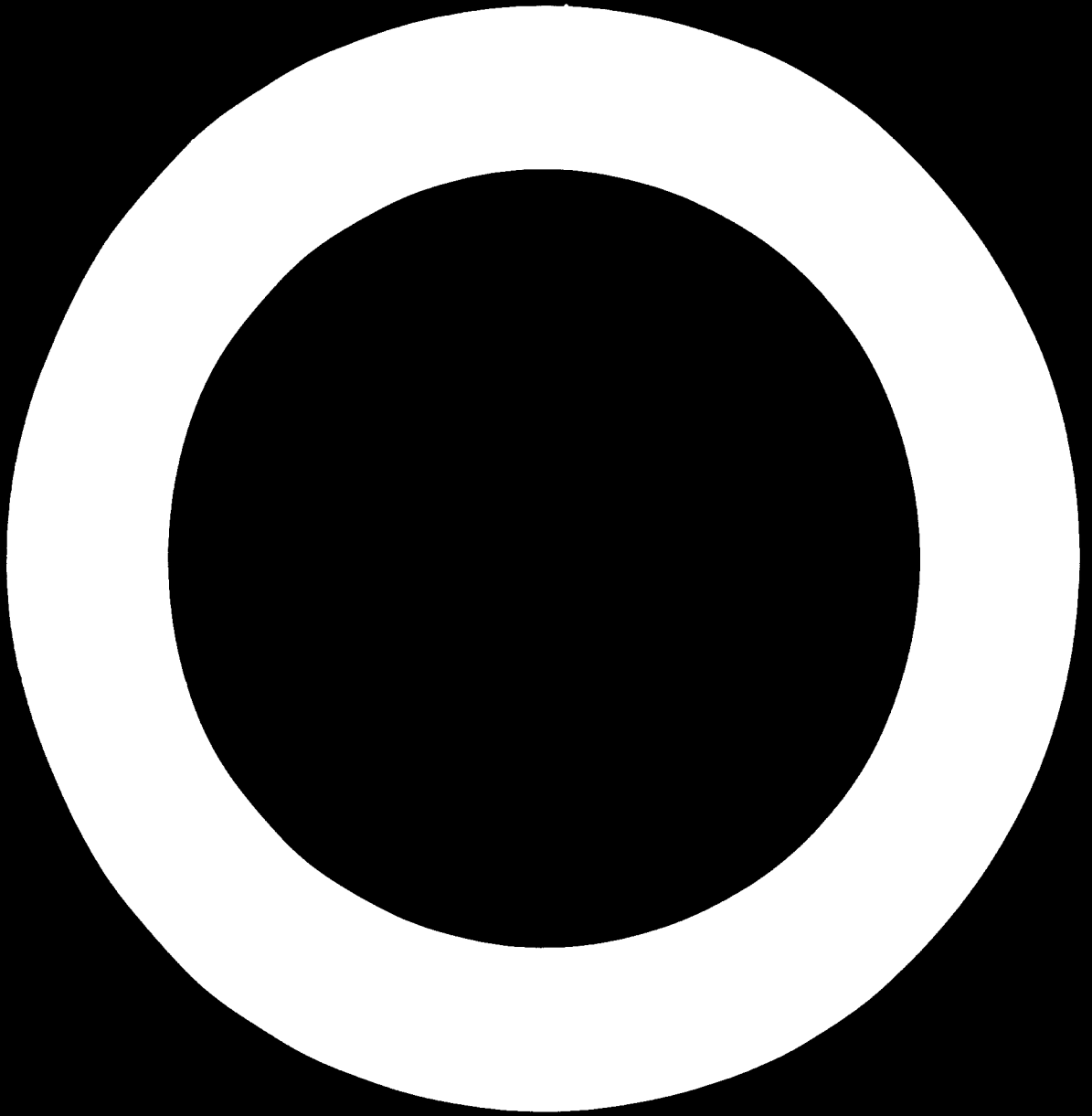
An example of international co-operation in industrial research is that which exists among the three East African countries, through the East African Industrial Research Organization (EAIRO). This co-operation has been established in line with the aspirations of the countries which address themselves to servicing industry through specific projects. For

example, EAIRO is working with the assistance of an international agency on the acceptability of sorghum in diet and on the extraction of a drug from the sisal plant.

Certain difficulties exist in the development and functioning of regional co-operation. These may arise from differences in political ideology, industrial strategies or policies concerning co-operation in industrial research. Certain basic prerequisites are necessary for the successful establishment of such co-operative programmes. These include clear identification of the areas for co-operation; development of a well defined programme; establishment of clear communication and understanding by all parties concerned; suitability of industrial environment; and maintenance of regular contacts between the parties concerned. The areas for co-operation should be in line with the practical industrial needs of the lesser developed institute. Co-operation is more successful if operated on a project basis. The projects might involve, for example, the development and adaptation of technologies suited for rural areas; agro-industrial development; and direct assistance to an industrial enterprise. Such projects might also help to bring about labour-intensive technologies suitable for a particular country.

Some of the advantages of international co-operation include the exchange of experience; the development of the managerial and technical skills of less developed institutes; assistance in the preparation and execution of industrial research projects; selection of technologies, processes and equipment for new ventures; elevation of operational standards of less developed institutes; joint implementation of research projects; and the sharing of research capabilities.

International co-operation at the institute level would be greatly enhanced if a political framework were also established. The Lome Convention of African and Caribbean countries, for example, includes co-operation in such areas as transfer of technology, establishment of industries, training, and a common market for industrial products. The Minor River Union Agreement is another example of international co-operation which provides a sound base for co-operation in industrial research.





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Annex II

LIST OF DOCUMENTS

<u>Symbol</u>	<u>Title</u>
ID/WG.204/1	Provisional agenda
ID/WG.204/2	Provisional annotated agenda
ID/WG.204/3	Provisional schedule
ID/WG.204/4	Aide mémoire
ID/WG.204/5	Adoption of Imported Technology in developing countries (document prepared by T.P. Mushi, Research Officer, National Development Corporation of Tanzania, Dar-es- Salaam, United Republic of Tanzania)
ID/WG.204/6	Functions and Organization of Industrial Research Institutes (document prepared by E. Lartey, Director, Ghana Industrial Research Institute, Accra, Ghana)
ID/WG.204/7	International Co-operation in Industrial Research, by C.L. Tarimu, Director, East African Industrial Research Organization, Nairobi, Kenya
ID/WG.204/8	Planning of National Industrial Research Activities, by UNIDO Secretariat
ID/WG.204/9	Industrial Extension and Information Services of Research Institutes, by I.A. Akinrele, Director, Federal Institute of Industrial Research, Oshodi, Lagos, Nigeria
ID/WG.204/10	Needs and Requirements of Industry, by E.A. Ocloo, President, Ghana Manufacturer's Association, Accra, Ghana
ID/WG.204/11	Co-operation Amongst University, Research Institutes and Industry in Technological Activities, by R.P. Patel, Dean, Faculty of Engineering, University of Nairobi, Kenya
ID/WG.204/12	Provisional List of Participants
ID/WG.204/13	International Co-operation in Industrial Research - the Experience of the Caribbean Industrial Research Institute, presented by H. Charles, Director, Caribbean Industrial Research Institute, Trinidad and Tobago
ID/WG.204/14	Industrial Information Services of Research Institutes, by L.B.E. Lofoli, Scientific Director, Central African Industrial Research Centre, Lubumbashi, Zaire
ID/WG.204/15	Final Report



ANNEX III

INDUSTRIAL PLANTS VISITED

West African Bread Company, Apapa, was established in 1961. Its major share holdings belong to a British firm. Nigerian participation is through the Nigerian Industrial Development Bank which has acquired some shares.

Total investment now is of the order of N 3.5 million. The company produces sewing thread, candle wick and knitting thread from Nigerian cotton and imported dyes and chemicals. It is linked to a sister company in Manchester (England).

The total staff is about 600 - of which 3 are senior staff, 30 intermediate staff and the remainder general workers. With one exception the staff is entirely Nigerian. The company works three shifts daily, and production is about 4 metric tons a day. The company has laboratory technologists and facilities for improving on dyeing techniques and for carrying out quality control tests.

Lever Brothers (Nigeria) Ltd was established in 1924. It is owned by the transnational corporation, Unilever, but the controlling shares are held by Nigeria. Total investment is of the order of N 50.0 million.

The company produces soaps, detergents, body creams, margarine, vegetable cooking oil, orange squash and toothpaste. It supplies over 80 per cent of the Nigerian market consumption of the above products.

The major raw materials used are palm oil and palm kernel. These are obtained locally. The company extracts 11 tons per day of oil and 8 tons per day of expeller cake from the palm kernel. All chemicals are imported.

The company employs 1,600 staff comprising 200 senior (10 non-Nigerians) and 1,400 junior (all Nigerian) staff. Daily production is on a three-shift basis. The company has a well-established quality control laboratory and a

ment development department. Major research and development work is carried out at the parent company of the Unilever group.

Nigerian Breweries Ltd., Iganmu, was established in 1949 and is owned by the United Africa Company Ltd., England and Heineken International, Holland. Current Nigerian total investment is about N 10 million.

The company produces beer (Star, Gulder), Bitter Lemon, Golden Organge and Schweppes (soda and tonic water). Apart from sugar, which is obtained locally, all the raw materials (barley, malt and hops) are imported. The company is helping to investigate the possibility of producing barley malt in Nigeria through an irrigation scheme in the northern part of the country.

The total staff is 1,500 with only 4 non-Nigerians. Production goes on 24 hours daily in three shifts. The company produces 450,000 litres of beer and 27,000 litres of soft drinks per day. The FIIR carries out research and development work on the malting characteristics of Nigerian cereals on behalf of the company. The Huk Central Laboratory at Rotterdam also undertakes some work for the company. A well-established technological department is headed by a highly qualified Nigerian chemist. The department carries out quality control on all products, both in-line and after production.

Lisabi Mills, Maryland, Ikorodu Road, Lagos, was established in 1937 and incorporated as a limited liability company in 1939. Its Yaba office was opened in 1949. The company moved to its present production site in 1954. It is owned by some 120 shareholders and financed through the United Bank for Africa. Total investment is about N 150,000.

The company produces a wide range of items including yam flour, bean flour, ground pepper, ground melon, ground-nut oil, melon seed oil, coffee, bitter leaves, black pepper, rice, dry okro, and roasted ground nuts. All the raw materials are locally supplied. Monthly production includes about 45 tons of yam flour; 3 tons of bean flour; 15 tons of pepper (ground); half a ton of black pepper; 4 tons of melon oil; 12 tons of melon seed;

20,000 kilogrammes of dry okro; and 20,000 kilogrammes of coffee. Bitter leaves and rice are produced occasionally.

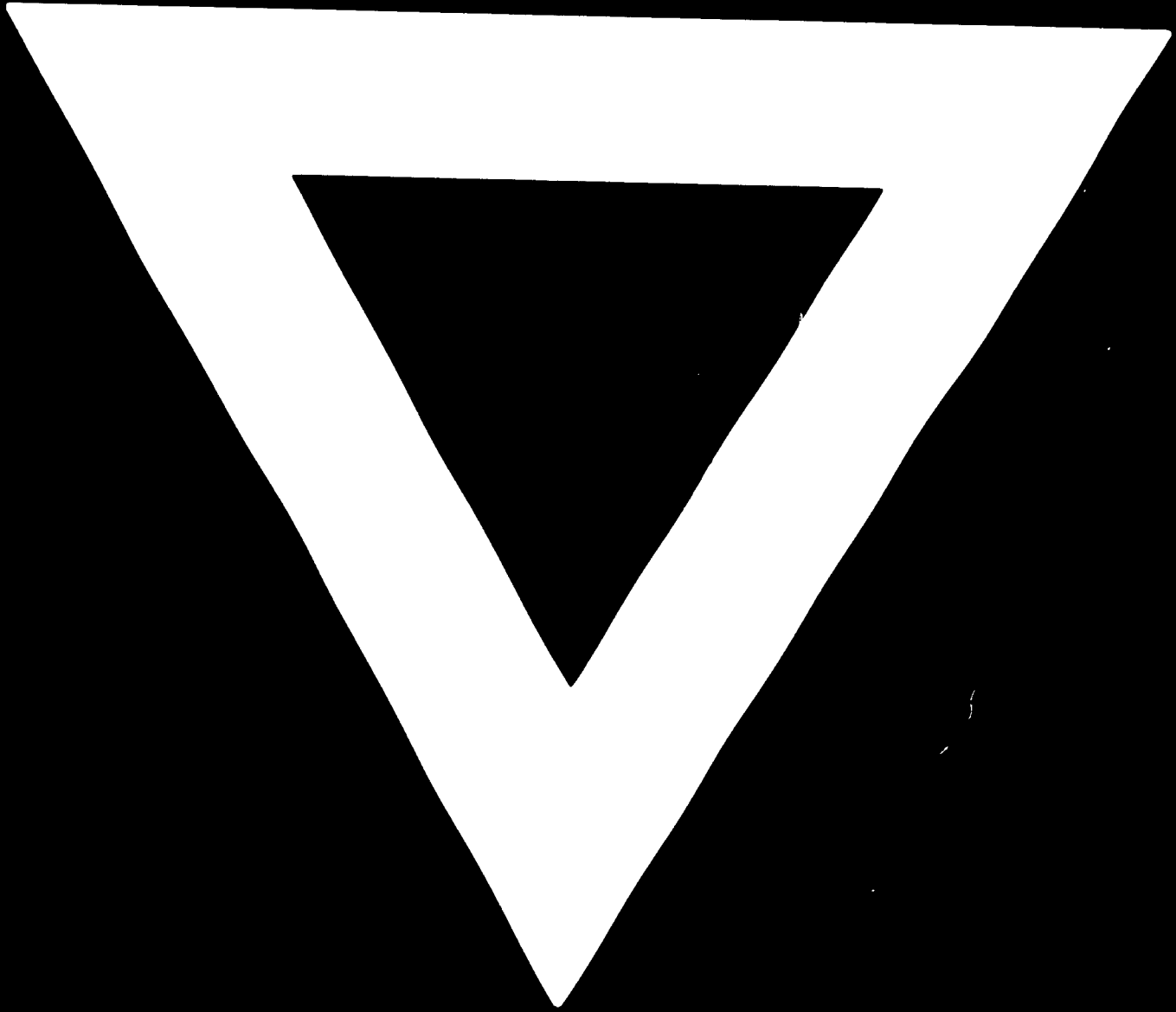
The company employs a total of 29 staff consisting of 7 senior and 22 junior staff members. Except for three nationals of Niger, all the staff is Nigerian. Although it does not have an elaborate research and development programme, the company carries out quality control work on its own products. The FIIR assists from time to time with technological and technical work.

Vegetable Oils (Nig). Ltd., was established in 1964, and is owned by the Western State Industrial Investment and Credit Corporation, an agency of the Government of Western State of Nigeria. Initial investment in the company was about N 3.5 million. The Bunge, of the Federal Republic of Germany, owned 15 per cent of the shares until June 1972. Since then, the company has been wholly owned by the Government of the Western State.

The company makes palm kernel oil and palm kernel cake from palm kernel seeds produced locally. Annual production is about 60,000 metric tons of palm kernel produce, consisting of about 45 per cent crude oil and 52 per cent cake. The company will soon start to refine the crude oil.

The entire staff (33 senior and 381 junior) is Nigerian. The company does not undertake any research and development work. Some advice on the technological and technical aspects of its operations is provided by: the FIIR; the University of Ibadan (on cake); the University of Ife (on cake); and the Tropical Products Institute in the United Kingdom. The company does, however, carry out internal quality control testing on raw materials and products. It also carries out tests such as expeller and boiler water tests on some of its production equipment to prevent corrosion and scale formation.





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