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INDUSTRIAL EXTENSION SERVICES OF RESEARCH INSTITUTES 1/

Strategies for development, operation and promotion in developing countries

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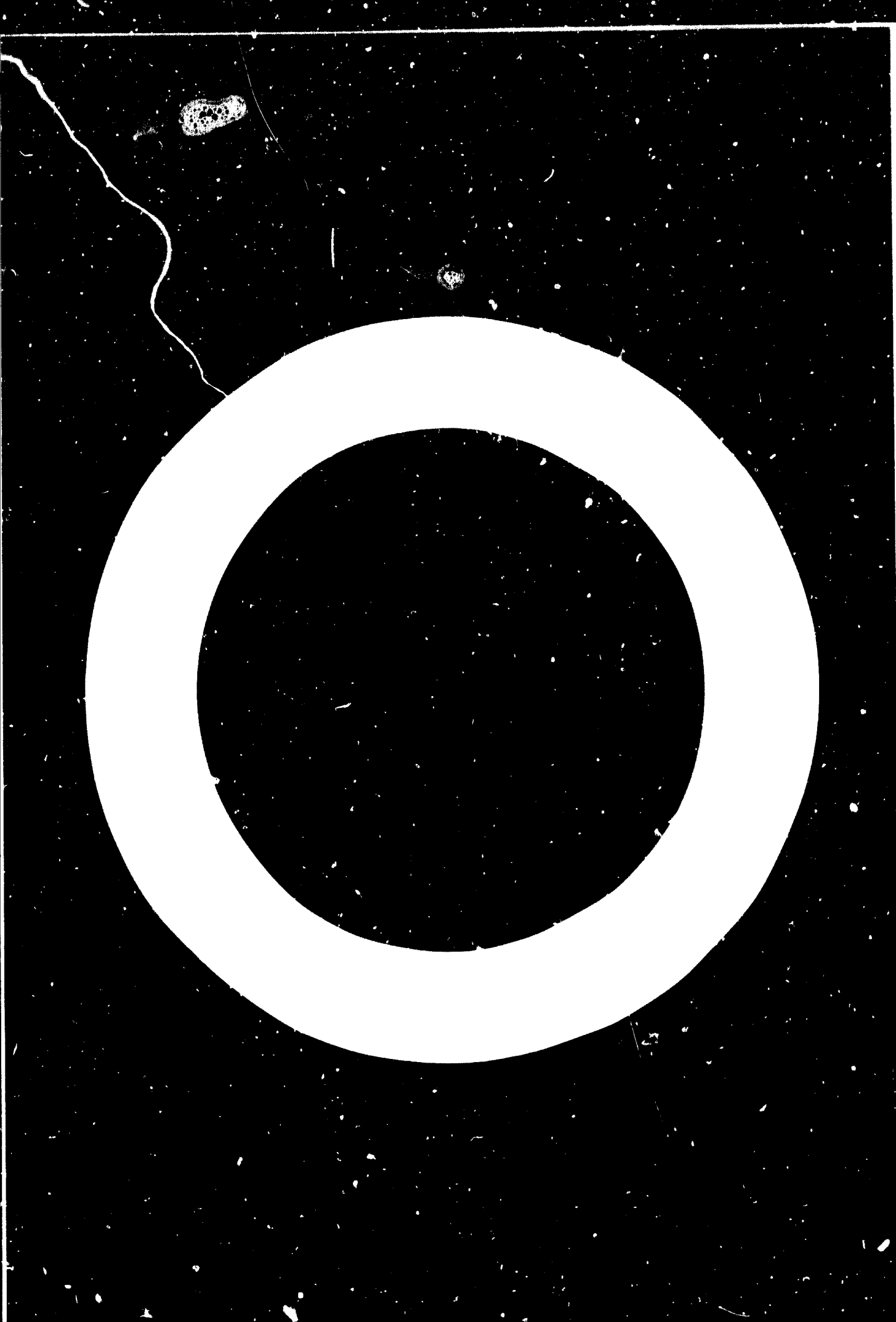

Summary

The climate of industrial development activity in developing countries poses special problems requiring the intervention of organised technical services from industrial research institutes. Because of the tendency to set up industrial enterprises largely as production units, there is a considerable scope for the application of operations research to improve management performance, techno-economic studies for elaborating new products as well as investment diversification, trouble shooting to tackle production problems and laboratory analysis for quality control. These services are recommended as of high priority to establish the credibility of local industrial research institutes. Development corporations and banks should also be persuaded to set up or support pilot industries designed to develop the results of industrial research so as to stimulate enterprenueral investment in innovative ventures. These issues as well as the current experience of FIIR of Nigeria are discussed in the text.

CONTENTS

INTRODUCTION

There has been much debate during the last decade or so as to what should be the pragmatic role of Industrial Research Institutes [IRIs] in the industrialisation process. Diverse views have been expressed ranging from the neo-classical concept of establishing IRIs as the scientific base of industrial development programmes to the ultra-modern practice of organising it as a commercial enterprise per se. In the contribution to the debate UNIDO states

> "It has become clear that the pattern of work and structure of Industrial Research Institutes found to be appropriate in industrialised countries has to be modified in developing countries; and also that the pattern must vary somewhat from one developing country to another depending on national targets, the stage of industrial development, size and status of industrial companies and other local condition".

One common view widely accepted however is that industrial research institutions, in whichever circumstances they occur, should be techno-economic in function, innovative in operation and persuasive in approach. It is within this broad and articulated perspective that the extension services needed by industry and other potential clients can be conceptualised, developed and operated effectively.

On a forum such as this, that is, at a Joint Consultative meeting of participants drawn from African countries, all of which fall within the class definition now described as developing countries, it would be appropriate to examine the general features of our mode of industrialisation, and the institutional and national policy constraints to the effective mobilisation of local Industrial Research Institute services. This paper will attempt to give a lead thought to these issues and propose some strategies aimed at

strengthening the possibility of linkages with Research Institutes. The role of extension services in the achievement of this vital objective will be discussed. The experience of the Federal Institute of Industrial Research, Oshodi, Nigeria in promoting the results of research to industry and organising extension services will also be related.

I. THE INDUSTRIAL CLIMATE IN DEVELOPING COUNTRIES

Industrial enterprises in developing countries generally show certain features in their organisational planning. They are characterised by a low profile of innovative activity, a high degree of expatriate management control, exclusive product orientation to domestic market and a short-term amortisation of investment. These features constitute in-built constraints to the use of local industrial research services during the economic life of the enterprises. National policies for the promotion of industrial development are usually liberal in developing countries in order to attract foreign investment into local manufacturing. A concomittant effect of this is that the growth and structural development of industrial enterprises are not strictly monitored and controlled. Foreign entrepreneurs are therefore able to exploit the honest desire of developing countries for the social benefits of industrialisation such as employment of labour, merchandising and urban development to set up technically weak infrastructures for their production activities.

The three major types of industries usually found in developing countries may be described as follows:-

[1] The largest organisations, small in number and usually concerned with the export of primary products are based chiefly on imported technology. Their productivity is kept high with continued infusion of advanced technology.

[2] A few medium-sized indigenous companies produce consumer goods largely for domestic use with known technologies. Although they may have developed some internal technical competence, they need help with further improvement of products and processes or with diversification of product lines.

[3] Most enterprises are small to medium-size firms some of which rely on dispersed household operations. They are generally outside the orbit of national research and development organisations and lack information on technical improvements that they could make.

These profiles offer a tremendous scope and challenge for extension work by industrial research institutes. Specific services which these institutes could promote to local industrial enterprises consist of the following:-

[1] Information derived from a global review of current knowledge in specific industrial technological and techno-commercial fields;

[2] Operational research for systematic analyses and solutions of their management, production, inventory control, financial and marketing problems;

[3] Testing and analysis of raw materials and intermediate products of local derivation;

[4] Testing and analysis of finished products for standardisation, quality control and certification;

[5] Technical investigations to improve quality of finished products and process efficiency;

[6] Development of new process for an existing or

[6] [illegible] laboratory and pilot plant level;

[7] Design and fabrication of simple process equipments like mixers, driers, kilns, stills, etc.;

[8] Engineering and technology adaptation to make use of the nation's natural endowments;

[9] Trouble shooting in industrial plants;

[10] Techno-economic studies aimed at identifying new investment opportunities.

The acceptance by local industries to utilise these services for the improvement of their operational activities and for national economic development will largely depend on the establishment of a credibility relationship between industry and research institutes on the one hand, and between research institutes and government bodies responsible for national planning on the other. It is for example known that companies operating branches of multinational corporations usually prefer to use their own well-established central research and testing facilities. They believe that local research institutes are not able to offer prompt and effective services largely because of their bureaucratic orientation, as well as doubled technical capabilities. Whilst these reasons reflect a credibility gap, a greater interaction between these companies and local research organisations could be fostered however by government policy in the form of tax exemptions for local research expenses. Also, by insisting on higher local content of materials and labour in products of multinational corporations, they will be forced to strengthen local supplier sources, and inevitably have to turn to local research institutes for help.

With indigenous enterprises, the problem of utilising industrial research services is of a slightly different dimension. These companies tend to suffer from the effects of poor management and pursue

the line of least resistance. As long as their products can be sold in the market and they can make a handsome profit, they hardly think of the need to evaluate their performance technically and to upgrade the quality of their product in anticipation of possible shifts in market demand. In countries where national standards for commodities have not been established and monitored, these companies revel in the production of shoddy goods and get away with them. The attitude in this case is not due largely, to a lack of credibility for local research institutes, but to ignorance of the value of allocating some of their investment capital for research and development work that can lead into product or process improvement. Again, government intervention is required here to encourage innovation in these industries through fiscal incentives for expenditures incurred for the purpose.

II. ACTIVITY THRUST OF INSTITUTES

Experience has shown in many industrial research institutions that the most productive aspect of their work programme is in problem solving exercises for real situations, an activity usually described as trouble shooting or operations research. In the United States of America, for example, where many independent industrial research institutes survive mainly on contract services, this activity could generate as much as 60 per cent of the income of an institute.

The problems often encountered may involve the use of technical information and know-how to assist the manufacturing company in current operations, including both efficiency of processing and maintenance of product quality. They could also involve research into all or any aspects of conducting or operating a "business" and treating the business as a living organism in its proper environment. Work concerned with the introduction of new products or processes is not included; rather, the problems are usually of short-range character. Those that need to be investigated in considerable depth are classified as research and development projects.

[illegible] activity that can quickly establish [illegible] industrial research institutes. Quite normally though, research laboratories in developing countries either do not have such operational activity as a developed function or where they do, it is limited to laboratory analysis and testing. It is now widely recognised that the major problem facing indigenous industrial enterprises in developing countries is the relatively low level of management performance. Local managers of industrial organisations still rely largely on intuitive judgement to solve their business problems. They fail to realise that as their firms grow larger and the socio-economic structure of their countries become more sophisticated, industrial problems tend to assume greater complexity. The idea that scientific methods can help the businessman or the industrialist to make better and more reliable management [illegible] decisions is not too well known. Industrial research institutes therefore have a persuasive role to make this fact known and adopted by industrial entrepreneurs and managers. In order to do this successfully, they have to establish active operational research programmes for potential clients particularly for the small and medium-scale industries that are usually not able to employ such specialised technical personnel within their establishments. In this way, these institutes can effectively establish industrial clinics for the healthy development and maintenance of client enterprises.

A common feature of industrial research institutes in developing countries is that they are often too small to be viable. They are thus unable to attain a critical threshold of resources and effort. The range of skills in a single organisation is usually limited and therefore is not able to keep up with worldwide advances in technology, or to permit the formation of broadly based interdisciplinary project teams. Furthermore, small organisations often splinter their activities into several isolated sub-units, each inadequately staffed.

Other constraints include inadequate personnel and low fluctuating levels of funding.

The inability to set up project teams to [illegible] effectively tackle industrial problems from an interdisciplinary perspective stems from a lack of personnel with diverse backgrounds and skills. In most institutions, the core of the professional staff is confined to natural scientists and engineers, with no specialists in marketing, industrial economics, operations research and the social sciences. Because the industrial sector has been too weak to take the initiative the government has generally launched industrial research institutes as government agencies, with all the attendant bureaucratic problems. Recently however, recognition that research institutes cannot thrive under rigid bureaucratic controls has led a number of developing countries to transform these institutions into self-administering organisations. Despite this transformation, other incentives will need to be created to promote greater interaction between these institutions and their clients.

Another dimension to the task of promoting innovative services for industry arises from the need to motivate more indigenous entrepreneurs into the manufacturing sector. It is not unusual to learn of entrepreneurs in developing countries who have the capital but do not know in what enterprise they could invest in. Others who are able to identify attractive investment opportunities are unable to exploit them because of the dearth of technical services required for the formulation and execution of the related industrial projects. An industrial research institute should not only be able to fill such a gap in entrepreneural development, but also should, within the framework of its extension services activity, channel industrial investment into new technologies and unexploited resource endowments.

One effective way to mobilise the resources of indigenous entrepreneurs for investment in local manufacturing is to prepare for them industrial profiles of feasible projects preferably designed to maximise the utilisation of local factor inputs. These should contain

outlines of cost estimates of total investment and working capital, required sources of finance, appropriate technology and sources of supply, manpower requirements, market opportunities, and profitability. This would serve as a preliminary document to focus their attention towards local investment opportunities as well as provide basic guidelines for the preparation of detailed feasibility study of the chosen project.

In furtherance of this idea and as a bold move towards promoting greater confidence of local entrepreneurs in manufacturing enterprises, some countries have established development corporations with the specific purpose of setting up industries with innovative orientation. The essence of this approach is to create a number of model industries which would accelerate the transfer of industrial skills to indigenous enterprenours and thus encourage them to set up similar enterprises or buy over such pilot projects. The emphasis here is "innovation" in the planning the execution of industrial projects under this scheme. Unless the industries have an innovative bearing, they would just become privileged competitors against other private sector projects. Whence development corporations should as a matter of basic policy, engage largely in industrial projects involving the commercial scale up of research results or similar innovative activity. Seen in this perspective, these corporations would be able to function essentially as Industrial Research extension organisations.

III. FIIR AND THE NIGERIAN INDUSTRY

The Federal Institute of Industrial Research was established in 1956 as a positive response to one of the major recommendations of the economic mission of the International Bank for Reconstruction and Development to Nigeria in 1954 in the wake of her industrialisation programme. Its functions were elaborated as follows:-

[1] To carry out basic research into the raw materials available in Nigeria for use in industry and the processes which can be used most effectively to convert them.

[2] To carry out pilot scale trials of processes found in the laboratory to be technically feasible.

[3] To calculate, by means of larger scale tests, or otherwise, the probable viability of such processes if established on a commercial scale.

During the first 15 years of its life, the Institute developed its strength in scientific and technological research operations and established specialist laboratories for Food, Industrial and Analytical Chemistry; Pilot plant and Engineering [Mechanical and Electrical] workshops. On the whole, 42 items of local industrial raw materials have been characterised and 15 industrial projects recommended as being techno-economically feasible for commercial exploitation. Of these, less then 10 items of raw materials have actually entered into local manufacturing industry whilst 3 industrial projects only have been taken up for commercial investment.

The low uptake of the results of research by industry has been attributed to a number of factors amongst which are:-

[1] That almost all of the manufacturing industries are foreign based with no interest in backward integration to refine locally available raw materials needed for their production.

[2] That a good many of these industries have subsidiary investment interests in traditional raw material suppliers outside the country and so have no desire, ab initio, to break with such markets.

[3] That expatriate controlled commercial banks have been less liberal in their credit policy to

indigenous entrepreneurs are of greater doubt of their technical and management know-how to establish and operate viable primary processing industries.

In an assessment of the performance of the Industrial sector after first National Development Plan [1962-68], it was observed that the sector grew at the rate of 21% per annum, whereas its contribution to the gross domestic product rose from under 2% to just over 6%. The major factor responsible was attributed to the fact that industries depended to a large extent upon imported raw materials which accounted for about 50% of the value of their production. In a more recent review, [1975] the import content of the manufacturing sector is still considered high. On the average, 34% by value of the raw materials is imported, and for every naira of value added, the economy spends 67k on imports.

Although import substitution has been the main cornerstone of the Institute's research policy whilst technical assistance to industry was mainly in the form of laboratory analysis of their product samples, the fact that no major influence was achieved in the mobilization of local inputs for national industrial production led to a review of the role that industrial research could effectively play. In the meanwhile, the industrial scene has been rapidly transformed by the proliferation of manufacturing industries. Consumer goods of varying quality but nearly in all cases, of poorer quality than imported counterparts are being produced for the domestic market. The promulgation of the Enterprises Promotion decree has compelled the transfer of the ownership of many foreign owned industrial enterprises to indigenous investors while at the same time pre-empting the retraction of expatriate management. Credit capital to indigenous entrepreneurs has become easier as a result of government directives to commercial banks, resulting in an upsurge of

investment in local manufacturing by indigenous entrepreneurs. These sectors have thus prompted a shift in the demand for industrial research services in favour of feasibility studies, management services, operational research and trouble shooting.

In response to this changed need, FIIR established in 1972 a specialist division within its organisation to co-ordinate and develop its extension services to public and private sector clients. This division known as the Industrial Analysis Division gives assistance to clients by first identifying their problems and subsequently proffering solutions based on the use of operational research techniques involving the analyses of their management, production, inventory control, financial and marketing systems. The scheme also provides for effective liaison between the staff of the Industrial Analysis Division and laboratory personnel for the tackling of technical problems.

The organisational framework of FIIR's extension services is being planned to cover the whole country through a net-work of field stations to be located in areas of industrial activity concentration. The initial thrust of this service to existing industries has revealed mainly problems of operational nature, particularly amongst those enterprises that have indigenous managemen . The problems identified clearly indicate the inter-relationship between elements of management, economics, production, engineering, and quality control. When solutions are proposed to the client industries, many of them are unable to raise the required capital resources for their implementation. Under such extreme situation, therefore, it may become necessary for the institute to further assist the client to identify and even to procure orcdit finance for the project.

IV. CONCLUSION AND RECOMMENDATIONS

Industrial research institutes should, in these modern times, relate their activities with the problems of developing a virile

[illegible] to establish an organization team with to provide extension services to potential clients in the industrial community. In the developing countries where the management policies of some manufacturing enterprises, particularly the so-called branches of multinational companies are dictated by absentee investors, local research institutes have the herculean task of breaking their unpatronizing attitude which is sustained on the pretext of keeping company secrets and availability of their own research laboratories. This can be facilitated by establishing the Institute's credibility with short range services as in operational research and trouble shooting.

With indigenous investors, their needs for technical assistance would appear to exist at three dimensional levels. First, their on-going industrial enterprises would need to be assisted to attain efficient management performance. Secondly, new investment opportunities should be investigated to enable them exploit local resource endowments and encourage investment or products diversification. Finally, local entrepreneurs would benefit immensely from models of industrial enterprises which can demonstrate a modern approach to the organisation and management of manufacturing industries. All of these activities should constitute the operations of the extension services programme of an industrial research institute in a developing country.

Above all, success can only attend an industrial research extension programme if the infrastructural base is right. An industrial research institute should have sufficient resources to support a critical threshold of effort and be capable of working in interdisciplinary project teams for the solution of the problems of industry. Although, the institutes will need to be fully funded by government as a service organisation in developing countries, yet they should be allowed to function as autonomous institutions in order to

deal freely with all potential clients and to competitively draw their staff from all sources of high level manpower.

Extension services units should be organised to become the "change agents" of research institutes and should preferably be located in industrial estates or areas of industrial activity concentration. Costs charged for technical services to industry should be subsidised or tax free to act as incentives for the utilisation of industrial research services to improve industry performances.

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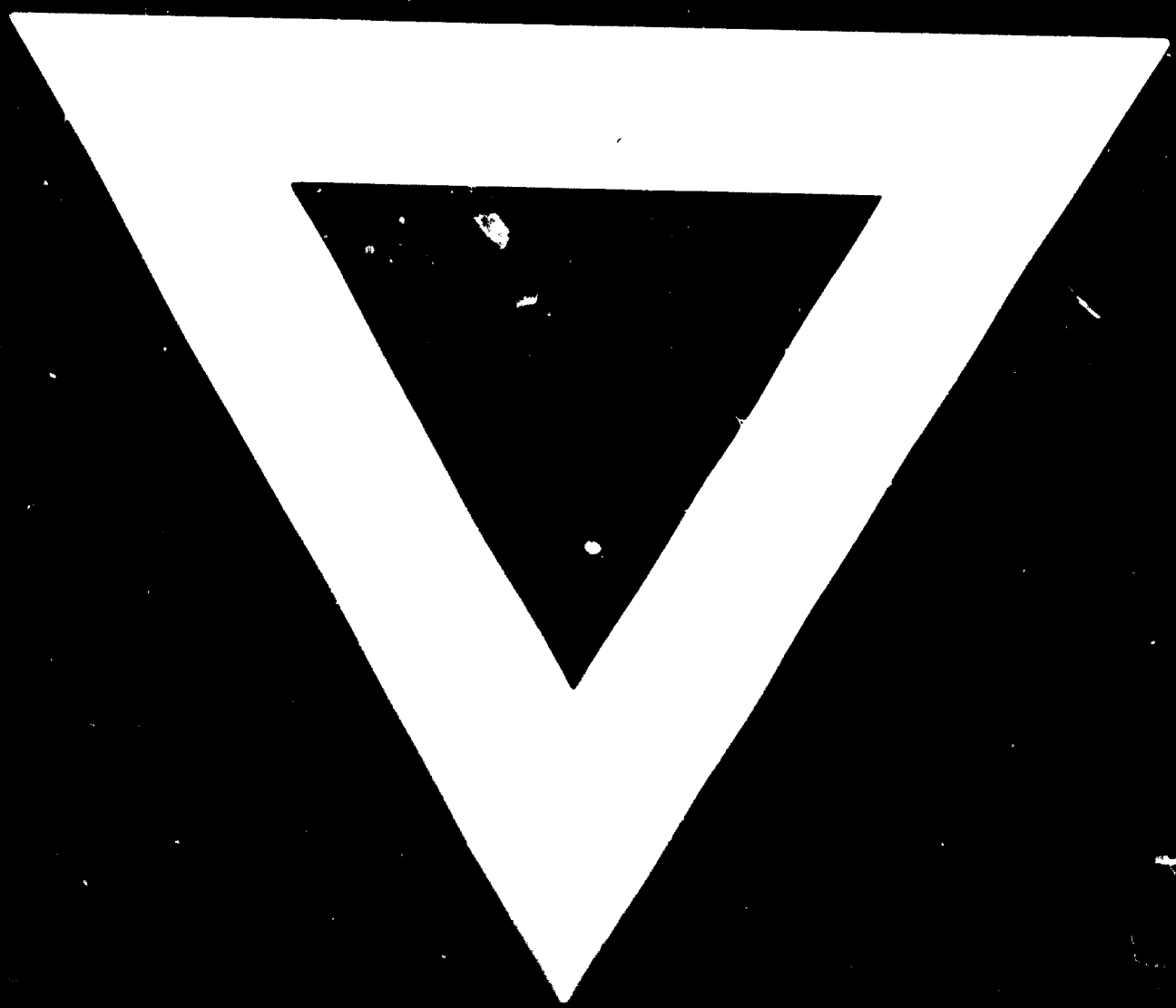

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