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DEVELOPMENT OF SUITABLE SKILLS

FOR INDUSTRIAL RESEARCH<sup>1/</sup>

by

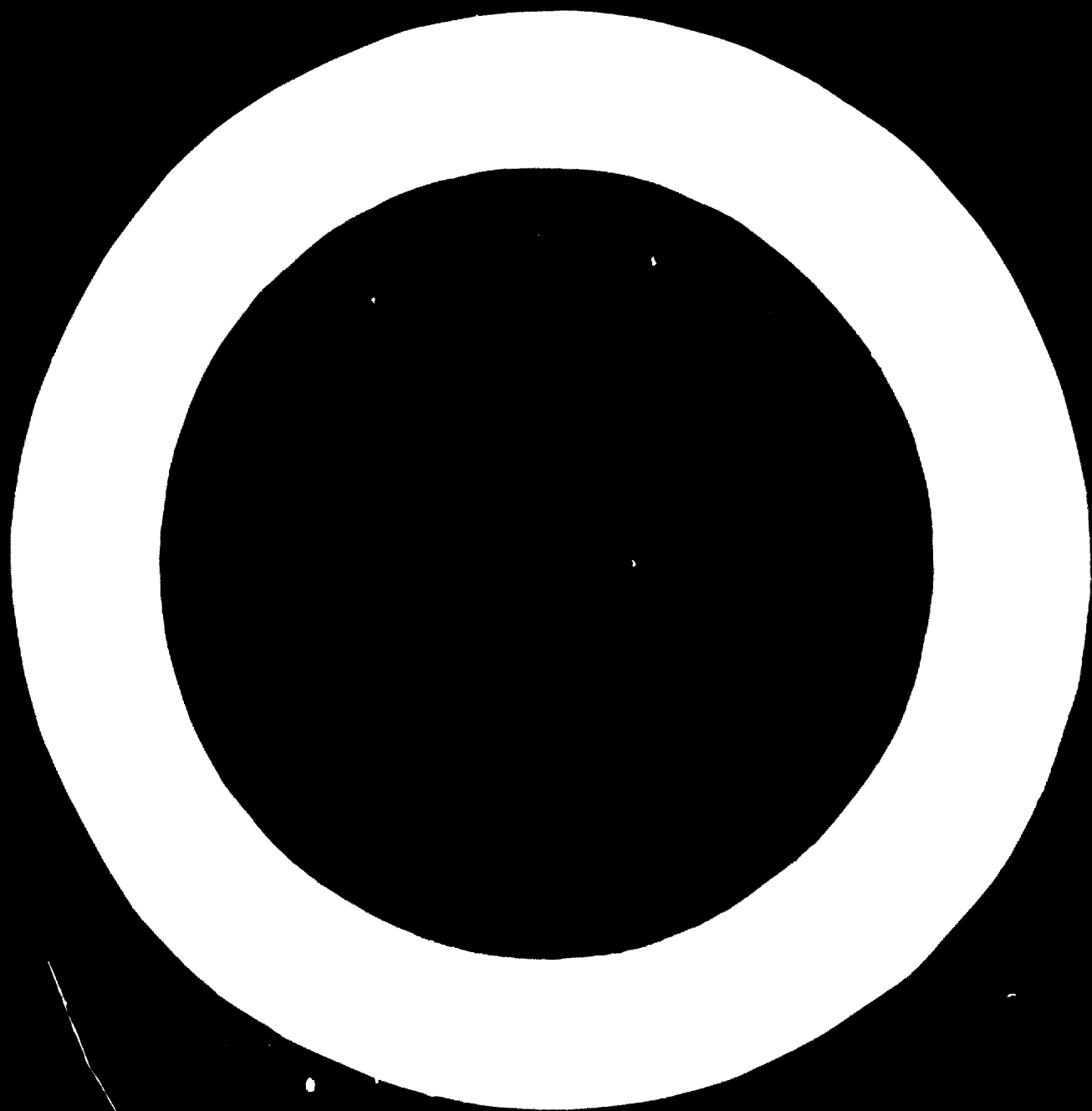
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## Introduction

In the implementation of their industrialisation programmes developing countries are often confronted with problems which are similar in many of these countries, yet because of vastly dissimilar social, cultural and economic backgrounds, different approaches are necessary for their solution. While parallels can be drawn in some cases, persistent attempt to search for model answers to these problems will only lead to over-generalised results which are more academic than practical. Industrial research, in a rather vague sense, is often looked upon as an essential pace-setter for industrial growth and a problem-solver for industrial troubles. However, if the basic requirements of industrial research are not understood and met, research and development activities will more than likely be launched with a false start. This paper is concerned with one aspect of industrial research, namely, the development of suitable skills. This is, in fact, the most important aspect of the development of industrial research institutes because the success of an institute depends on the quality of its management and the ability of its professional and technical staff. Industrial research institute can be successful only if it enjoys the confidence of the people it serves. Only people can create this confidence by their good performance. The types of skill required and the development of these skills depend to a great extent on the objectives of the industrial research programme which in turn are governed by the special conditions that are prevalent in a country. This paper will highlight some of the major considerations associated with the process for skill development and will briefly indicate the way SISIR, i.e. the Singapore Institute of Standards and Industrial Research, goes about to accomplish this end.

### The Need for and Functions of Industrial Research Organisations

Industries in many developed countries are able to carry out their own research, but those in developing countries often are unable to do so due to technical and financial limitations. As such, industrial research in developing countries is carried out mainly by government or semi-government organisations and institutes. Such research institutes may be a centre of specialised study relating to a particular industry or it may cater to the industrial community in general.

Developing countries do not have the capacity to meet their scientific and technological requirements from their own resources nor would it be sound strategy for them to attempt to do so. In the early stages of industrialisation, a developing country depends on the transfer of technology from advanced countries. To avoid the pitfall of becoming too dependent on imported technology it must build up an indigenous scientific and technological capacity. A country without an indigenous scientific and technological capacity has no means of being aware of its own needs, nor of the opportunities existing in science and technology elsewhere, nor of the suitability of what is available for its own needs. Thus far from being substitutes for each other the obtaining of technology from advanced countries and building up of a scientific and technological capacity are in fact complementary. It must be pursued together. The rate at which the capacity to apply and adopt foreign technology to suit local conditions can be developed depends among other factors on the availability of suitably trained personnel.

The main aim of industrial research organisations in a developing country is to provide technical assistance to existing industries and to assist in the establishment of new industries.

The scientific and technical activities range from basic research through applied research and development to extension services. It is however not possible for any one industrial research organisation in a developing country to cover this wide spectrum of activities at any one time and hence it is important to establish priorities.

Another important function of an industrial research organisation in a developing country is to survey indigenous resources and raw materials and to investigate possibilities for their use in the manufacture of new or improved products. Initially, research and developmental studies should be directed towards the development of technology with relatively high labour and low investment requirements. This would result in more effective use of capital and employment opportunities for the available labour force.

#### Manpower for Industrial Research

The criteria for a successful industrial research programme can be summed up in the 5 "Ms":

Manpower

Money

Methods

Machinery

Material

High on the list is the criterion on manpower. Unless there is available, a corp of suitably qualified personnel in industrial research, effective utilization of other resources in the country cannot be fully exploited. Unfortunately there is a universal shortage of experienced industrial researchers, particularly so in the developing countries. Formal training in educational institutions, while providing a foundation, does not develop the specific

skills and proper attitude required nor the appreciation of industrial problems. It is therefore necessary to augment this basic education and to develop the orientation and competence for industrial research. The skills required usually vary according to the types of research activities. Objective criteria therefore must be used in the planning training activities and in the selection of personnel training. While the main aim of training programme is to develop the specific skills required for the accomplishment of an industrial research programme, training should enable personnel to advance to more responsible and thereby create job satisfaction.

Though the exact types of levels of skill required will depend on the research activities of a country, manpower requirements may be generally divided in three categories:

1. Management Expertise
2. Professional and technical competence
3. Technician dexterity

#### Management Expertise

Management is the most important factor in the creation and efficient use of resources, including trained personnel. It is now recognised that management plays a decisive role in the industrial research organisation. It establishes priorities and plans an industrial research programme according to the objectives set at national level. Only too often has an industrial research effort come to naught due to the absence of well defined aims. In defining the areas of activities it must assess the skills required and provide for the acquisition and development of these skills. It must recognise the need to keep the internal organisation flexible enough to manage



the scope of work and to suit the abilities and personalities of individual staff members. While allowing sufficient freedom for individual research work to stimulate creativity it must at the same time be able to combine individual efforts into concerted team work upon which the success of a research organisation largely depends. While providing for job satisfaction, management must also be mindful of the importance of motivating staff by offering good working conditions, competitive remuneration and promotion prospects.

The important role of management in industrial research was recognised only in recent times. The training of technology-minded and cost-conscious managers with entrepreneurial talent is most necessary. Because research management training programmes must be relevant to the social and economic system of the country, they vary according to the level of development. There are, however, some general considerations for such basic training programmes. Training should cover all levels of management ranging from policy making through the different modes of policy implementation to evaluation and management. Besides general principles of management, studies should include the processes of innovation, adaptation and decision-making. Another important aspect is the development of entrepreneurship. Such training should preferably be conducted locally as a working knowledge of local conditions and practices is essential for effective management. One point that must be specially emphasised in training for management skills is that management expertise can be learned but not taught because it involves the cultivation of technical aptitude and the development of a proper attitude. There are basic rudiments of the "Art" which can be conveyed through formal

training, but unless the "Art" is practised and deployed skill is not acquired.

In-house management training is a practical way of developing the skills required. Whatever the training programme is, actual participation and decision-making is essential. The traditional method of industrial management training include:

1. Formal Training
2. Workshop Discussions and Case Method Training
3. Training on the Job

A suggested form of training involves attachment to industry or other research organisations. This is theoretically sound but in practice has obvious problems and difficulties arising from the necessity for active participation in all levels of management including policy decision.

#### Professional and Technical Competence

It is obvious that the technical part of any research work requires the participation of qualified professional personnel comprising the research scientists, innovative designers and engineers, industrial economists and sociologists. This group of professional personnel is the backbone of an industrial research organisation, from which scientific and technological developments and creative research are generated. It also serves as the technical arm of the organisation reaching out to industry to assist in the solution of problems arising out of day-to-day production situations or in the development of technology for local applications.

Optimal performance requires that scientists and engineers keep abreast of developments and innovations. Towards this end, industrial researchers should have the widest possible access to the great amount of scientific and technical information available in advanced countries. Personnel also need to gain additional experience or widen their competence and broaden their perspective through studies abroad or through exchange schemes between educational and research institutions. Universities may participate in the development of suitable skills by orientation of graduate studies towards the objectives of industrial research. University participation in industrial research has been a much-talked about topic, but little has been or achieved by universities in most developing countries.

In industrial research, technical competence needs to be backed by an appreciation of industrial activities and problems. Training activities therefore must aim at establishing a good communication link with industry to enable an understanding of not only technical matters, but also of management and marketing operations and economic problems. This aspect of training is tricky as it requires access to operational procedures in industrial establishments. How this may best be achieved needs to be carefully worked out in relation to the industrial environment in a country.

#### Technician Dexterity

The supporting base of industrial research organisation is made up of technicians and skilled workers. In addition to a general school of education the training of such workers is relatively uncomplicated. Training may be provided at

polytechnics or similar institutions or in research organizations. The important pre-requisite institutions is the **identification** of the types of skills required. Appropriate training activities may then be planned. Most of these people are trained on the job. Many are sent to Polytechnics to supplement their theoretical knowledge if this is not being provided for by the institutes that employ them.

The Singapore Institute of Standards and Industrial Research (SISIR)

In the Singapore Institute of Standards and Industrial Research, staff development has top priority. We believe that it is the people in the institute that counts. The growth of SISIR parallels that of its staff development programme. Starting off initially in 1963 as a small technical unit (Industrial Research Unit) of the Economic Development Board with 25 staff, the Institute's activities have since expanded in both scope and variety and has a staff of 200 in 1972. Material testing services were first offered in response to the needs of industry at that time. Through the performance of these comparatively easy tasks, the young and rather inexperienced staff of the Institute were given the opportunity to get in direct contact with industry. As the facilities and number of experienced staff of the Institute increased, work of a more sophisticated nature usually involving trouble-shooting or problem solving for industry became common activities of the Institute. Gradual exposure to actual industrial problems of increasing complexity gave the officers a better grasp of the real life industrial situation. Better understanding helped to build confidence and with confidence more difficult work could be accomplished. It was through such self-sustaining process of in-house training that so much progress had been made in the last four years.

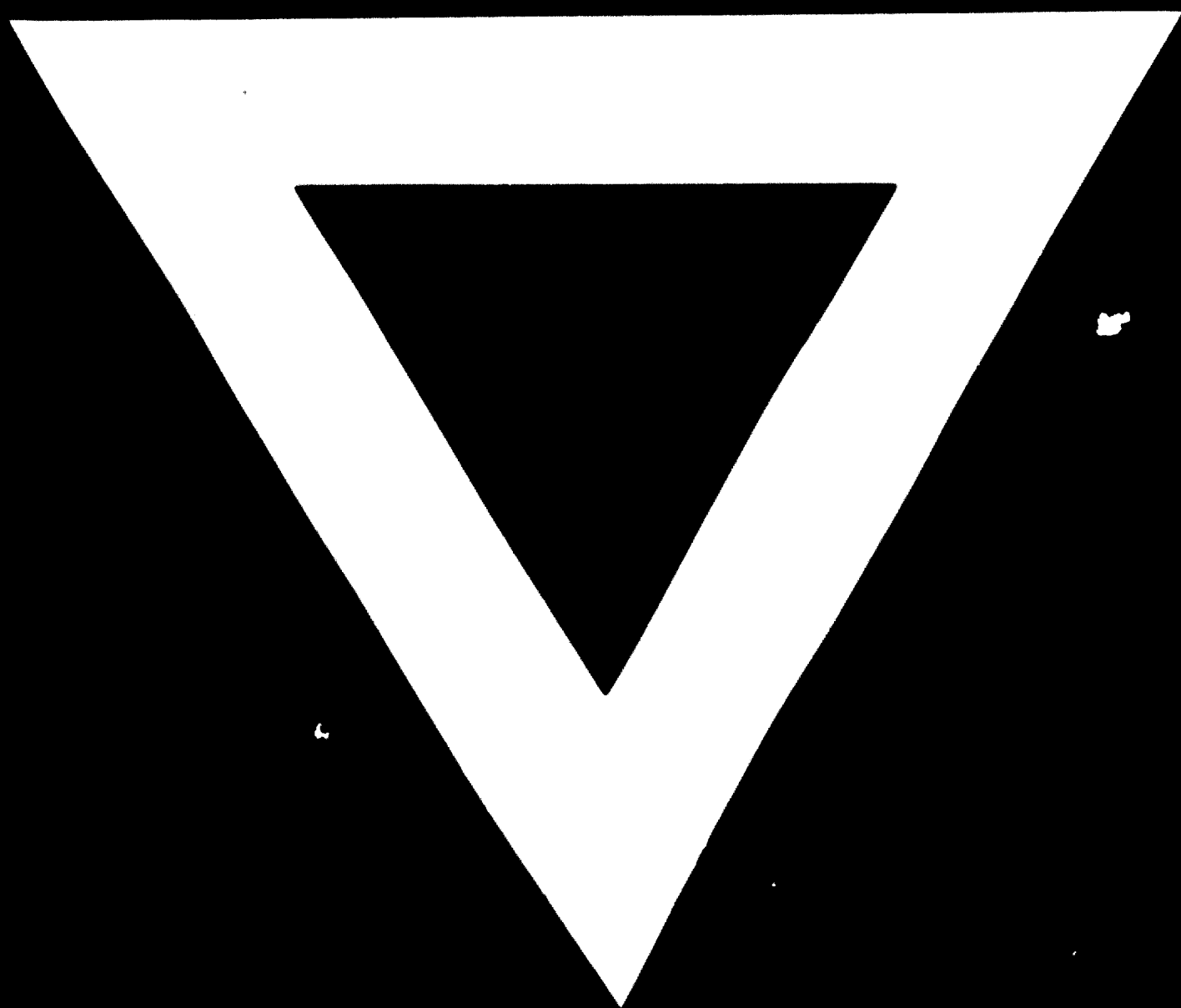
In 1969 standardization and quality control were added to the activities of the Institute. In 1970 a separate division within SISIR was formed where projects of bigger magnitude and higher level of sophistication are being handled. Techniques of project management were introduced and all senior staff were at one time or another given the chance to work in multi-disciplinary groupings under the general guidance of project leaders. A few specially selected short-term consultants are employed by the Institute from time-to-time to help in some of the projects. Our staff gained considerable experience and confidence through working with these consultants, some of whom are provided by UNIDO under its Special Industrial Service Scheme. Almost the entire professional staff of 60 have had some form of overseas attachment and experience. These attachments are selected to suit the individuals as well as meeting the needs of the Institute. This is usually not an easy task to do.

The intermediate technical staff, the technical officers, laboratory technicians and assistants, which form the bulk of the Institute's technical staff, also have special programmes of training of their own. Many are trained on the job, others are given special leave to attend sandwich courses in the Polytechnic and extra mural studies, and some are sent overseas for more specialised training in selected fields.

In addition, a Technical Information Section was formally established in early 1972 to cater for the needs of the staff in the first instance, but now being extended to industry in the form of a current awareness and question and answer service. There is no doubt that SISIR has made some considerable headway since 1969, but there is still a long way to go. Skill development is a continuing process

and there must be no let up lest stagnation will set in. Equally important is for management to create conditions which will motivate staff to continuously improve themselves and remain with the Institute.





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