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Research Organization TNO

By H. W. Julius,* Chairman, Central Organization for Applied Scientific Research
in the Netherlands (TNO), The Hague

In the Netherlands the rise of applied research as an impetus for progress came during and after the First World War, but not until after the Second World War did research and scientifically based development reach their present dimensions.

This evolution of research is reflected in the establishment and growth of the Organization for Applied Scientific Research—*Toegepast Natuurwetenschappelijk Onderzoek* (TNO)—in the Netherlands.

The early years

In the 1880's, when a serious crisis hit Dutch agriculture—and thereby the foundation of the country's economy—for the first time science was called to the rescue.

Artificial fertilizers had recently been introduced and the new agricultural college at Wageningen had been established. The dissemination of information on how to increase crop yields was a first step, but definitely not enough. The Government created regional experiment stations where agricultural engineers and biologists used test plots and laboratory facilities to find out how farmers could use their land in the best possible way. The value of this work proved to be so great that it continues today, almost 90 years later.

This, then, was the beginning. The Dutch Government, in close co-operation with private enterprise, introduced science into the process of economic production. From this stems today's Dutch system: collaboration between the Government and private initiative.

The system has two advantages: It prevents excessive official penetration into the actual research work, and it prevents an attitude of laxity that may easily arise from the confidence that government, the mighty provider, will do the job.

The effects of the First World War

A certain complacency characterized the beginning of the Twentieth Century, but the First World War destroyed this. Though the Netherlands was not directly involved in the War, the citizens experienced its effects through scarcity of materials, goods and edibles.

Participants and non-participants alike soon saw that this was a new type of war, one in which the decisive factors were science, inventions and their applications.

Unfortunately, most Dutch citizens and certainly government officials did not realize the significance of the war developments which they were observing from a safe distance. One of the very few, however, who did perceive future developments was H. A. Lorentz, Nobel Laureate and world-famous theoretical physicist.

In 1917, Lorentz asked the Royal Netherlands Academy of Sciences, of which he was president, "whether it was not of great urgency to use all the science and experience available in Holland to search for ways and means that would yield the highest possible return from the few raw materials and production facilities available in Holland".

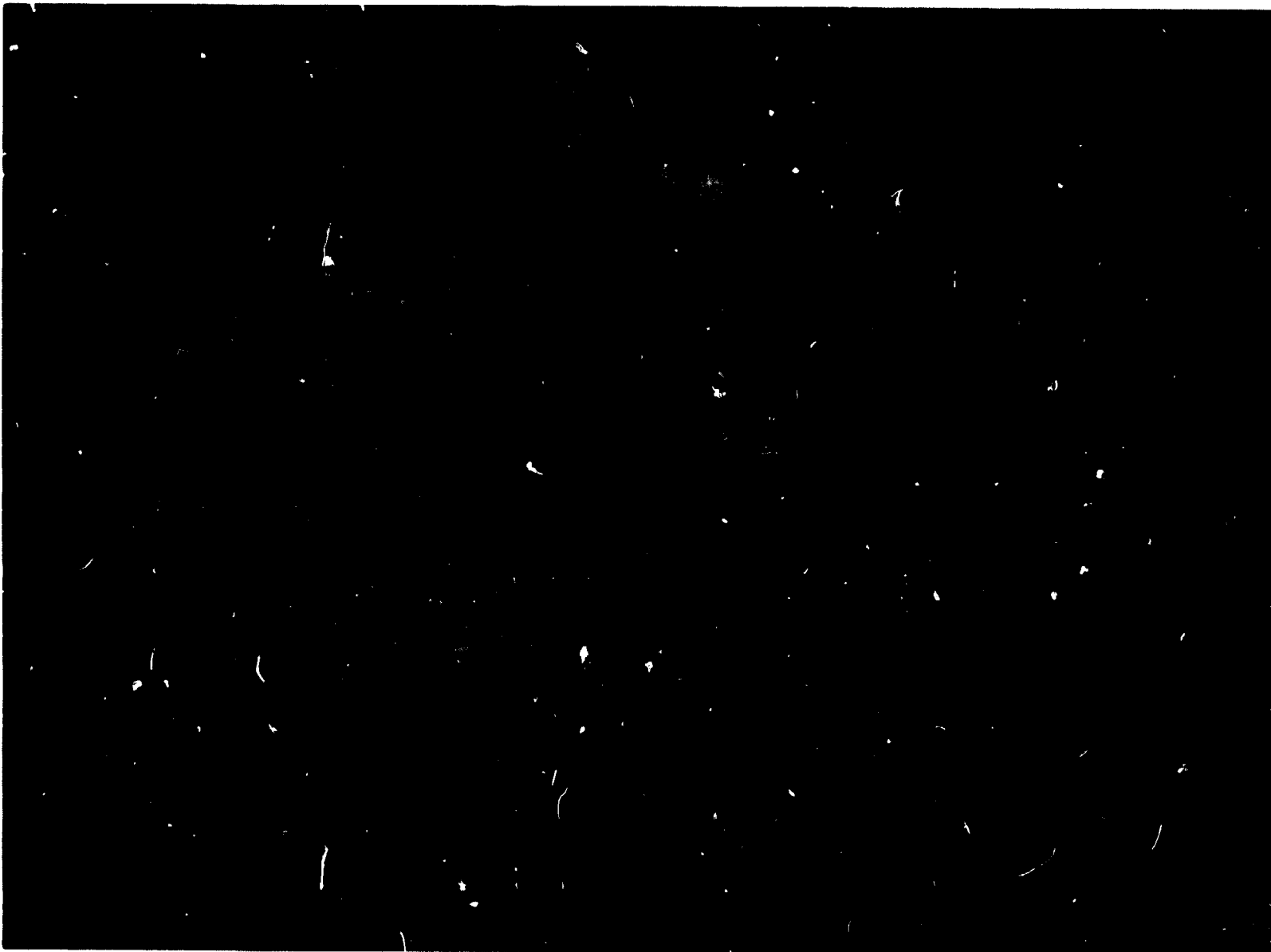
The Academy set up a committee which submitted a report to the government in 1919. The report recommended focusing attention on the development of applied scientific research so that Holland would not lag behind other countries in the forthcoming industrial development.

The government reacted slowly, making no definite decision until 1930. At that time, the Parliament passed an act creating the Netherlands Central Organization for

* For a brief biography of Dr. Julius, see "Men in Research and Development", page 55.

Serves Dutch Community

Model experiment in towing tank (Netherlands Ship Model Basin).





Remote measurement of human exertion (Institute of Medical Physics TNO).

Applied Scientific Research, the organization now known as TNO. The assignment TNO received has wide scope — "to ensure that research is put at the service of the community in the most efficient manner possible".

Organization of TNO

Since it was clear from the start that the Central Organization TNO could not do all the work implied in the assignment, the Act made the following provision for special organizations:

On the recommendation of the Central Organization or after having consulted this body, Our Ministers shall, whether acting in co-operation with others or not, be authorized to call into existence special organizations charged with the task of ensuring that applied scientific research shall be put at the service of any national interest or any branch of national welfare in the most efficient manner possible.

The regulations of the four special organizations which exist today harmonize with the TNO Act. These organizations and the Central Organization are all corporate bodies, so each can handle money, appoint staff, conclude contracts and sue and defend in proceedings.

The board which heads the Central Organization consists of prominent people from the world of science, from the commercial sector and from the several sectors of the

community interested in applied research. It is symbolic of the significance accorded to the organization that the Crown, with the advice of the cabinet ministers concerned, appoints the board members. As a result these functionaries have official status equal to that of university professors, members of the Royal Netherlands Academy of Sciences etc. Only the Crown can dismiss them. Accordingly, they possess a degree of liberty that would not exist otherwise.

The boards of the special organizations have a similar structure. Their members are selected from that sector or the sectors in which the special organization carries out applied research. Their members, too, are appointed by the Crown with the advice of the cabinet ministers concerned.

The four special organizations and their dates of establishment are: Organization for Industrial Research TNO, 1934; Organization for Nutrition and Food Research TNO, 1940; National Defence Research Organization TNO, 1946; and Organization for Health Research TNO, 1949. Since 1957 the institutes for agricultural research have been connected with TNO not on an organizational but on a scientific basis only, i. e. according to their programmes and co-ordination of the work.

Government subsidy

The budget of each special organization is subject to the subvention regulations for the Central Organization TNO.

For the subsidy which the Government grants, the Central Organization submits to the Minister of Finance a budget which incorporates the budgets of the special organizations. (TNO is the only body corporate in the Netherlands which follows this procedure.)

Each calendar year, the Central Organization distributes the money received under this government subsidy among the five organizations. That each ministry may know exactly what TNO spends on research in that ministry's sector of interest, the Finance Ministry uses an accounting procedure which shows how the amount allocated is distributed. All of the ministries except those of Justice and Foreign Affairs are interested in TNO work in some degree, but the subsidy ultimately figures in the budget of the Ministry of Education and Science.

Interrelations of the five bodies

To avoid conflicts of interest between the central and the special organizations, the TNO Act stipulates that the Central Organization "shall refrain from direct action on any subject lying within the scope and competence of any of the special organizations".

The executive committee from the Central Organization's board is entrusted with the interrelations of the five bodies corporate. The committee consists of the chairman of the Central Organization, a vice-chairman who is not

connected with any of the TNO organizations, and the chairmen of the special organizations, who are, in that capacity, members of the Central Organization's board. The chairman of the Central Organization chairs the executive committee's weekly meetings, where all matters pertaining to the organization are dealt with.

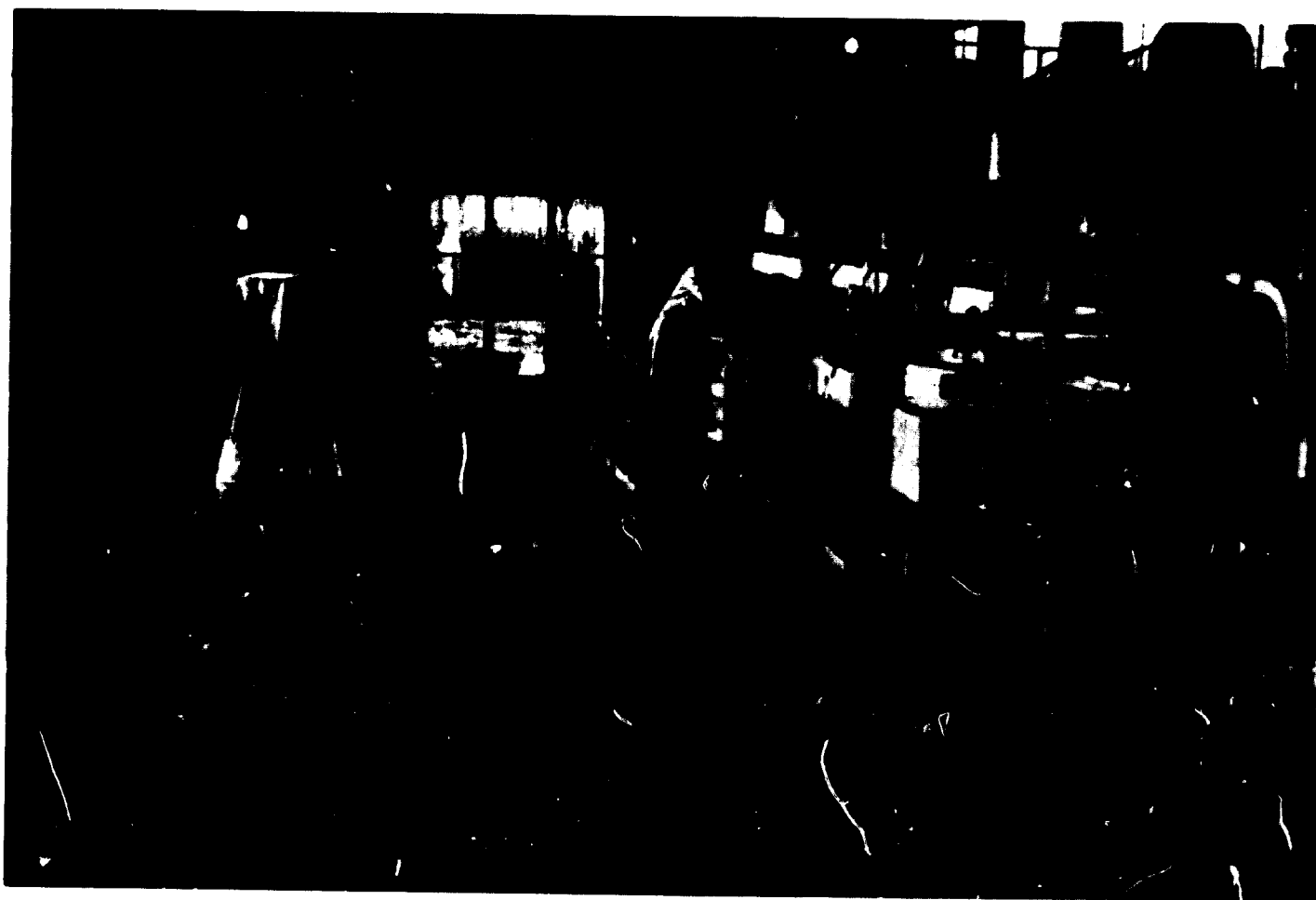
As another safeguard of the proper co-ordination of the five bodies, the secretary and the treasurer of the Central Organization provide the secretariat and the financial administration of each special organization. The different secretariats and the general treasury are accommodated in a common head office. The regular meetings of the secretaries, like those of the chairmen of the five organizations, help to ensure unity in the over-all pattern.

Within this pattern the Central Organization is the service organism for all of TNO. It comprises the central financial administration, the personnel department, the economic technical department and the public relations section. The economic technical department of the Central Organization *inter alia* streamlines that part of technical aid to developing countries that involves scientific assistance.

Government influence

Since the Government provides a subsidy, the influence of the Government is an essential and primordial element in the TNO system. To that end the law appoints the

Equipment for unit processes (Central Technical Institute TNO).



Treasurer-General as an *ex-officio* delegate of the Minister of Finance to the Central Organization. The Crown, with the advice of the minister or ministers concerned, appoints a delegate and a deputy delegate to the board of each special organization. Through these delegates the ministers not only can influence the policies to be followed but also can keep conversant with what goes on in the special organizations.

The TNO Act provides that "each delegate shall be competent to lodge an objection to a decision by the board". This veto right belongs to all delegates on the boards of the special organizations who are also delegates on the board of the Central Organization. The veto right can be exercised to suspend a decision that is considered to be in contravention of a specific ministry's policy. The board decision is then submitted to the judgement of the minister.

Actually, this veto is seldom exercised. Instead, consultations take place at a stage when the course to be steered has not been rigidly set and ideas and views can be profitably exchanged.

Activities of the special organizations

The first special organization span off (1934) by the Central Organization TNO was the Organization for Industrial Research TNO. It is the largest by far, being about as large as all the other special organizations put together. It has fifteen institutes, seven specialized departments or centres and seven foundations. Though each foundation is a body corporate, the seven are closely linked with the Organization.

The Organization has two types of institutes: the subject-oriented group serving specific branches of industry (wood, leather, plastics, textiles, building materials, paints, ceramics etc.) and the method-oriented group (chemical laboratory, mechanical constructions, general technical institute).

The Organization provides powerful support to medium- and small-sized industries. It organizes courses for low-cost automation of small-sized serial productions, aims at new production and processing techniques and does new product research and development. Another of its functions is carrying out quality tests that are so complex and refined that private laboratories equipped for routine jobs simply cannot do them. The Organization can render assistance to practically every branch of industry.

After the Second World War, it made a vital contribution, directly and indirectly, to the rapid industrialization of the Netherlands, a must in view of the loss of the Dutch colonies. In ten to fifteen years, the Netherlands, which had been mainly agricultural and commercial, became well known as an industrial country.

The Organization for Nutrition and Food Research TNO has two primary research fields: the effects of nutrition on sick and healthy people and food technology. It conducts nutrition research on food components which man needs (e. g. vitamins) and which make food attractive (e. g. consistency and aroma) and on the manner in which man uses these components.

Food technology research concerns the preparation of food, analysis of harmful components, conservation and quality control. Through this part of its work, the Organization serves the foodstuffs industry, an important industrial sector in Holland.

The National Defence Research Organization TNO carries out research on behalf of the navy, air force and army. Obviously, much of this research is under military security regulations. The great advantage in this special organization being centred within the national organization for civil research is that it can collaborate efficiently with all the other TNO laboratories and with the centres for research on material, such as plastics and textiles.

As would be expected, this special organization has close ties with the Ministry of Defence and the military members of the board play the leading roles in the making of policies.

The Organization for Health Research TNO attends to the research involving Holland's preventive medicine policy. More than its sister organizations, this special organization subsidizes investigations—only those connected with general public health interests—being carried on by workers outside TNO. It also runs five institutes and has a number of working parties. Their research on special sectors of medical instrumentation and on environmental hygiene has bearing on the country's industrial development as well as the health of its citizens.

Contract research

The Netherlands has a number of research associations which do not have joint research centres; instead they apply to TNO. The appropriate TNO institute, or a combination of institutes, carries out the research for them on a contract basis. The furniture industry, for example, can apply to the Forest Products Research Institute TNO, the Fibre Research Institute TNO or the Paint Research Institute TNO—depending on the problem to be solved. The collective approach in a project will, of course, benefit the entire furniture industry.

If the parties who submit the problem bear the full

Revenues of the TNO Organizations
(In Nfls 1 000^a)

	Subsidies		Other revenues ^b		Total ^b
	1955	1965	1955	1965	
Central Organization ^c	4 884	24 842	774	4 574	29 416
Organization for Industrial Research	6 607	26 242	5 043	15 305	41 547
Organization for Nutrition and Food Research	895	4 656	265	2 357	7 013
National Defence Research Organization	3 328	18 580	638	1 619	20 199
Organization for Health Research	1 870	9 310	86	1 864	11 174
Totals	17 584	83 630	6 806	25 719	109 349

^a Nfls 1 000 = \$ US 276.40.

^b Agricultural research excluded.

^c Excludes figures relating to internal accounting for work done by one TNO organization for another.

cost of the research, they may have the exclusive use of the results. When exclusive use is not a primary consideration, the knowledge gained through the research project may be published. In this case the so-called stimulation arrangement can come into play. Under this arrangement, the government makes as much money available as the branch of industry pays to TNO for the investigation in question. This doubling of the research effort helps to promote the "research-mindedness" of industry; the results belong to the whole branch.

One company or firm can place an order for research and pay the TNO institute concerned for the entire research cost, overheads included. The company then has the full and exclusive use of the research results. Since secrecy is a must, all TNO employees working in situations that involve confidential contracts sign an agreement pledging their secrecy. Moreover, they are bound to secrecy for two years after their contract with TNO expires.

When approached for sponsored research on a problem which another party has already submitted, TNO refers the second party to the first. This procedure has sometimes yielded co-operation between firms and even prompted the establishment of research associations.

On the rare occasions when such a combination is not

desired, TNO advises the second party to consult other research agencies.

Finance

TNO receives money mainly from two sources: the Government and the sponsors. The sponsors are industries, special governmental executive bodies and international organizations (e. g. Euratom). Moreover, in recent years TNO has advised and carried out investigations for other countries and for the Netherland's technical aid agencies for developing countries.

The accompanying table on the revenue for 1955 and 1965 makes the growth of TNO apparent.

The government subsidy enables the Organization to carry out independent and progressive research, to aim at the future. The contract research focuses on a given question in a specific formulation and seeks an effective answer. Such questions tend to stimulate free research, and from this arise questions of future possibilities. Serving both the Government and private industry, TNO attempts to keep the delicate balance between finding the answers to today's specific problems and foreseeing those still in the future.

For additional information on TNO, see *Industrial Research News*, Vol. I, No. 1, pp. 67-69.

Managers of Institutes Discuss Common Problems

Nineteen participants from developing countries in Africa, Asia and South America discussed common problems at an inter-regional Workshop of Managers of Industrial Research Institutes. Held in Athens from 4 to 18 July 1967, the Workshop was organized by UNIDO in co-operation with the Government of Greece, which acted as host country. Eight expert consultants and 24 Greek observers also attended.

Though the participants represented countries in various stages of development, they found five problems common to industrial research institutes in developing countries. Those involve staff, remuneration, promotion, finance and training.

The participants felt that a world-wide shortage of scientific and professional staff with requisite research experience exists and that local remuneration policies make it difficult for developing countries to attract and hold these staff members. Countries which gear salaries of research personnel to governmental salary structures seem to have more difficulty attracting qualified professionals than others do. Where salaries of research personnel have been equated to those of university staff, the problem appears to have been reduced. Participants also noted a high turnover of professional staff in countries basing promotion on length of service and establishment requirements.

Agreeing that self-sufficiency for institutes in most developing countries is far away, participants cited such financial problems as the inability of small industry to pay for sponsored research and the need for educating industry to pay for work done by institutes.

Reports from the various countries indicated problems in training both professionals—who often need an industrial orientation to supplement basic training—and technicians who must acquire appropriate skills.

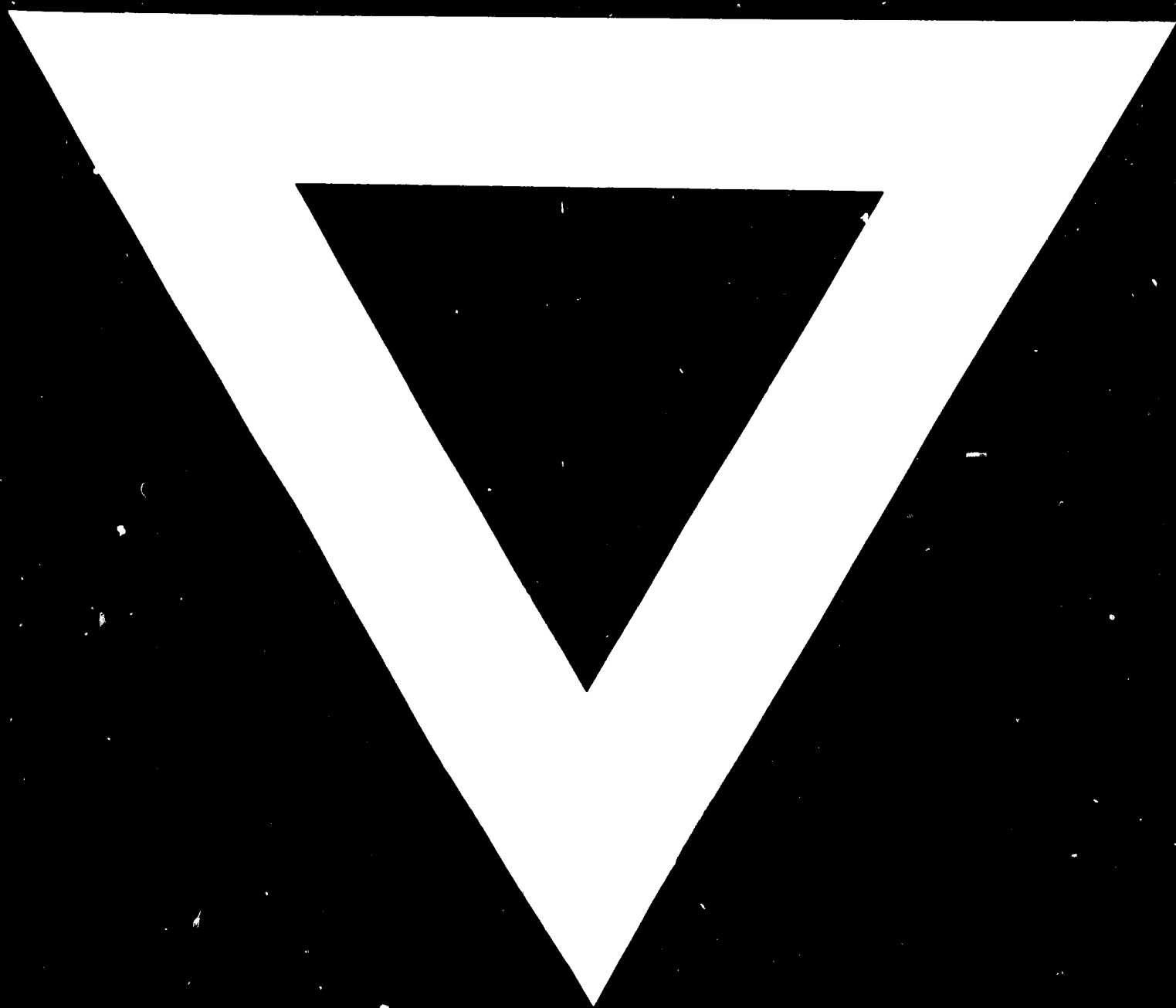
The Workshop resulted in ten recommendations, most of them directed to the governments of developing countries or to UNIDO.

The Workshop recommended that governments of developing countries organize and co-ordinate their industrial research institutes within the framework of autonomous statutory bodies. Another recommendation was that these countries give institutes financial support not only for their establishment but also on a continuing basis for a reasonable period in order to ensure satisfactory planning and programming of the work.

The Workshop recommended that UNIDO do the following: take steps to form competent groups for evaluation of the performance of institutes, at their request; establish regional and international study programmes with emphasis on plant visits; continue to organize regional and international seminars and study programmes on industrial standards and quality control and to assist actively in the establishment of standards organizations; take steps towards the establishment of an international association of industrial research institutes.

Other recommendations included holding similar workshops at regular intervals and devoting one future workshop primarily to the economic and organizational aspects of industrial research in developing countries.

J. Gerakis, deputy director of the Hellenic Industrial Development Bank, was chairman of the Workshop. Participants elected the following officers: Salvador del Carril, Argentina, first vice-chairman; K. Hussain, Pakistan, second vice-chairman; E. Lartey, Ghana, rapporteur. The director of the workshop was L. Katkhouda of UNIDO's Industrial Services and Institutions Division.



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