OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

02137

United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.233/1
7 September 1976

ORIGINAL: ENGLISH

Meeting of Selected Heads of
Research Institutes

Vienna, Austria, 18 - 22 October 1976

DESCRIPTION OF THE ACTIVITY OF THE RESEARCH INSTITUTE OF THE ELECTRICAL INDUSTRY (VKI - HUNGARY) IN SOLVING TECHNOLOGICAL PROBLEMS AND TRANSFER OF TECHNOLOGY

by

J.L. Lukács*

* Managing Director of VKI - Hungary, oorrespondent member of Hungarian Academy of Soiences.

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

id.76-5036

CONTENTS

1./ Aims and activities of the Organization and its role in developing technologies.

VKI was established by the Hungarian State in 1948, and is fulfilling its duties in two fields;

- development of the Hungarian power-current industry
- for other branches of industry elaboration of technological and circuitry problems, which can be solved the easiest way through electrical means.

The Institute performs its tasks with a staff of 700 employees.

Main fields of activity of the Institute;

- Development of insulating materials, corrosion and weather resistance problems of electrical component parts.
- Solution of circuitry problems of power electronics for roll mill drives, inverters and electric vehicles.
- Technological research in metalforming semiconductors and building materials.
- Direct generation of electric power by means of solar cells, thermo-generators and fuel cells.
- Development of electrical switching apparatus.
- Development of ceramic insulating materials.

Prototypes are being developed in the laboratory of the Institute equipped with technical facilities worth several hundred million Forints. Production of these prototypes on a small-scale basis is carried on in the Institute's own pilot plant representing approximately 25 to 30 per cent of the entire capacity of VKI.

At present the following fields are considered as being of outstanding importance:

- Development of technolgies by direct application of electrical power for processing of metals and building materials
- Power electronics.
- Local energy systems: solar cells, thermo-electric generators and chemical energy sources.

For the World's developing countries, the electric power industry is of major importance in two fields:

- satisfying requirements of culture and comfort,
- boosting industrial production by putting high-productivity processes and tools into the hands of workers.

As is known, the sustained power output of a worker is 50 watts, whereas on output of 500 to 600 watts i.e. almost 1 HP can easily be delivered by some electric tool held in hands.

Help and assistance to developing countries can be offered by VKI in the fields of local power generation /f.i./ for irrigation by solar cells of new production as well as in the field of transportation.

2./ Manpower and financial resources

As already mentioned, 700 people are employed by VKI, including

1 member of the Hungarian Academy of Sciences,
7 candidates of technical sciences
12 engineers with doctor's degree
138 university graduates
20 technical high-school graduates
120 technicians
402 workers and administrative employees

Stock of fixed assets of the Institute represents a value of about 200 million Hungarian Forints, 60 per cent of which are machinery and measuring instruments, the rest are building investments.

The 1975 turnover of the Institute was about 145 million forints.

80 per cent of the above sum came from contracts concluded with various industrial establishments, while 20 per cent resulted from government contracts.

The 145 million Forints comprise about 120 million spent on research and dovelopment and 25 million on small - scale production.

For the period of the coming Five-Year Plan a 10 to 25 per cent and financial increase of personnel the institute has been scheduled. The income of research and production will be similar to that of the past. sources

3./ Description of existing and proposed research and development activities.

Corresponding to the fields indicated in Paragraph 1/ each field being covered by a department with a staff of 80 to 140 a more detailed description of the activities is given here:

- Development and testing of insulating materials, corrosion and weather resistance of electrical component parts.

  Elaboration of epoxy resin indoor and outdoor type supporting insulators up to 440 kV.

  Development of electrophoretic insulations.

Development of technology of producing low-pressure enclosures and moulding machines for this purpose.

Development of technology for coating of metals with epoxy resin power.

Design of complex insulation of electric motors.

Development of other coating for protection of component surfaces.

Pollution resistance tests.

Tests of resistance to corrosion and to solar radiation.

- Solution of circuitry problems

High-power control equipment /up to 6 MW/ for roll mills, metallurgical equipments and for sludge pumpe drives.
Thyristor drives for vehicles fed by primary or storage batteries or overhead wires.

Frequency and voltage controlled asynchronous and synchronous motor drives.

Electric power supply for electric cattle-grids.
Inverters for rail-road, telephone centrales and power generating plants.

- Technological research

The following fields of technolgical research are being dealt with:

- In metal forming technology:
electro-dynamic hot metal forming /shape blowing of healed tubes by applying pressures of several thousand kg/sq cm/
electro-dynamic pressure casting of aluminium, bronze and iron .

plasma technology for metal working

- Semiconductor technology
  - Production of silicon power diodes and thyristors,
  - Elaboration of bismuth-telluride cooling alloys,
  - Germanium-silicide materials for thermoelectric generators /thermo-electric generators were delivered up to 300 watts power for oil and gas lines/
- Elaboration of hybrid micro-circuits with built-in miniature band thyristors up to 1 kW controllable output
- Technologies for building materials:
  Melting of surfaces of prefabricated house-building elements to provide weather resistance by application of plasma jts
  Application of ceramic coatings
- Direct generation of electric energy

  Within this research target the technology of producing high-power solar cells has been developed, and for the Hungarian Post generators for supplying microwave transmitters up to 0,5 kW has been built.

  Using the germanium-silicide thermo-electric materials PB-gas, oil and natural-gas fired thermo-generators have been constructed for the output range of 50 to 300 watts.

  Very important results have been achieved in the development of electro-chemical power sources.

The zinc-air batteries capable of storing 1 kWh energy in a weight of 5 kg should be mentioned. Within this research work high- and low- temperature /750 to 800° C and 80 to 100° C respectively/ fuel cells have been developed. With these batteries ten 2.5 -ton electric lorries and two types of 16 -ton electrically operated hybrid autobusses have been constructed.

- Development of electric apparatus

  A series of high-rupturing-capacity low- and high-voltage fuses has been elaborated.

- Vacuum contactors of 250 amp and 1100 Volt rating have been developed

  Short-circuit test with test currents up to 30 Amp D.C. and 100 Amp A.C. can be performed at our short-circuit testing laboratory.

- In the field of ceramic insulating materials the following development work has been carried out:

  Technology of producing high-precision ceramic components of complicated shapes.

  Development of a ceramic material for fuse holders of high mechanical and thermal shock resistance

  Development of heating resistors directly embedded in ceramic enclosures

  Elaboration of infrared heating elements.

4./ Activities, if any, outside the country and present status of co-operation with other local and foreign institutions

The Research Institute of Electrical Industry has established relations with almost all similar institutes of the socialist countries, thus with

Vsesoyuznyj Institut /Moscow/
VUSE /Prague/
Instytut Electrotechniky /Warsaw/

We co operate with the West-European firms Siemens and Brown-Boveri.

Our Institute is of course, in close co-operation with all Hungarian research institutes, especially with the Research Institute for Electric Power Industry dealing with the research work related with the Hungarian Power System.

5./ An analysis of the problems faced by the organization in the development and transfer of technology and the solutions found.

It should be pointed out that according to our experiences the introduction of the results of research activities to industrial use is a tiresome and laboring work.

First of all, it must not be forgotten that after the research period usually a 6 to 10 times greater effort is required by the industrial realization of a sucessfully concluded research work. For this purpose respective man-hours and financial means must be taken into account in advance.

Generally this requirement is underestimated or left out of consideration, and it should be emphatically pointed out when submitting a research result to an adapting country.

According to our experience, when new technologies are to be introduced, two aspects must be made clear and verified for the adapting party.

First of all, the advantages to be expected from the introduction of a technology must be demonstrated, whether offering cultural benefits, or contributing to an increase of industrial production, or being promising in some other respect.

--The second aspect to be explained is that for a firm or for the country the introduction of a given technology is a necessity as a result of prevailing circumstances or, in some respects, even unavoidable considering general evolution. Consequently, if the introduction of a technology must be accomplished later a protracted introduction may result considerable financial losses. Generally, the emphasis is to be laid on the motivation by interests.

Our more detailed experiences will be given in a concise form by surveying the factors which, when neglected or inadequately taken into account, may cause difficulties in transferring a technology. Of course, proper consideration of these factors will contribute to the success.

In any industrial introduction of a research achievement the following four aspects play a decisive role:

1. Survey of local conditions of the adapting party
2. Selection of the required product and production planning
3. Introduction of production with respect to machinery and personnel
4. Tasks of the adapting party.

Going into the details, the following can be stated:

1./ Survey of local conditions of the adapting party

1.1 Geographic and climatic conditions should be examined in detail

1.2 Local availability of raw material offers considerable advantages in contrast to import or long-distance transportation.

1.3 Status of ambient industrial level may have a decisive effect on production, although our Institute cannot agree with the opinion that

the developing countries will have to pass through all the earlier stages of industrial development /e.g. in the manufacture of metallic component parts there is no need to follow the sequence "lathe - NC-lathe - automated production line," but in many cases the introduction of chip-free metalforming is the best solution /e.g. by adopting the method of electrodynamic metal shaping/.

1.4 Also in the technical training of manpower itt will often be appropriate to make them acquainted with the most up-to-date technical level, without dealing with intermediate steps of pat technological development.

2./ Selection of the required product and production planning.

2.1 In the selection of a product it is an important factor whether a product is to be produced for local consumption or for satisfying demands outside the country. In the first case, the value of national labour that can be invested in a product is only dependent on the demand, whereas in the second case, however, marketability of goods is limited by the minimized cost of critical production series already established on the world market.

Generally it is better to select a family of products instead of a single product, and to think of perspektiv product expansion when organizing the production.

2.2 In production planning it is especially important to employ persons who have skill in ensuring

minimum investment costs by which the set aim can be achieved. It is a sound method to entrust persons or institutions with the task of checking the ready-made plans of investments, against the reception of a certain share of cost reductions proposed and accepted. According to our experiences gained with inland investments under such circumstances, reductions of investment costs up to a ratio of 1:2 can be achieved

2.3 Sometimes with regard to local conditions, the possibility of processing of semi-finished goods shall be considered. Of course, delivery of semi-finished goods shall be ensured by proper contracts.

2.4 It is an important aspect in production planning to ensure proper mechanical, psychical and loan conditions by which the proper schedule of production is guaranteed. This aspect shall not be left out of sight especially by final assembly lines.

2.5 In the phase of planning further possible developments - based on futurological considerations - in the adopted technology, should be kept in mind, since these developments become realities with a high degree of probability.

3./ Introduction of production with respect to technical and human factors

3.1 If a plant similar to the planned is in operation somewhere in the world, the best method is to have the foremen and perhaps one part of the skilled labour be taught and trained in that plant.

3.2 Sufficient time shall be allowed for the test series, for eliminating initial defects and for making exact adjustments. Premature starting of foul scale production usually results excessive number of waste products repairable at high cost and financial losses.

When such defects occur, normal production run shall immediately be stopped and the basic cause of trouble eliminated.

3.3 As early as before production is started, properly trained maintenance and universally trained crews shall be provided for. These are capable of eliminating any defects quickly and efficiently and of ensuring service continuity of the plant.

4./ Tasks of the adapting party

4.1 It is important to provide for reasonable social conditions, with respect partly to meals and partyly to sanitary conditions. This may be regarded as influencing the general living standards.

4.2 No physical and financial efforts shall be spared in giving thorough training to skilled manpower. Inadaquate level of training will manifest in intolerable ratio of waste products.

4.3 The system of wages and other compensations should be such as to provide, within a certain interval, for a linear relation between the quantity of goods produced by the person and the controlled quality ot the same. Both factors should be considered as equally weighted.

According to our practice in certain respects the introduction of technologies is favourable influenced by a bonuses system lined up with

- point of time starting normal production
- number of pieces produced within give time interval ,
- quality figure characterizing the pieces produced that time interval.

6./ Any significant experience relevant to the theme of co-operation among research institutions

Our experiences in this respect can be summarized in a very concise way. Namely by the statement: "If there is one who can do something better than ourselves, let him be entrusted with it."
The above sentence involves the following:

6.1 First of all, one has to know that somebody has already performed some activity in some details of the problem. That means, in any research work the knowledge of interdisciplinary fields and activities being there performed is essential.

6.2 The management of each research institute has to fight against the rather fashionable way of trying to solve problems in their full verticality within one institute. This tendency is due partly to psychical, partly to vanity problems and partly to financial interests. From the point of view of intellectual economy, of the country, it is definitely harmful. /A multiple amount of brain-work is spent on solving the same problem proportionally with the quantity of possible mistakes.

6.3 An important argument in favour of co-operation is the recognition that, a work performed in an isolated form fails to be successful, whereas the same when done through a joint effort would have possibly resulted in full success. Also here the problem is related with the false view: the fear of sharing the glory of success. In reality, however, the research worker may choose between 50 per cent glory and 100 per cent failure.

7./ Comments and suggestions as to possible areas of joint research

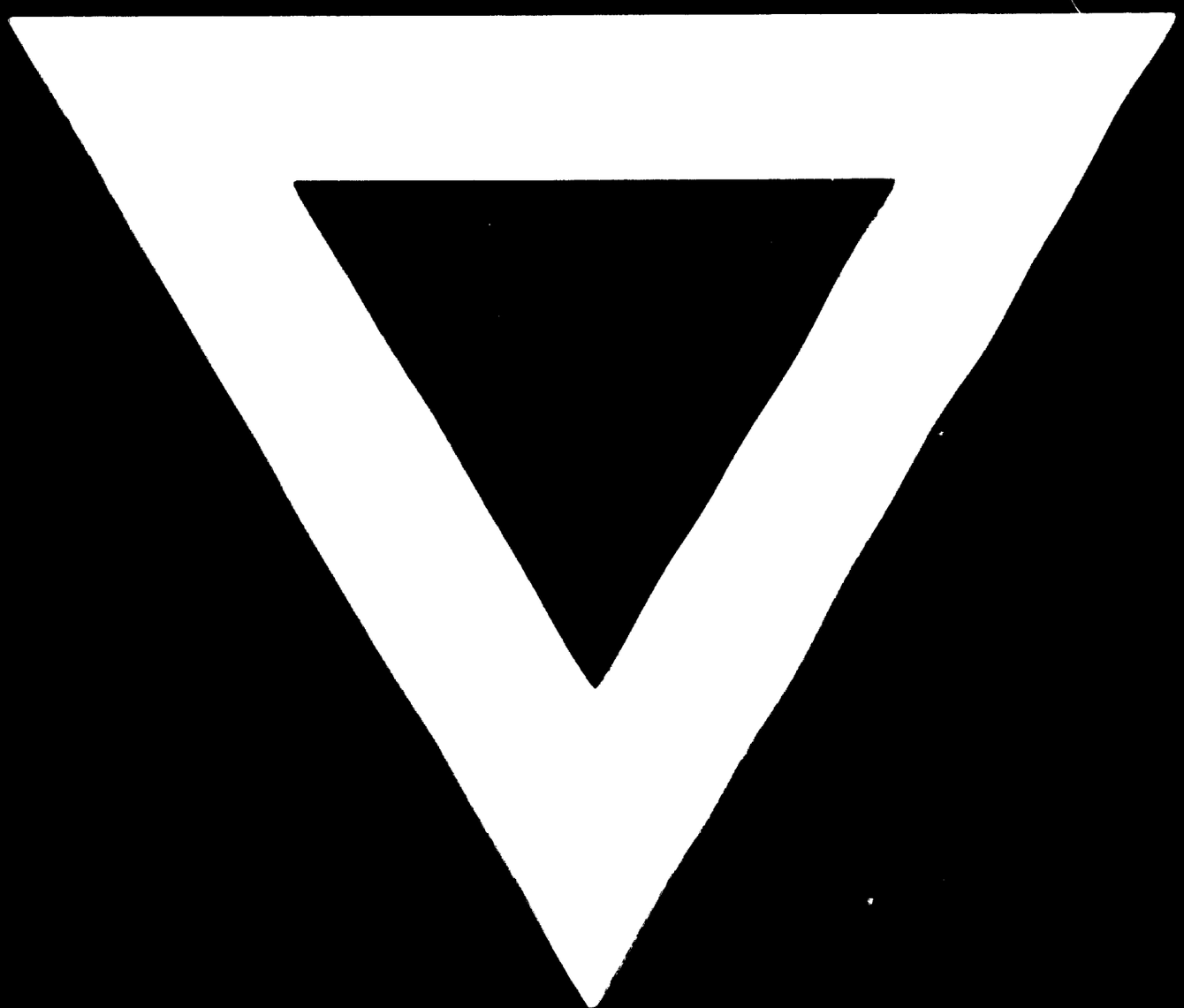
The Hungarian Research Institute of Electrical Industry /VKI/ would gladly join technological investments, their planning and execution now in course of realisation in the developing countries.

We think the following fields can be efficiently represented by our institution:

- electric automation
- technology of direct forming of metals and building materials by means of electrical energy.
- stationary and mobile chemical, solar and thermo-electric power sources.

In the above fields, of course, we are also ready to co-operate with other European institutes in introducing new technologies in developing countries.

B-902



82.09.27