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University Involvement in Industrial Development <sup>\*/</sup>  
- Initial Responses to UNIDO Survey -

Factory Establishment and Management Section

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\* The replies are partly reproduced verbatim, partly summarized.

The following comments briefly summarize the findings of the first round of exchanges between universities and institutes of higher education on the subject of industrial development activities ~~initiated~~ by UNIDO.

1) Advantages of such Activities

The advantages, which are generally recognized of involving universities in industrial development are three-fold. The country would benefit from a reduction, stoppage or even reversal of the so-called brain drain. Universities would be put into a position to attend to a number of local needs rather than being concerned exclusively with foreign techniques and conditions, thus raising the country's self-sufficiency. The university, and in particular its students, would benefit from increased knowledge gained through its access to industrial problems and (problem-solving) facilities. The industry would benefit from local training facilities for its managerial and professional staff on a graduate, post-graduate and extra-graduate level.

2) Problems encountered

Funding and gaining the confidence of the industry are seen as the most common obstacles. Other problems such as the possible interference of university activities with foreign patent rights are mentioned, but appear to be of marginal importance only.

3) Institutionalization

There appears to be a general tendency to formalize the university involvement in industry through the creation of sometimes semi-autonomous institutes with emphasis on the functional or specific priority areas mentioned below. Some institutes concentrate on macro-economic aspects, others on contract research, others on technical consultancy. Most are a mixture of pluri-disciplinary activities reflecting the professional capacity available for this purpose within the university.

4) Functional Aspects of University Involvement

The following functional activities were observed:

- a) Industrial Plans and Strategy Formulation  
often supported by macro-economic surveys
- b) Pre-implementation Activities

- i) Aid in the decision-making processes through:
    - market studies including the collection of data on natural resources and supplies
    - feasibility studies
    - process choice with preference to local inventions
    - project evaluation
  - ii) Promotional activities to obtain sponsors for industrial investment projects.
  - iii) Research and design
    - contract - or applied research
    - engineering design
  - c) Supporting activities
    - i) general consultancy (trouble shooting, etc.)
    - ii) training
      - on-the-job or as project coordinators of consultancy assignments
      - of trainers
      - for new industries (craftsmen, etc.)
      - refresher or initiation courses for graduates and persons from outside the university, etc.
- 5) Specific Industrial Priority Areas
- a) Small-scale industry
  - b) Use of local resources (skills, raw materials, (sugar research, essential oils from local plants), communication systems such as harbours (free zones, etc.)).
  - c) Energy alternatives: biogas, solar energy
  - d) Low-cost housing: of wood or concrete
  - e) Agricultural implements: water pumps, rice threshers, bullock carts, presses, driers, ovens
  - f) Maintenance of local industrial activity through improvised machine repair (when spare parts are not available), fabrication of jigs and tools, bolts and nuts, welding, etc.
  - g) Simple chemical products such as soap, caustic soda, paper glue (from cassava), etc.
  - h) Textile weaving and manufacture

6) Related Aspects

- a) Environment
- b) Development Banking
- c) Food Distribution
- d) Macro-economic Measures (incentives for small-scale industry, dis-incentives for monopolies, octroi policy, etc.)

7) Newer Developments

- a) The establishment of pilot plants by institutes of higher education
- b) The active development of local inventions and innovation by universities

These are topics of world-wide interest at present and an exchange programme on either of these two points alone would appear justified.

8) Form of future Exchange

Apart from the possibility of direct contacts between the universities listed in the "Details of the Replies Received", exchange programmes could be organized within UNIDO's programme of technical cooperation between developing countries.

Furthermore, all bibliographical background material of successes and failures in this field will be collected and published in a later circular. Contributions from all cooperating institutes are invited.

B: EVALUATION OF QUESTIONNAIRES

A total of 24 institutes have so far responded to our enquiry. Filled-in questionnaires were received from 9 of them, some having sent a questionnaire for more than one faculty. Questionnaires were received from universities in Cameroon, Costa Rica, Hongkong, Kenya, Mexico, Sierra Leone and Fiji (University of South Pacific). Their content will be of interest as follows:

Technical consultancy is carried out by all institutes, whereas business consultancy by five out of the nine. Contract research was done by six of the institutes, which answered the questionnaire.

Practice-oriented teaching in the form of sandwich courses (which are carried out partly inside the university, partly in industry) was mentioned by three institutes.

Of great significance appears the observation, that in eight of nine cases the initiative had been taken by the university itself, whereas industry was mentioned four times, the Government only three times as initiator. Management Associations and Development Banks were mentioned only once each, although reference was made to the IDRC in two instances within the correspondence.

Four institutes considered their approach to industrial development formalized. In three cases the Government had issued supporting legislation. The services were remunerated in five out of the nine cases, although in one case the remuneration was said to be poor.

Answers on Questionnaires (total number answering: 9):	Institutes
	<u>marking</u> yes
1) Sandwich courses part of which are carried through in class and part in practical work?	3
2) Technical consultancy assignments?	9
3) Business consultancy assignments?	5
4) Contract research?	6
5) Who initiated these activities?	

	yes
The institute?	8
The Government?	3
The Management Association?	1
The industry?	1
a) Development Bank?	1
6) Are these activities remunerated?	5
7) Has the Government taken legislative steps to foster such activities?	2
8) Have steps been taken to formalize (or institutionalize) the institute's involvement in industrial development?	4



C: DETAILS OF THE REPLIES RECEIVED

As indicated earlier, a total of 24 replies have been received and are reflected here.

LATIN AMERICAN INSTITUTES

COSTA RICA

Universidad de Costa Rica  
Escuela de Administración de Negocios  
Ciudad Universitaria  
Costa Rica, América Central  
Lic. Adonai Ibarra Bejarano, Director

The School of Business Administration of the university has recently introduced a requirement for a "community oriented effort" for graduation, which could be carried out in the industrial field, particularly the small-scale industry. The university as a whole has issued regulations to stimulate the exchange of services with public and private sector companies to spread the results of scientific research and to permit contract research against adequate fees. The university is highly interested in an international exchange of the type envisaged.

GUATEMALA

Universidad de San Carlos de Guatemala  
Instituto de Investigaciones  
Economicas y Sociales  
Ciudad Universitaria  
Guatemala, C.A.  
Adolfo de León L., Director

The institute has carried out some activities in the field of industrial development in general, reports of which can be requested.

GUYANA

National Science Research Council Guyana  
Greater Georgetown  
Guyana  
P.A. Munroe, Secretary General

The Council has founded an Institute of Applied Science and Technology to be located on the campus of the University of Guyana. It

will be its instrument to achieve a synergistic role in the growth of the association between industries and universities. The Government technical institute, which for some time had not been related to industrial development, is now planning to give courses to craftsmen and technicians at certificate level, who must be employed and over 18 years of age. Also the national service programme is mentioned, where students are assigned to work with the NSCR in problems of direct industrial concern such as the development of biogas and of essential oils from local raw material. Funding is seen as one of the major obstacles to the activities in these areas.

The University of Guyana  
Turkeyen Campus  
Georgetown, Guyana  
Maurice A. Odle, Professor

The Institute of Development Studies of the university of Guyana states that industrial consultancy was performed by research fellows in an individual capacity. The institute has just concluded an extensive study of technology in the Caribbean together with the Institute of Social and Economic Research of the University of the West Indies, involving in the industrial area food processing, petrochemicals, motor vehicle assembly, textiles, but also related aspects such as commercialization of technology, environmental consequences of industrialization, as well as general theory of technology and development. The institute is interested in a bibliography of case studies.

The University of Guyana  
Faculty of Technology  
Turkeyen Campus  
Georgetown, Guyana  
P.O. Westmaas, Dean

The Faculty of Technology of the University of Guyana has tested the possibilities of industrial consultancy, but actual assignments have been carried out individually rather than on a faculty level. The faculty is interested in finding an optimum approach to industrial consultancy. The faculty is one of the few, which mentions some of the problems it has encountered in the past, for instance with patent claims when a research contract was about to be concluded. It is active in spreading intermediate and often indigenous technologies in such areas as low-cost building, welding, use of alternate energies, etc. The experience will be issued in the form of case studies by the end of the year - or early 1979.

MEXICO

Universidad de las Americas  
Instituto Tecnológico  
Puebla, Mexico

The university sent the questionnaire specifying non-remunerated technical and commercial consultancy activities initiated both by the university itself as well as by the industry. The Government of Mexico had issued legislation to promote such activities.

Instituto Politecnico Nacional  
Division de Ingenieria y Ciencias  
Exactas  
Mexico 16, D.F.  
Ing. Raul Gonzales Apaolaza, Jefe de la Division

The institute expresses interest in the exchange of experience.

Universidad Tecnológica de Mexico  
Mexico 17, D.F.

The university informs of market studies, project evaluations, etc. which it carries out with its department of management, organization, accounting, financial administration, marketing, micro-economics, industrial relations and tourism.

Universidad Iberoamericana  
Mexico 21, D.F.  
Ing. Jorge A. Corzo, Director

The university emphasizes its activities in adult education for professionals and non-professionals and mentions its recent (since 2 years) activities in consultancy and applied research. It is, however, felt that the scarcity of funds and a certain lack of confidence on the part of the industry are problems to be overcome.

2) AFRICAN INSTITUTES

CAMEROON

University of Yaounde  
Ecole Nationale Supérieure Polytechnique  
Yaounde, Cameroon  
E. Njoh Mouelle, Secrétaire Général

The Ecole Nationale Supérieure Polytechnique of the University of Yaounde sent the filled-in questionnaire, stating that it carries out sandwich courses and technical consultancy activities for instance in maintenance of electronic equipment in black Africa, which are partly initiated by the Institute itself, partly by the Government. Contract research is also carried out against payment of a fee (which is different from the technical consultancy, which was not remunerated) in the areas of electrotechnical equipment and civil works. The Government has taken steps to stimulate these activities. Of particular interest is the subdivision of study time into the categories: theoretical courses, practical assignments and work/study leaves each of which part accounts for approx. a third of the students' time (the courses about 40%, the other two categories 30% each). Of interest in this connection also is the list of subjects at year end (1967).

- Study for a coffee grading plant
- Critical evaluation and presentation of alternative construction possibilities for a bridge and six more research projects in the field of construction industries, involving the use of cement or plywood
- Contribution to the housing problems (low-cost housing) in Cameroon.

Each of these studies was closely followed by a teacher and some of these will be followed by experimental activities this year.

An article on the subject of whether teaching activities should also be involved in applied research comes to the conclusion that introductory training, adult training, training of trainers and applied research should be closely linked.

Of particular interest is the distinction between the training of specialists - where one must focus the activities on a rather narrow subject (as illustrated by the subjects listed above) and the pluridisciplinary training of what is called the university type. The choice between the two depends on the students' - and the Government's - priorities.

#### GHANA

University of Science and Technology  
Technology Consultancy Centre  
Kumasi  
Ghana, West Africa  
Dr. J. W. Powell, Director

The Technology Consultancy Centre of the University emphasizes the need for involvement in industrial development as a natural consequence of the university's role to prepare students for their future positions in society. The centre has mainly assisted small industry in less sophisticated technologies, sometimes with certain innovative elements such as for instance a paper glue made from cassava starch for which a patent application was filed. Jigs and tools for local industries were designed and improvised machine repairs carried through in the absence of spare parts. Pilot plants were established to make soap, caustic soda, paper glue, bolts and nuts, wooden products, hand-woven textiles, small processing plants and agricultural equipment such as water pumps, rice threshers, bullock carts, presses, driers and ovens. Training was carried through in such varied areas as weaving, soap making, welding and capstan lathe setting.

Also the suppliers and consumers markets were studied. Emphasis was given to the use of local raw material and skills.

The initiatives normally arise out of problems brought to the centre by Government departments, public and private industries, individual craftsmen or farmers, cooperatives or village development committees. Members of any faculty of the university can become involved in the problem-solving process.

About 20% of all projects are carried through against a fee.

A very interesting function of the centre is the follow-up activity, for which a special programme was devised: For this purpose young graduates of the university become trainee project managers in their field

of competence (for instance metal products or agricultural extensions) with a task of coordinating between the consultant (for instance a teacher of one of the faculties) and the client (for instance a public or private firm) to ensure follow-up and implementation. These trainee project managers are encouraged to study for a post graduate diploma in industrial management.

The centre employed in 1977:

Six senior staff

Eleven supporting staff

Fourty trainers (part time)

Twenty technicians and machinists in a workshop

Its development is impressive and more than half its income has recently been derived from earnings of its production units. Income from these has almost doubled every year during the past three years.

After five years of operation, the centre has gained acceptance and interest within the academic community, although only a minority of teachers (10% of the 300 professors and lecturers) have been involved in the centre's activities plus another percentage of the teaching staff, which has carried out individual consultancy work. The initiative now comes from interested students who want to be associated with the centre's activities.

#### KENYA

University of Nairobi  
Faculty of Engineering  
Nairobi, Kenya  
Prof. Rajni P. Patel, Dean

The Faculty of Engineering has had a substantial record of technical consultancy and applied research assignments to industry and the Government. It has also been involved in business consultancy. It owns well-equipped laboratories and good workshops. Sometimes, these activities, which are generated by the institute itself, the industry or the management association, are remunerated. To formalize its endeavour, an industrial Research and Consultancy Unit has been established in cooperation with UNDP and UNIDO. The areas of immediate interest are the following:

- 1) More appropriate technologies for several small-scale manufacturing processes (mechanical, electrical, chemical,

food processing, furniture, etc).

- ii) Prototype of agricultural implements and equipment.
- iii) Prototype of equipments and processes utilizing solar, wind, water, geothermal, chemical (e.g. methane and alcohol) and other local sources of energy.
- iv) Designs of low-cost buildings using local materials including design of farm structures.
- v) New uses of local materials (bentonite, pumice, sisal, soap stone, etc.).
- vi) Prototype equipment and structures for water raising, storing and transporting.

The unit also aims at the development of local arts and crafts (wood carving, textiles, ceramics, etc.) and will also carry out studies of production methods in various industries using alternative levels of technology. It will provide specialized testing services.

### MAURITIUS

The University of Mauritius  
Reduit  
Mauritius

The University, specifically its School of Industrial Technology, has assisted industrial free zone factories with regard to the choice of process technologies and by carrying out industrial consultancy assignments.

It specializes furthermore in research in the area of cane sugar technology.

### NIGERIA

Ahmadu Bello University  
Department of Economics  
Zaria, Nigeria  
Prof. G.M.K. Kpedekpo, Ag. Head of Department

The University has carried out a survey of small-scale industry in several Nigerian states. Some of the findings were indicative of world-wide phenomena such as the concentration of industrial activity (particularly also small-scale industry) in metropolitan areas and larger communities (80% of small-scale industry income of Kano state is generated in the Kano metropolitan area where 64% of the 6383 small-scale enterprises of the state are located).

The types of activities of these enterprises are tailoring (39% of all firms), bicycle repair (10%), carpentry (7%), blacksmiths (5%), motor vehicle repair (4%).

There are practically no small-scale firms (capital less than \$80,000 with 1-50 people employed) among the companies producing manufactured goods.

The study points to the necessity to foster the development of small-scale industry as a means of generating employment and counteracting the migration to the cities.

It states that most of the industrial growth in the past had been in the field of large-scale industry.

University of Benin  
Dept. of Chemical and Petroleum Engineering  
Benin City, Nigeria  
Prof. G.N. Bhat

The University emphasizes the necessities of institutes of higher education for:

- Laboratories for technical analysis of local raw materials
- Applied (laboratory) research **for local industry**
- Pilot plants for engineering laboratories
- The encouragement of industrial consultancy
- On-the-job training of students who must be prepared **for such** training by the university. **Use of industrial facilities for final year projects of students**
- Teaching by experienced engineers
- Vacation work of teaching staff in industry

#### SIERRA LEONE

University of Sierra Leone  
Fourah Bay College  
Freetown, Sierra Leone  
Eldred Jones, Principal

The Fourah Bay College of the University sent background material from its Faculty of Engineering, the Department of Mechanical Engineering, Physics, Chemistry, Geology and Botany.

The Faculty of Engineering houses an Advisory Services Unit through



which professional contacts with industry and Government are channelled. It has the only materials research centre in Sierra Leone and provides technical and consultancy services in the following fields:

- a) Design and manufacture of machine components suitably adapted for local operation conditions.
- b) Design, development and manufacture of machines which can be utilized in small-scale industries such as cooperative farms. Examples of the units' work in this field include the development of palm-oil presses, solar water heaters, a palm nut cracking machine and an electrocane water heater (for domestic use which takes in kerosene as input fuel converts it into gas which is then utilized for combustion).
- c) Introduction of local materials into all classes of building construction.
- d) Evaluation and development of inventions.

Some of the current activities of the unit include:

- i) The development of new power sources.
- ii) Development of first stage industries utilizing raw materials such as bauxite and iron ore and even certain classes of agricultural products.
- iii) The development of invention - using local talent and materials to improve original local inventions to the stage of where they would be commercially productive. The encouragement of indigenous entrepreneurship for taking over the production on a large scale.

The results of research and other work carried out in the Unit are published in its Engineering Research Publication (ERP) series.

The Department of mechanical engineering also works through this Unit but in addition also works on projects for manufacturing industries, Government institutions and mining companies. Usually a nominal fee is charged.

The Department of Physics lists a research project in the use of nuclear techniques for mining purposes.

The Department of Chemistry carried out projects in the following areas:

- a) Investigation of the quality of sands in the beaches in the Western area with a view to their utilization for making glass. The initial investigation has been completed with very encouraging results.
- b) The chemistry of gara and tie dyeing with a view to improving or optimizing the local processes currently used.
- c) Pulp and paper making from local grasses and local woody materials.

The department now and again undertakes when requested specific short-term

activities for industrial concerns and outside bodies. Such requests generally involve testing the quality of products and materials, for example analysis of water samples, oil samples and perfumes, investigation of the levels of contamination in imported materials, the quality of the air in holds of shipping vessels, etc.

Some **two** years ago this department prepared and piloted through a paper giving details of a programme for post-graduate training, research and development of natural resources and industrial applied chemistry. One of the areas of activities envisaged for such an institute was in the establishment of small-scale chemical industries applied to natural resources, studying materials from quality and quantity aspects in accordance with the relevant needs of Sierra Leone, and in the setting up of various small-scale manufacturing pilot plants.

The Department of Geology has been involved in exploratory projects, structural mapping and other important activities which are, however, by their nature only indirectly related to industrial development.

The same is true for the Botany Department, where however the view prevails that its advisory services could be useful in the food industry (canning of fruits and fish, bottling of drinks), pharmaceuticals, routine water quality control and micro-biological tests.

All departments are in favour of setting up an all-embracing - formalized - centre for training, research and development in the context of industrial development inside the university.

#### TANZANIA

University of Dar es Salaam  
Economic Research Bureau  
Dar es Salaam, Tanzania  
R.B. Mabele, Director

The Economic Research Bureau of the University has been involved in assisting the Government in determining its industrial development strategy. It has furthermore carried out feasibility studies.

Recently, an industrial and scientific organization was set up for the purpose of making Tanzania self-sufficient in industrial consultancy. The Government has followed a policy of involving the university also in this new organization by appointing the Director of the Economic Research Bureau as well as the Dean of the Faculty of Engineering to its board of directors.

3) ASIAN - FAR EASTERN AND PACIFIC INSTITUTES

HONG KONG

University of Hong Kong  
Faculty of Engineering and Architecture  
Hong Kong  
Y.K. Cheung, Dean

The University is currently considering setting up a small industrial liaison office to formalize the role of the University in the industrial development of Hong Kong.

Individual members of the University have since considerable time carried out industrial consultancy activities in such areas as technical and business consultancy as well as contract research. The initiative was taken partly by the University staff, partly by the industry and they have normally been remunerated.

The University expresses an interest in an international exchange on the subject.

INDIA

University of Bombay  
Department of Economics  
University Campus  
Bombay, India

The Centre of Advanced Study in Industrial Economics and Public Finance of the University has basically worked on such macro-economic topics as Industrial Policy and Planning, Industrial Structure, Monopoly and Concentration, Wage Policy and Wage Determination. Research projects are also carried through in the fields of:

- a) Economics of scale in Indian Manufacturing Industry
- b) Incentives for small-scale industry
- c) Study of octroi for the Bombay Municipal Corporation

which are financed from outside resources such as the Indian Council of Social Science Research (a), the Industrial Development Bank of India (b), and the Municipal Corporation of Greater Bombay (c).

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## PHILIPPINES

University of the Philippines  
Quezon City, Philippines  
Onofre D. Corpuz, President

The University expresses **great** interest in the exchange and will supply background material after having obtained the respective reports which will then be communicated in a later circular.

The University has an Institute for Small-scale Industries as well as a College of Business Administration, where the respective information from other universities would be considered useful.

## SOUTH PACIFIC

The University of the South Pacific  
Centre for Applied Studies in Development  
Suva, Fiji  
Derek Medford, Director

The recently created Centre of Applied Studies in Development, which is supported by eleven small Pacific Island countries, has carried out two important studies on topics related to energy production (solid fuel technology) and consumption. Another techno-economic study related to the possible effect of high fructose corn syrup on the world sugar market. A multi-disciplinary crash programme was carried out by nineteen university experts for a country review and problem analysis for Fiji, covering, among many other aspects, also the country's industry.

A comprehensive environmental management programme involved the centre in the coordination of efforts to define the locally appropriate environmental development including the potential role of industry in this context. The Fiji Central Monetary Authority has contributed to the centre's work on the problems of Development Banking and Monetary Economics, and the two organizations have jointly staged a seminar on "Business Development in the South Pacific Social Context."

Sponsored by the IDRC, the urban rural food distribution systems were subject of a special university research programme. As pointed out in UNIDO's paper "Stimulation of Industrial Development through modern Management of Distribution", distribution systems are a prerequisite to industrial development.

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Altogether, the Centre has been involved in technical and business consultancy assignments, <sup>and</sup> contract research. It has furthermore carried out, sandwich courses.

Initiatives came from the Centre itself, the Government and the Fiji Development Bank.

The activities are - although often poorly - remunerated.

Problems encountered are financial and sometimes attitudinal. One of the main stated purposes is to permit the training of technology managers at home.

### THAILAND

Khonkaen University  
Development Planning Section  
Khonkaen, Thailand  
Vira Chankong, Secretary

The University is in the **process** of establishing a Regional Adaptive Technology Centre for the north-eastern region of Thailand, where there is a scarcity of industrial plants and where those factories, which do exist, do not have access to consultancy capacity for non-routine problems.

Economic incentives followed by training of qualified personnel, technical and industrial consultancy services as well as research for the acquisition and adaptation of technology is required in the area. A further possible activity of the centre is seen in the identification of promising industrial (agro-industrial in particular) ventures and their promotion among Government and private agencies (by documents, seminars, study tours, workshops or short courses).

Khonkaen University  
Faculty of Engineering  
Khonkaen, Thailand  
Dr. K. Prabripataloong, Chairman

The Faculty of Engineering specifies the training aspect further:

- quality control
- production planning and control
- production management
- industrial pollution and advice on
- new adaptive or appropriate technologies for better production efficiency of industries

The collection of data on available natural resources, the preparation

of feasibility studies for industries utilizing these resources are further suggestions. There is also an indication of interest in setting up an industrial development plan for the region, utilizing available data about various resources and known technologies.

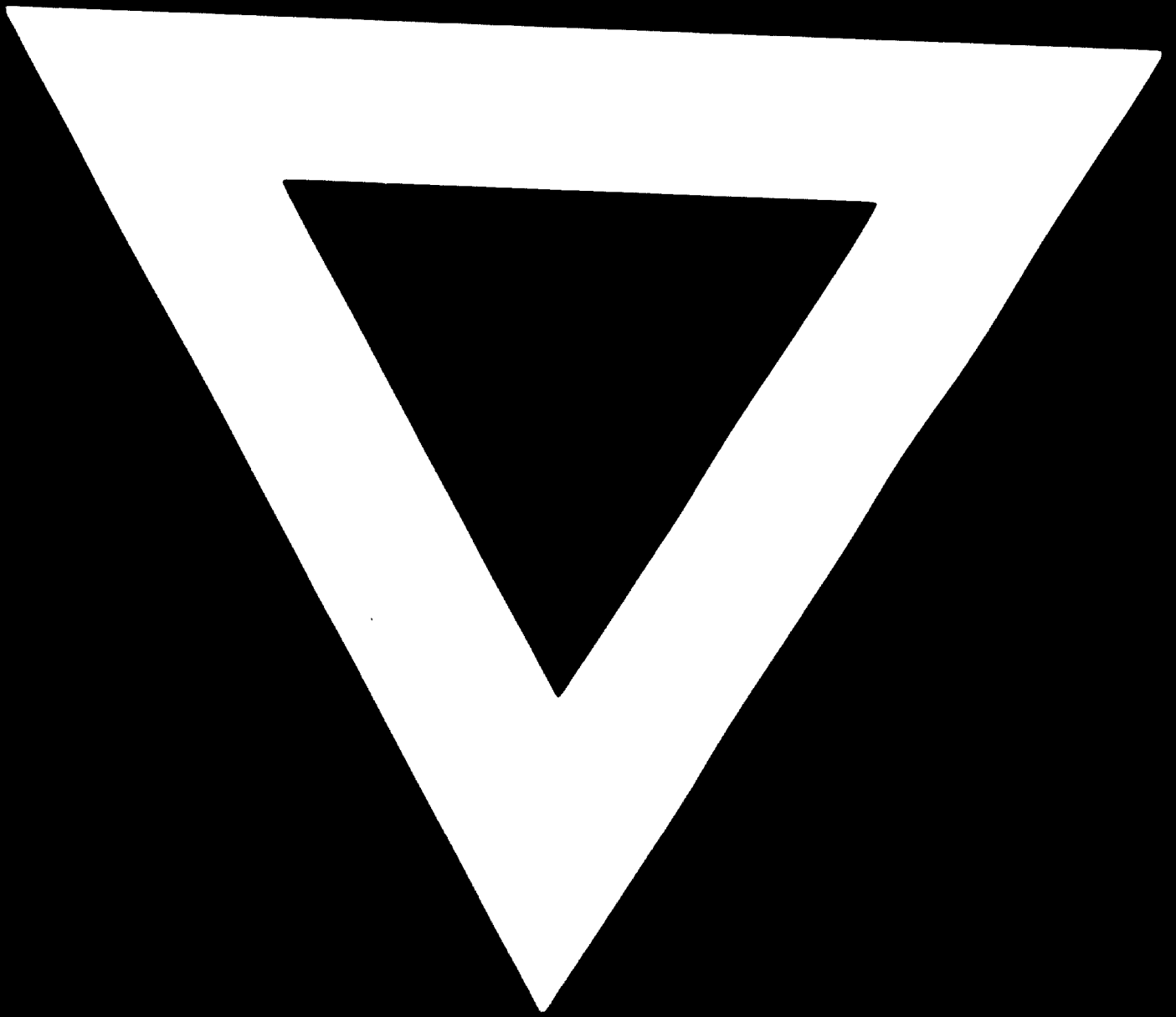
Ramkhamhaeng University  
Faculty of Business Administration  
Huamak, Bangkok, Thailand  
Prof. Paibool Suwanposri, Dean

The University has recently (in 1976) established a Department of Industry services, the objective of which is to spread technical knowledge of industrialization to the students and to carry out research projects for industrial development. There is a substantial interest on the part of the Faculty in the ongoing exchange.

Also, this University is interested in the exchange programme and offers to communicate more details on the subject at a later date.



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