INDUSTRIAL RESEARCH PROGRAMS IN PUBLIC UNIVERSITIES, WITH EMPHASIS ON THE UNIVERSITY OF THE PHILIPPINES *

By

JAIME C. LAYA**

Two basic questions arise in connection with the role of public universities in industrial research. First, what type of industrial research should public universities undertake; and second, what activities can be included as part of industrial research?

Industrial research is of course conducted by private companies themselves, industry associations, consulting firms and professional research organizations, government agencies and schools—both public and private. A definition of the ideal division of labor between these entities would be beyond the scope of this paper, but on the basis alone of the fact that public universities receive a certain amount of support from taxpayer funds, it would be logical to assume that probably the bulk of its research effort should be directly linked to the society's problems. As noted by a group of educators, the public university "... has the responsibility to use knowledge to help solve the problems of the citizens which support it."[1] The importance of industrial research in public universities thus follows directly.

---

* Paper read at the Industrial Research Workshop jointly sponsored by the National Science Development Board (NSDB), Council for Economic Development and the Economic Development Foundation, held in Baguio City, January 26–February 1, 1969.

The assistance of Prof. Rodolfo M. Casiple of the College of Engineering, Mr. Dominador G. Faustino of the Forest Products Research Institute (FPRI) and Prof. Emmanuel Tamesis of the Department of Geology and Geography, all of the University of the Philippines, is gratefully acknowledged.

** Professor of Finance, University of the Philippines College of Business Administration.

[1] John A. Hannah *et al., A Study of the University of the Philippines* (Quezon City: University of the Philippines, 1958), p. 4.

A detailed definition of the scope of industrial research is likewise beyond the scope of this work, but consistent with common usage, it is considered for present purposes to comprehend all kinds of research in all disciplines that are of use to industry. As such, the definition would include research on type and quality of output, production methods and systems, marketing problems and possibilities, financial requirements, human behavior in industrial organizations and all other areas of management in industry. Excluded, however, are research projects in agriculture which nonetheless are often relevant for industrial purposes.

The University can do research in any or all of several capacities. University research institutes may have programs of research covering broad areas of knowledge and not necessarily undertaken for purposes of immediate use. Research programs would be geared, rather, towards the accumulation of a body of research findings essentially as an end in itself. Individual faculty members may do research as a scholarly exercise, as part of his teaching preparation or as consultant to government agencies or private industry, and in some instances, even as part of the school's extension and community services—to service, for example, certain routine needs of industry such as conducting analyses of materials.

University research in the Philippines is of course undertaken in practically all disciplines, of which industrial research accounts for a rather small portion. The bulk of the research effort appears to be directed to the natural and the social sciences, mostly pertaining to the former. And of research geared to practical and immediate uses, agricultural research accounts for the lion's share.

This paper surveys the industrial research now being done in Philippine public universities, as well as the potential that would be realizable with the removal of funding and other constraints. Emphasis is placed on the University of the Philippines which, as described in the following section, accounts for most of the research now being done in Philippine public universities.

PUBLIC UNIVERSITIES IN THE PHILIPPINES

There are six public universities in the Philippines. Arranged in order of size, these are as follows: (1) University of the Philippines;

(2) Mindanao State University; (3) Central Luzon State University; (4) Central Mindanao University; (5) University of Eastern Visayas; and (6) University of Northern Philippines. The University of the Philippines is both the oldest and the largest of the six. Its ₱38.9 million budget is almost 13 times larger than the budget of the second largest—Mindanao State University, which expects to spend a total of ₱3 million in 1969. Annex A shows further details of the universities' budgets.

Research is only one of the activities of these universities. Primary emphasis continues to be given to teaching: with varying degrees of emphasis given to programs of community service, student development, faculty development, national and regional development and so on. None of the public universities use a full-fledged system of budgeting and accounting for individual programs. Little effort is made to allocate faculty time, for example, into teaching and research or to identify the portion of the costs of research institutes, which are properly considered as being due to teaching activities. It is impossible, for this reason, to know precisely how much is being spent for research and most other university activities. Data on research projects supported by foundations and other outside sources are also incomplete. However, accepting at face value the figures budgeted for research cited by each school, a figure of 12% is obtained as the portion of university budgets being spent on research.

RESEARCH IN PUBLIC UNIVERSITIES OTHER THAN THE UNIVERSITY OF THE PHILIPPINES

In terms of absolute amounts, the University of the Philippines accounts for about 93% of the research work being done in all public universities. Of the 7% being done in the other five, very little, if any, is devoted to industrial research. Annex A shows research expenditures budgeted by the six universities.[2]

No industrial research appears to have been done at the Mindanao State University (located in Marawi City) prior to 1968. Its College of Engineering, however, started in 1968 on its plan to undertake: (1) quality control studies for industrial enterprises in the Iligan area;

[2] The basic source of this section is Republic of the Philippines, *Budget for Fiscal Year 1969*, pp. 748-67.

(2) hydrological and meteorological studies; and (3) improved low cost rural and urban housing. As noted in Annex A, a total of ₱185,000 has been budgeted for research by Mindanao State.

Central Luzon State University (Muñoz, Nueva Ecija) directs its research effort towards agricultural and has done little or no work directly applicable by industry. Its research program is conducted hand-in-hand with its graduate education program which is mainly in agriculture; and both are expected to entail ₱42,000 in 1969.

The research program of the University of Eastern Philippines (Catarman, Samar) centers on "agro-meteorological research and allied research work in agricultural economics and production." The sum of ₱47,660 is being set aside for the purpose in 1969.

Central Mindanao University (Cotabato) has a research program in agriculture, for which ₱125,000 is budgeted in 1969. There appears to be no plan for industrial research during the year, however.

The University of Northern Philippines (Vigan, Ilocos Sur) anticipates no expenditures on research for 1969.

INDUSTRIAL RESEARCH IN THE UNIVERSITY OF THE PHILIPPINES

For more than fifty years since its founding in 1908, the primary objective of the University of the Philippines is "advanced instruction in literature, philosophy, the sciences, and the arts," and "professional and technical training." It was only in January 1961 that the University officially announced a second objective: "to encourage and undertake research and contribute to the growth and dissemination of knowledge."[3]

Research received substantial emphasis during the term of former President Carlos P. Romulo, who announced:

> Parallel with the growth of the graduate program and exceeding it where community needs dictate, research activity shall

[3] Guadalupe F. Ganzon, *Research: Reappraisal and Rededication; Papers and Proceedings, 1966 U.P. Faculty Conference* (Quezon City: University of the Philippines, 1966).

> be intensified in all units, and, if necessary, in local centers or new institutes to be established for the purpose. Expansion is to be effected by an over-all increase of funds alloted for research, establishing of research iinstitutes and centers, provision for research professorships and instructorships, occasional relief from teaching, the recognition of the status of the researcher, and an adequate incentive plan. . . . Highest priority for research grants will be assigned to projects that relate closely to social and economic plans for development of the government.[4]

In line with this policy, research expenditures of the University have quadrupled from ₱2.6 million in 1962 to ₱10.3 million in 1967. These figures include total expenses for research institutes (such as the Institute of Economic Development and Research (IEDR), the Institute of Asian Studies, the Philippine Eye Research Institute and others, most of which, as previously noted, also conduct some teaching work), and research support received from outside sources. The NSDB and the Ford and Rockefeller Foundations are among the outside sources of research support.

In addition to obtaining and otherwise providing for financial support, the University has devoted resources for the development of research personnel, the expansion of research facilities, and the maintenance of the necessary administrative machinery. These are discussed below.

Research Manpower. The pool of trained manpower in the University of the Philippines is the largest by far in the Philippines; of the 2,046 full-time members of the Faculty in 1968, there were 199 Ph.D.'s, 575 Master's degree holders and 390 holding the degrees of M.D., LL.M., D.V.M. and D.D.M. More than one hundred moreover, were then engaged in graduate work both here and abroad. Technicians and administrative staff numbered 531 in 1968. While the existing Faculty-student ratio of 1:8 still requires normal teaching load to be 12 to 15 hours a week, reductions in class work are possible and now more frequent, to allow time for research.

---

[4] *University of the Philippines: 1967* (Quezon City: 1967), pamphlet.

Facilities for Research and Publication. The inauguration on April 24, 1968, of the UP Computer Center provided one of the most significant boosts to research at the University of the Philippines. Only a limited number of desk calculators had previously been available for research purposes, posing a major limitation that was finally overcome with the installation of an IBM 360/40 acquired with Ford Foundation assistance. Technical details of the UP Computer Center equipment are in Annex B. The computer's capacity is already inadequate for certain uses; a further increase would of course result in greater research capability, and, allow the installation of a time-sharing system probably sufficient for most large-scale computing needs in the Philippines. The minimal amount thus required is being proposed for Science Fund assistance.

The University Library system consists of over half-a-million volumes that, while relatively small compared with libraries abroad, has nonetheless been described as the best in Southeast Asia. Of direct relevance to industrial research is the availability of about 16,500 volumes in the Engineering Library, 14,000 in the Business Library, 7,600 in the Economics Library, 2,300 in the Geology and Geography Library and various other specialized collections.

The dissemination of research findings is one of the functions of the recently established University of the Philippines Press. Founded with Rockefeller Foundation assistance, the Press has the basic aim of providing "a concrete and deliberately conceived facility for the encouragement, publication and dissemination of scholarly, creative and scientific volumes, monographs and tracts (which) commercial publishers would not ordinarily undertake to publish." No work which might be classified as being the result of industrial research has been published by the Press thus far, however.

Academic units of the University also have their own publishing programs, mainly the issuance of periodicals that often contain articles of interest to industry. These include the *Natural and Applied Science Bulletin, The Philippine Review of Business and Economics, Philippine Journal of Public Administration, The U.P. Engineer, Forestry Leaves, Philippine Law Journal* and the *Philippine Journal of Veterinary Medi-*

cine. Only the last three regularly include materials concerned with production problems and techniques. The other journals ordinarily contain materials useful for planning, marketing, financing, managing and other activities of industrial organizations.

Research Financing, Administration, and Compensation. The University's general funds (obtained from student fees, the national government contribution, net earnings of business units) have been tapped for research expenditures. Extensive support has also been received from foundations and other outside sources. The Ford and Rockefeller Foundations have shouldered large chunks of research costs, as have the NEC, the AID, the SSDB, national government agencies and other sources both local and foreign.

A large part of the University's research funds are allocated by four research councils: (1) Natural Science Research Council (NSRC); (2) Social Science Research Council (SSRC); (3) Community Development Research Council (CDRC); and (4) Labor Research Council (LRC). Funds provided by general University sources and from various other agencies such as the Presidential Arm on Community Development (PACD), the Department of Labor and others are allocated by these Councils.

Coordination and administration aspects of projects supported by the NSRC and the SSRC are undertaken by the Office of Academic Services, which is responsible to the President (through the Assistant for Academic Affairs). Projects of the CDRC are conducted by the Council itself through its Chairman—a practice also adopted by the LRC.

Research projects are also financed and undertaken directly by academic units of the University. Most colleges and research institutes provide for research programs in their regular budgets or with grants specifically secured for the purpose.

Research work is still often considered as extra work deserving extra compensation, either in terms of reduced teaching load or in terms of research honoraria. Unlike the practice of many schools in the United States, for example, the basic salary of faculty members in the University of the Philippines covers a full 12-month period. In some

American schools, faculty members get a nine-month basic salary and are given the opportunity to earn another three-months' salary by rendering extra work in research, summer programs and so on. A built-in incentive for contract research work thus exists. No book reimbursements are made, either, to compensate the University for any teaching load reductions. Instead, grants sometimes provide for honoraria and is paid to the researcher involved.

INDUSTRIAL RESEARCH PROJECTS SUPPORTED BY UNIVERSITY RESEARCH COUNCILS

A quick look at the grants made by the four research councils shows that of the 173 projects and project renewals supported by the NSRC and the SSRC over the academic year 1966-1969, only 19 seem to be of direct industrial significance. Of these 19, only a handful are directly concerned with industrial production problems. CDRC projects show a similar orientation away from industry, although by its nature LRC research is related to industry.

In terms of relative emphasis, NSRC and SSRC projects related to industry account for 13.86% of total project grants during the three-year period. Major grants made by the two councils include the following: (1) evaluation of the potential uses of Philippine coals for the metallurgical industries; (2) assessment of heat stress in some industrial operations; (3) studies on the utilization of local phosphate deposits for fertilizer manufacture; (4) RP-US tariff relations; (5) sociological-anthropological studies of selected communities in metropolitan Manila; and (6) solvent extraction of thiocyanate, chloride, cynanide, bromide ion and so on.

The CDRC was established to support investigations meant to facilitate the implementation of the Philippine Community Development Program (PCDP), and, has already published the results of 26 of its investigations. Only one of these, however, *The Ready-Made Clothing Industry in Minglanilla,* by Rev. Fr. Richard Arens, S.V.D., appears to be also classifiable as industrial research.

The LRC was created to assist the Asian Labor Education Center (ALEC), a unit of the University, in its research program. Council re-

sources have so far been devoted to a long-range study of the labor movement in Asia and a study of the Philippine labor situation. The latter study covers in detail "the status of the Philippine labor force, distribution, occupational composition, migration, utilization, mobility, manpower requirements of key industries, and wage and incentive structures."

INDUSTRIAL RESEARCH IN SELECTED ACADEMIC UNITS OF THE UNIVERSITY OF THE PHILIPPINES

1) *The College of Engineering.* Most of the research in the College of Engineering is being done under the auspices of the University of the Philippines. Industrial Research Center (UPIRC), which was established in 1954 to extend "assistance to industry, government entities and the general public in terms of technical and specialized services not available elsewhere in the country." These specialized services include research investigations and consulting work.

Members of the faculty and technical staff of the College of Engineering are simultaneously staff members of the UPIRC, with research and other projects being staffed in accordance with project requirements. Clients are charged all direct costs: including researcher honoraria, and a contribution to the College's overhead—the latter representing depreciation and other general costs.

The laboratory facilities of the College are open to UPIRC undertakings: these include facilities for materials testing, soil mechanics, sanitary engineering, chemical engineering, electrical engineering, mechanical engineering, physical metallurgy, ore dressing and extraction, metallurgy and hydraulics. The College also maintains machine, welding-and-force, wood-and-pattern and foundry shops.

Equipment is thus available for testing structural materials, soil investigations, photoelastic studies, experiments in unit operations, heat transmission, unit processes, hydraulics, electronics, circuit analysis, nuclear instrumentation, metallography, ore dressing and extractive metallurgy, fuel testing and so on. The machine, wood and welding shops are equipped for the fabrication and erection of needed experimental apparatus.

The bulk of the work being done by the UPIRC consists of materials testing mainly for the construction industry. However, it has done a wide variety of work as may be seen in Annex C.

UPIRC acts on the basis of inquiries received from outside agencies or individuals. It shies away, as a rule, from projects that may compete with professional engineering practice. The lack of internally activated researches is due partly to a lack of more specialized equipment and funds for operating expenses, as well as to the attractions of professional consulting work which compete heavily for faculty time. A particularly noteworthy need exists for a structural dynamics laboratory the lack of which prevents much-needed studies of the effects of earthquakes, typhoons and other dynamic factors on buildings and other structures.

A long list of research projects potentially useful to industry has been shelved for at least these major limitations. Judging alone from faculty qualifications (32 Master's degree holders, three Ph.D.'s and more to arrive), the yield of additional research funding is potentially great.

2) *Forest Products Research Institute* (FPRI). A semi-autonomous unit within the University of the Philippines, the FPRI was established in 1957 as a consolidation of the former Forest Products Laboratory and Forest Products Research Section of the Bureau of Forestry. The Institute was created within the University with the thought that coordination with the UP College of Agriculture would be thereby facilitated.

The general purpose of the FPRI is to conduct research on the 3,800 species of Philippine woods—geared mainly towards the problems and needs of the logging, lumber, plywood, pulp and paper, construction, handicraft and other wood-processing industries. As presently organized, the FPRI has five technical divisions, each pursuing a delineated research program:

a) The Chemical Investigations Division is responsible for research on the pulp and paper-making qualities of wood, as well as its chemical composition and other properties in order to determine suitability for various uses. Thirty research projects are currently being undertaken by the Division: including the chemical analyses of hardwood, bamboo, cogon and various other agricultural fi-

brous materials. Also being studied are the chemistry of cellulose, hemicelluloses and lignin from Philippine woods; and the production of charcoal and tannins. Direct industrial application occurs in the Division's studies of the pulp- and paper-making possibilities in Philippine wood species: including the chemical properties, production processes and other aspects of pulp and paper-making.

b) The Industrial Investigation Division is in general responsible for research on the mechanical properties of wood, and for the comparison and evaluation of different species of wood with regard to their behavior during processing operations. The 27 research projects currently undertaken by the Division find direct use in the wood industries. Among the projects being currently undertaken are technical and economic surveys of veneer and plywood mills, studies of wood wastes, alternative veneer-cutting techniques, the effects of alternative ways of veneer drying and gluing, plywood exposure tests, problems in timber lamination, the identification of wood varieties for specific industrial purposes, the machining properties of Philippine woods and the bending and finishing properties of selected woods. Technical aspects of logging and lumber manufacture are also part of the Division's work.

c) The responsibility of the Timber Physics and Engineering Division covers investigations and studies on the mechanical and physical properties of all Philippine wood species, with respect to structural uses and reliability in construction and manufacture of wood products. Thirty-two research projects are now being undertaken by the Division most of which are directly useful to the construction industry. The strengths of various types of woods used for joints and fastenings are being studied, as are the design and testing of structural members and building components such as trusses. The stresses of structurally important Philippine woods are being investigated along with alternative ways of housing construction and prefabrication. Packaging materials using Philippine wood and fiberboard are also being studied for durability and strength.

d) The 36 projects being undertaken by the Wood Preservation Division deal with types of seasoning processes and mechanics, wood-moisture relationships, wood preservatives, resistance to fire and insects and studies of wood-decaying fungi.

e) The Wood Technology Division (26 projects) studies wood anatomy as an aid in wood identification, the suitability of specific woods for veneer-and-plywood manufacture and ways of utilizing minor forest products.

While nominally under the supervision and control of the University of the Philippines, the Forest Products Research Board serves as the governing body of the Institute. The Board is chaired by the Director of Forestry; and the Dean of the UP College of Forestry is an ex-officio member. The research program of the Institute is determined by the Board with the assistance of wood-using industries, which are periodically invited to fill out questionnaires on possible research projects.

The annual expenses of FPRI amount to ₱1.1 million and its full-time staff numbers about 230. Funds are appropriated by Congress separate from the government contribution to the University of the Philippines and are not included in the amount shown in Annex A. To supplement its income, the Institute undertakes cooperative projects with individual firms such as the provision of technical assistance in the improvement of veneer production techniques and others.

The Institute publishes its findings in four major report series: *Industrial Reports, Wood Processing News, Technical Notes* and *Timber Series.* Research output is also often published in the College of Forestry publication—*Forestry Leaves;* and in publications of the Department of Agriculture and Natural Resources (DANR).

3) *College of Arts and Sciences.* Research work done in the College of Arts and Sciences are for the most part those previously noted as being supported through the NSRC and the SSRC. In addition to these, however, special note might be taken of the research activities of the Department of Geology and Geography and the Institute of Applied Geology, which assist the mining industries in mineral exploration.

Major research projects now in progress include: (a) geochemical prospecting for copper using arsenic as a tracer; (b) sedimentological study of upper miocene deep-sea sands in Luzon and their application to petroleum exploration, (c) studies on the application of geophysical methods for mineral exploration with emphasis on induced polarization (variable frequency), (d) electromagnetic and resistivity surveys; and (e) copper-gold mineralization and quicksilver deposits in certain areas in the Philippines. These projects are being done without research support in cooperation with private firms or with foundation assistance.

The Department and the Institute maintain laboratories for geochemistry, geophysics, mineralogy, petrology, paleontology, photogeology, x-ray and emission spectrography, ore microscopy and for the preparation of polished and thin sections. Major items of equipment, which are available to industrial users at minimal rents, include induced polarization equipment (sender-receiver generator); an x-ray diffraction and fluorescence unit; an emission spectograph; research petrographic, mineralographic and binocular microscopes with accessories and ancillary photomicrograph equipment; and various types of geophysical and other equipments.

Pure research has been the direction of the work being done at the Departments of Physics and Chemistry, but special mention may also be made of the research program in the Department of Chemistry. Consisting of 8 Ph.D.'s and 10 M.S. degree holders (with 3 more Ph.D. candidates presently abroad), the Chemistry Department has unusual capability for industrial research.

A large number of basic research projects are presently underway, but the major industrial research activity of the Department has been the previously noted work on the evaluation of the potential uses of Philippine coal for the metallurgical industries. A major and continuing project over the past three years, this piece of research has concentrated on the physical and chemical characteristics of different coal deposits in the Philippine—including possible ways of improvement through blending and other ways. Malangas coal has been identified by the Department as being the most promising commercial-sized deposit known. Destruc-

tive distillation has also been tried on coal samples in order to obtain data on possible useful chemical content and other properties.

Research on the utilization of coconut parts has also been done—including studies of ways of oil extraction, the characteristics of coconut shell charcoal and so on. Related work is being done, moreover, in the Department of Agricultural Chemistry in Los Baños.

Among the pieces of equipment available in the chemistry laboratories are: (1) x-ray diffractometer; (2) spectograph, (3) countercurrent extractors (one hundred); (4) polarograph, (5) light photometers, (6) gas chromatograph—and others. A complete radioisotope laboratory is presently in the process of acquisition as a joint Physics-Chemistry undertaking. Other equipments such as an electron microscope are also being purchased.

Hardly any industrial research is being done in the other departments of the College of Arts and Sciences, but the Department of Psychology has undertaken attitude survey projects intended for marketing use of various industrial firms. The Department of Botany is also undertaking a study of the protein content of certain types of algae for possible use as food.

U.P. faculty members are major contributors to learned national journals as well as college publications, which include the *Natural and Applied Science Bulletin (NASB)* and the *Philippine Social Sciences and Humanities Review (PSSHR).*

4) *College of Business Administration.* The Division of Business Research and Publications (DBRP) of the College of Business Administration has been engaged for almost four years now in the development of a body of case material on Philippine industrial practice. The case studies prepared cover marketing, production, financial, behavioral and other administrative aspects of a wide range of Philippine industries.

While basically intended for use as teaching material in its Master of Business Administration (MBA) Program, and for use in other schools and companies conducting training programs, the case studies generally disclose much information concerning institutions and management

practice in the industries covered. The work thus constitutes both research on, and research for, industry.

Also being written are notes on various aspects of business management. A long-range plan includes the possible preparation of industry studies, indicators useful for industrial planning purposes and other pro jects similarly intended to contribute to management practice and decision-making.

The College and the School of Economics jointly publish *The Philippine Review of Business and Economics (PRBE),* which comes out semi-annually. Case materials are publicly available through the Philippine Case Clearing House, Inc. (PCCH), which also acts as a distribution-point for cases prepared by other schools.

5) *School of Economics.* While most of the research done at the School of Economics are intended to be useful at the national planning level, some of the sixty on-goiing or completed research work done in 1967-1968 are also helpful for company planning purposes. Among these are studies on fertilizer distribution, business concentration, credit criteria and various studies of national accounts. On at least one occasion, the School did a study in cooperation with an oil company, resulting in the work *An Economic Survey of the Limay, Bataan Area,* by Amado A. Castro, James A. Storer and A. Cesar Corvera.

6) *College of Home Economics.* The College conducts research in all its departments that include: (a) clothing, home furnishing and crafts merchandising; (b) clothing, textiles and related arts; (c) food and equipment merchandising; and (d) nutrition and dietetics. The food-packaging and textile industries are thus direct concerns of the College's research thrust.

A pilot food plant is operated by the College as part of its food technology program; and is being used for experimentation in the processing and packing of various types of fruit and fruit products, meats and other foods. Major gaps still exist in the College's facilities, however, such as a quick-freezing unit and other specialized equipments which would allow it to do research over the whole range of food processing and preservation.

Facilities for textile research and experimentation are lacking, however, and have been proposed for possible Science Fund financing.

7) *Other Academic Units.* The wide range of industrial needs makes research in other units also relevant for industrial purposes. The bibliographic work being done by the Library, for example, is important in facilitating industrial research as a whole. The research studies of the Law Center on Taxation and Commercial Law are clearly useful not only for municipal and other judges but for industry as well. The studies of the Institute of Hygiene on industrial wastes and toxic material are certainly important to the business community. The College of Public Administration's findings on government practice and policy are useful to the business firm that has to deal with the government and with civil servants. The Colleges of Agriculture (and its affiliated institutes), Veterinary Medicine and Fisheries do research work in the commercial processing of agricultural products (which, as noted earlier, have been excluded from the scope of this paper). The College of Pharmacy does work related to the needs of the drug industry. Studies of the Population Institute, the Statistical Center and the Institutes of Planning and of Mass Communication, are useful in making industrial projections.

A bibliography of the research output of these and other units of the University is published periodically under the title *Research Works and Other Publications of the Faculties*—the most recent one being (regretfully) for academic years 1961-1963.

PROBLEMS AND POSSIBLE SOLUTIONS

On the basis of the number of highly trained personnel in the University, and on the basis of available research facilities, one wonders why the level of research—industrial research in particular—is no higher. The major difficulties used to be and to some extent continue to be: (1) the small appropriation for research operating expenses; (2) the heavy teaching load required of the faculty; (3) the low ratio of research-trained people tied up in administrative and extension work; (4) library facilities, equipment and supplies may be adequate for teaching

but are still inadequate for research purposes; and (5) physical barriers to research, particularly the lack of comfortable and quiet office space.[5]

Solutions proposed have included: (1) additional outlays for research; (2) reducing the student-faculty ratio even more, to relieve more researchers of teaching responsibilities; (3) the adoption of putting greater weight on publications as a basis for promotions;[6] and (4) the improvement of research administration through the creation of an office for a Vice President for Research, the organization of an Industrial Research Council (and the abolition of the UPIRC), a Humanities Research Council, in addition to the NSRC and the SSRC.[7]

Despite recent gains in research appropriations, in the faculty-student ratio, in staff training, and in research facilities, it seems clear that much additional financing is needed to be able to achieve maximum results in industrial research. While funds and facilities cannot by themselves guarantee research output, it appears that much of these constraints remain major ones.

One encouraging, though two-edged development, is the greater involvement of many faculty members in consultation, or extension work with private or public organizations. This is particularly true in the Colleges of Engineering, Business Administration, Public Administration and some units in the College of Arts and Sciences. Consultation work familiarizes the faculty member with local conditions, with the problems facing local industry, and with sources of information. It puts him, moreover, in a much better position to translate into the Philippine setting the principles and theoretical constructs in which he had more often than not been trained. In view of the high salary levels available in industry, one cannot overlook the fact that this opportunity to earn additional remuneration froom consulting work in effect constitutes a fringe

---

[5] Guadalupe F. Ganzon *et. al., "Research Promotion"; University Perspectives: Reports of the President's Ad Hoc Committees* (Quezon City: University of the Philippines, 1963), mimeo.

[6] *Ibid.*

[7] Enrique T. Virata and Augusto Tenmatay, *The Research Set-up in the University of the Philippines; Development and Planning of the University: Papers and Proceedings of the 1964 Faculty Conference* (Quezon City: University of the Philippines, 1965).

benefit. Certainly, the possibility of doing consultation work helps reduce the opportunity cost of a university career.

At the same time, however, outside consultation—unless adequately controlled—cannot help but cut into research time. The competition offered by this more profitable use of a faculty member's time can only lead to a reduction in the priority of university research work.

Funds, of course, offer the basic solution to this problem. Were enough funding available, faculty salaries could be sufficiently raised so as to eliminate or at least reduce the opportunity costs of doing university work—research in particular. Research funds providing for basic investigator salaries, or the allocated portion thereof and other direct and allocable costs would most certainly help in achieving this.

The University of the Philippines is in such a state of development that infusions of relatively small amounts can yield substantial benefits. It seems clear that additional expenditures to improve facilities already available (and in many instances, underutilized) will increase research capability of the country as a whole in an economical manner.

ANNEX A. ESTIMATED TOTAL EXPENDITURES AND RESEARCH OUTLAYS OF PHILIPPINE PUBLIC UNIVERSITIES, FISCAL YEAR 1968-1969*

	Total Expenses	*Research*	*Research as Per cent of Total*
University of the Philippines	₱38,900,000	₱5,050,000	13.0
Mindanao State University	3,066,000	185,000	6.0
Central Luzon State University	1,655,000	unspecified*	—
University of Eastern Philippines	1,076,000	47,660	4.4
Central Mindanao University	1,231,000	125,000	10.5
University of Northern Philippines	606,000	0	0
	₱46,634,000		

* Data from the *President's Budget,* 1969, and from the internal budget of the University of the Philippines.

ANNEX B. ABBREVIATED DESCRIPTION OF THE CHARACTERISTICS OF THE ELEMENTS OF THE CONFIGURATION OF THE IBM SYSTEM/360, MODEL 40 COMPUTER AT THE U.P. COMPUTER CENTER

A 2040 Model F Central Processing Unit with 65K 8-bit bytes memory, decimal arithmetic, floating point arithmetic, storage protection, multiplexor channel, 2 selector channels, and a 1052 Model 007 printer keyboard.

Two printers—one a 1403 Model 002 with 600-line per minute printing speed and the other a 1403 Model N1 printer with 1100-line minute printing speed.

A 2540 Model 001 card read/punch.

A 2821 Model 005 control unit and a 2841 storage control unit.

Two 2311 Model 001 disk drives which provide random access of storage of 7.25 million bytes per disk drive pack.

Four tape drives: a 2404 Model 001 magnetic tape and control unit with 7-compatibility, a 2401 Model 001 Magnetic Tape Unit and a 2402 Model 001 Magnetic Tape Unit. These units have a capacity of handling 22,500 bytes per second, or 45,000 decimal digits per second. Source: Bulletin No. 2 of the Computer Center.

ANNEX C. A PARTIAL LIST OF PROJECTS UNDERTAKEN BY THE U.P. INDUSTRIAL RESEARCH CENTER

1. Compression testing of concrete samples requested and submitted by private and government agencies.
2. Testing of steel bar samples submitted by private manufacturers and building contractors.
3. Soil investigation and soil test analysis for foundation purposes requested by private contractors, government agencies and building owners.
4. Chemical analyses of steel samples.
5. Thermal conductivity determination of plastic materials.
6. Foundry analyses of clay samples.

7. Investigation on aluminum alloy for hardness and tensile strength.

8. Study on the strength of concrete mixed with certain additives.

9. Analysis and investigation of the physical properties of cast iron pipes and asbestos cement pipes.

10. Investigation of sand and gravel for construction purposes.

11. Physical property analyses of cement samples.

12 Adjustment and calibration of high and low pressure gauges.

13. Photomicrograph studies of metal samples.

14. Hardness tests on turbine blades of jet engines.

15. Analysis of the strength of a certain type of roof framing.

16. Calibration of electric current meter equipment.

17. Quantitative determination of the residue of locally manufactured condensers.

18. Capacity and efficiency rating tests of pumps.

19. Electrical resistance tests of a type of dyna-motor.

20. Purification of fish meat for canning purposes.

21. Utilization of coir dust in the manufacture of charcoal briquets.

22. Design and fabrication of a pilot plant for the making of charcoal briquets from coir dust.

23. Spectographic and metallurgical analyses of steel samples.

Source: the UPIRC.