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**PROSIDING LOKAKARYA
METODOLOGI DAN MANAJEMEN PENELITIAN
DALAM-ILMU HAYAT**

**ILMU HAYAT DAN TANTANGANNYA
DALAM ABAD KE-21**



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Editor

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**PUSAT ANTAR UNIVERSITAS ILMU HAYAT
FAKULTAS PASCASARJANA
INSTITUT PERTANIAN BOGOR
1989**

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PENDAHULUAN

ILMU HAYAT MENGHADAPI ABAD KE-21

Bidang pertanian di abad ke-21 diproyeksikan dengan lukisan yang unik. Di balik bertambahnya mulut yang menganga kelaparan, lahan untuk menghasilkan bahan pangan kian menyempit, bahkan tingkat kesuburan-nyapun berkurang. Akibat eksploitasi bahan bakar fosil yang menghebat diiringi eksploitasi hutan tropika basah yang tidak terkendali, CO₂ udara yang meningkat jumlahnya dapat mengubah tatanan iklim dunia. Suhu atmosfer dunia yang naik menyebabkan melelehnya puncak-puncak gunung es di lautan dan meninggikan permukaan laut sehingga luas daratan lahan sepanjang pantai berkurang padahal di situlah hamparan ladang penghasil bahan pangan pada umumnya. Salinitas air makin tinggi sedangkan jumlah air bersih makin berkurang. Ditambah terjadinya polusi udara dengan meningkatnya kadar belerang, CO, metan dan asam-asam lainnya, sehingga situasi pertanian makin bertambah kompleks.

Rakyat negara-negara di belahan bumi utara yang umumnya lebih maju tingkat hidupnya makin meningkatkan konsumsi bahan pangan hewani. Sebaliknya rakyat di belahan bumi selatan, untuk konsumsi pangan yang bersumberkan karbohidrat pun tidak tercukupi. Padahal hanya sekitar 20 komoditi pangan berasal tumbuhan yang dikelola manusia di dunia saat ini.

Pencapaian produktivitas yang tinggi di masa lalu adalah berkat benih unggul dari varietas dengan rakitan genetik yang berpotensi produksi tinggi dengan usaha pemupukan yang intensif. Usaha demikian tampaknya makin menyempit, karena pertimbangan gejala 'levelling off' pada produktivitas, kemampuan produksi pupuk yang tentu ada batasnya, tumbuhnya biotipe baru dalam dunia hama, dan faktor-faktor yang telah dikemukakan tadi.

Timbul pertanyaan bagaimana Ilmu Hayat menghadapi tantangan semua itu? Di sana-sini memang masih terbentuk berbagai positivitas. Seperti pemanfaatan CO₂ di atmosfer yang meningkat kadarnya, eksplorasi sumberdaya hayati, pertanian organik, revolusi plastik, peningkatan ketahanan tanaman terhadap stres, pemupukan daun, pengendalian hama secara terpadu, peningkatan peranan mikoriza, pembenahan pasca panen, dan akhirnya rekayasa genetik. Semua itu teknologi maju dan canggih, yang apa pun maupun bagaimana pun ditentukan oleh manusia-manusia yang menangannya.

Institut Pertanian Bogor, dalam hal ini Pusat Antar Universitas (Inter University Center) yang membidangi Ilmu Hayat bermaksud mengadakan temu pendapat antara para pakar yang menaruh perhatian besar pada bidang Ilmu Hayat. Temu pendapat ini bertujuan untuk mampu merangkum wawasan di bidang Ilmu Hayat yang akan dihadapkan pada keadaan pangan

manusia di dunia pada abad ke-21 mendatang ini. Karena untuk mampu menghadapi tantangan besar itu diperlukan teknologi, sumberdaya hayati, dan juga rangsangan ekonomis, maka temu pendapat yang akan diadakan nanti sedapat mungkin juga akan menggali bukan sekedar masalah-masalah biologis, tetapi juga masalah manusianya dan kualitas yang ada di dalamnya, terikut pula sistim yang akan melayani.

Diharapkan pakar-pakar ternama di negara kita ini dapat menjawab tantangan abad ke-21 dalam Ilmu Hayat. Dengan masukan dari hadirin dalam lokakarya nanti Institut Pertanian Bogor dapat meniti lebih tinggi lagi tataran ilmu di bidang Ilmu Hayat.

Bogor, Desember 1985

Panitia

Negara-negara di belahan bumi utara yang umumnya lebih maju tingkat hidupnya makin meningkatkan konsentrasi bahan pangan bewani. Sebaliknya rakyat di belahan bumi selatan, untuk konsumsi pangan yang bermacam-macam per kapita per tahun pun tidak tercapai. Padahal pada sekitar 20 komoditi pangan berasal tumbuhan yang dikembangbiakan di dunia saat ini. Peningkatan produktivitas yang tinggi di masa lalu adalah berkat penipisan dari varietas dengan rekayasa genetika yang diperoleh melalui rekayasa usaha pemuliaan yang intensif. Usaha demikian tampaknya makin berkembang karena perkembangan gejala "leveling off" pada produktivitas. Kemampuan produksi pangan yang terus ada ditambah, ditambah dengan daya tahan gula darah dan faktor-faktor yang telah dikemukakan tadi.

Terdapat pertanyaan bagaimana Ilmu Hayat menghadapi tantangan ke-21 ini? Di era ini memang masih terdapat berbagai kesulitan. Sebagai contoh, CO₂ di atmosfer yang semakin bertambah, mengakibatkan perubahan iklim, terutama organik, revolusi hijau, peningkatan ketahanan tanaman terhadap stres, pemuliaan dalam pengembangan pangan baru, pemuliaan pangan mikroba, pemuliaan pangan hewan dan akuisisi rekayasa genetika. Semua itu teknologi maju dan canggih, yang pada umumnya penguasaannya pun dituntut oleh manusia-manusia yang bermamfaat.

Institut Pertanian Bogor akan hal ini Pusat Antar Universitas (Inter University Center) yang membidangi Ilmu Hayat berinisiatif mengadakan temu pendapat antara para pakar yang mewakili berbagai disiplin di-nya Ilmu Hayat. Temu pendapat ini bertujuan untuk mampu merangkum wawasan di bidang Ilmu Hayat yang akan dihadapkan pada keadaan panyan

**SAMBUTAN PADA PEMBUKAAN
LOKAKARYA
METODOLOGI DAN MANAJEMEN PENELITIAN
DALAM ILMU HAYAT**

Yth. Saudara Dekan Fakultas Pascasarjana IPB
Staf Pusat Antar Universitas Bidang Ilmu Hayat IPB
Para Peserta Lokakarya
Hadirin yang terhormat

Assalamualaikum W.W.

Pada siang ini kita bersama-sama hadir di ruangan ini untuk memulai Lokakarya berjudul Metodologi dan Manajemen Penelitian Dalam Ilmu Hayat dan Tantangannya Dalam Abad Ke-21.

Sebelum kita mulai menelaah masalah-masalah yang disajikan dalam Lokakarya ini, ada baiknya menengok sejenak kebelakang. Sebagai kita bersama saksikan bahwa perkembangan kehidupan di atas bumi ini telah dipelajari dengan tingkat yang cukup terinci dan sejumlah prinsip-prinsip umum telah diungkapkan. Yang terpenting diantaranya, misalnya adalah prinsip evolusi oleh seleksi alami adaptasi bertahap makhluk hidup terhadap lingkungannya dengan ketepatan yang meningkat oleh mutasi secara acak atau perubahan dalam gene yang telah merupakan sifat yang merupakan perbedaan utama antara makhluk hidup dari benda mati.

Telah banyak dipelajari tentang makhluk hidup dari berbagai aspek. Para ahli anatomi dan taksonomi misalnya telah mengungkapkan berbagai bentuk dan hubungan satu sama lain bagi lebih dari satu juta spesies tumbuhan dan hewan. Bagaimana berfungsinya secara keseluruhan organisme telah dipelajari oleh para fisiolog. Para ahli biokimia telah mengungkapkan interaksi biologi berbagai molekul organik yang menyusun makhluk hidup itu. Para ahli biologi molekuler telah menemukan molekul-molekul yang bertanggungjawab dalam reproduksi dan pewarisan informasi sifat keturunan dari generasi ke generasi yang merupakan suatu bidang yang telah dipelajari para ahli genetika, sebelumnya tanpa melihat pada tingkat molekuler. Hubungan antara makhluk hidup dengan lingkungannya telah dipelajari oleh para ahli ekologi, perilaku dan tumbuhan telah dipelajari oleh para ahli ethologi. Perkembangan organisme yang kompleks dari satu sel telah mengasyikkan para embryolog, sedangkan para ahli biologi evolusi telah mempelajari munculnya organisme baru dari bentuk yang telah ada selama periode geologi tertentu.

Hadirin Yang terhormat,

Perlu kita sadari bahwa perkembangan pengetahuan dalam Ilmu Hayat yang telah di capai selama ini terutama dikembangkan oleh para pakar yang tergugah untuk mendapatkan pengertian tentang hidup dan proses kehidupan itu. Penelitian para pakar tersebut tidak selalu bermanfaat langsung bagi masyarakat umumnya. Akan tetapi bagian-bagian atau potongan-potongan informasi yang dikumpulkan oleh para pakar selama bertahun-tahun itu akhirnya membentuk suatu kumpulan pengetahuan yang sangat luas. Penemuan yang nampaknya tiba-tiba dan spektakuler biasanya dilatarbelakangi oleh ketekunan dan kesabaran kerja banyak orang. Pekerjaan yang dilakukan demi ilmu "murni" dapat pada akhirnya menghasilkan produk yang sangat penting kegunaan praktisnya bagi umat-manusia. Peristiwa demikian ini banyak sekali kita temukan dalam Ilmu Hayat.

Saudara Sekalian,

Sejarah perkembangan Ilmu Hayat menunjukkan bahwa sudah banyak sumbangan Ilmu Hayat bagi kehidupan manusia dan mahluk pada umumnya. Akan tetapi untuk masa yang akan datang Ilmu Hayat dituntut lebih banyak lagi memberikan sumbangannya, oleh karena tantangan masa depan itu lebih besar dan beragam. Pertanian di abad ke-21, misalnya diproyeksikan dengan lukisan yang unik. Dibalik bertambahnya mulut yang menganga kelaparan, lahan untuk menghasilkan bahan pangan kian menyempit, bahkan tingkat kesuburannya pun berkurang. Akibat eksploitasi bahan baku fosil yang menghebat diiringi eksploitasi hutan tropika basah yang tidak terkendali, kadar CO₂ udara yang mengikat dapat mengubah tatanan iklim dunia. Suhu atmosfer dunia yang naik menyebabkan melelehnya puncak-puncak gunung es di lautan dan meninggikan permukaan laut sehingga luas dataran lahan sepanjang pantai berkurang, padahal disitulah hamparan sawah/ladang penghasil pangan pada umumnya. Salinitas air semakin tinggi sedangkan jumlah air bersih semakin berkurang. Ditambah dengan polusi udara dengan meningkatnya kadar belerang, CO, metan dan asam-asam lainnya, menyebabkan situasi pertanian semakin bertambah kompleks.

Rakyat negara-negara yang tergolong dalam kelompok Utara yang umumnya lebih maju tingkat hidupnya semakin meningkatkan konsumsi bahan pangan hewani. Sebaliknya rakyat negara-negara kelompok Selatan, untuk konsumsi pangan yang bersumber karbohidrat pun seringkali tidak tercukupi. Peningkatan produksi selama ini sebagian besar adalah berkat benih unggul dari varietas dengan rakitan genetik yang berpotensi produksi tinggi dengan penyediaan sarana produksi yang intensif. Usaha demikian nampaknya makin menyempit oleh karena gejala-gejala *levelling off* produktivitas, kemampuan produksi pupuk yang tentu ada batasnya, tumbuhannya biotipe baru dalam dunia hama dan faktor-faktor yang telah dikemukakan di atas.

Saudara-saudara hadirin sekalian.

Dengan skenario abad ke-21 seperti tersebut di atas, pertanyaan yang timbul adalah bagaimana Ilmu Hayat menghadapi tantangan-tantangan itu? Dilatarbelakangi oleh pertanyaan tersebut Pusat Antar Universitas Bidang Ilmu Hayat IPB tepat sekali mengadakan Lokakarya ini dengan topik-topik pembicaraan yang mencoba mengarahkan perhatian pakar Ilmu Hayat untuk menyiapkan diri menghadapi tantangan abad ke-21 itu.

Pada akhirnya saya ucapkan Selamat bekerja dan Semoga Lokakarya ini dapat memenuhi tujuannya.

Wassalamu'alaikum W.W.

Bogor, 19 Desember 1985.
Pembantu Rektor I,

SITANALA ARSYAD.

LAMPIRAN

Lampiran 1. Peranan Pusat Antar Universitas Bidang Studi Ilmu Hayat
(IUC—Life Sciences)

GENERAL DISCRPTION

Name of Inter University Center : Center of Life Sciences
Host University : Institut Pertanian Bogor
Address : Jalan Raya Pajajaran — Bogor.

A. GOALS AND OBJECTIVES OF THE IUC

A vast majority of problems facing developing countries, including Indonesia, have, that their solution are known and even practised. However, the problems seems to be that developing countries lack the adequate concept of scientific practise needed to overcome development hindrances. At this point the approach of relevant science should start. Thus in developing countries science must become more relevant with the existing local problems.

Science leaves off where a phenomenon is deemed to have been understood. The application of that understanding towards some specific practical purposes is considered to be the business of technology. Science seeks to "know why" and technology to "know how". For developing countries, a relevant science is that one which does not draw too sharp a distinction between science and technology.

With regard to the contents of a relevant science, one thing that must be resolved, is the amount of emphasis that ought to be placed on basic science in relation to that placed on applied science.

Indonesia, as one of the developing countries, can save considerable sums of money and much effort-and yet go a long way towards meeting her objectives — merely adopting the technology of developed countries, after adapting it appropriately. Instead of conducting each piece of research ourselves, as money saving device, we ought to whenever possible, look up the results of similar research in developed countries.

However, we can not abandon research altogether. We must do of our own — even only to acquire what are needed to understand the results of developed countries research and to be in a position to use such results following the necessary modification.

From this point of view, the primary *goal* of this center, particularly in the field of life science, it seem to be one of preparing the ground of technology borrowed (in the first instance at any rate) from the developed countries and grafted into whatever technology which already exists. Such transfer of technology can not take root unless the relevant part of sicence (in this case life science) are given due emphasis before hand.

To achieve the goal the center principle *roles* are to coordinate staff efforts and to provide facilities and other resources for the improvement of graduate programmes in the field of life science. Other roles of the center

are to develop and establish cooperative activities among universities in conducting research, short courses and other exchange of information.

In considering project impact, that is the degree of achievement of the center goal, as reflected in the above aspects, it will be important to identify the objectives of the center. Accordingly the *objectives* of the center are to improve graduate study programmes and to increase the number of graduate programme outputs in the field of life sciences. The other objectives are to assist and to back up efforts in the promotion of basic science nationally, particularly in the field of life sciences, fundamental as well as applied by way of incountry research and training, and overseas graduate and post-doctoral programmes.

B. SCOPE AND LIMITATIONS.

As money effort saving device, due to the limited funds that will be available, and yet a more fruitfull development can be achieved, the center will limit herself by setting up *The Biology of Renewable Resources* as the thrust and *The Developmental and Functional Biology* as the focus of the center's activities. The strategy of the center is basically *instructional* that is to sustain growth in expending instructional programs in the field of life science and to modernize instructional methods and views to bioscience. In the area of *research* the center will carry out investigations on biological problems of regional as well as national importance. The research activities of the center will be intensified by the study and the establishment of problem oriented projects designed to study major-biological problems systematically. The current level of research will be upgraded into advanced methods to promote the application of existing advanced technology to biological problems.

C. PROGRAMMES TO BE SUPPORTED.

A number of graduate programmes in several fields of study offered by the Graduate School of Institut Pertanian Bogor will be supported by the center. The major studies selected for the graduate programmes are : (1) Morphological and Functional Aspects of Terrestrial and Aquatic Plant; (2) Morphological and Functional Aspects of Terrestrial and Aquatic Animal; (3) Biochemical and Functional Aspects of Biological Compound and Microorganism; (4) Radiation in Biology and Agriculture; (5) Environmental study.

D. SUPPORTING DISCIPLINES.

The execution of the programmes by the center will be supported by the following disciplines :

- (1) Plant Biology :
Botany; Plant Pshysiology; Mycology; Microbiology.
- (2) Animal Biology :
Zoology; Anatomy; Embryology; Histology; Physiology, Pharmacology.
- (3) Biochemistry :
Biochemistry; Enzymology; Vitaminology.
- (4) Biophysics and Radiation Biology
Endocrinology; Physiological Chemistry
- (5) Population Biology :
Genetic; Ecology.

E. INTERNAL ORGANIZATION CHART.

See the following chart.

II. FIVE YEAR PLAN

A. OBJECTIVES OF THE PLAN

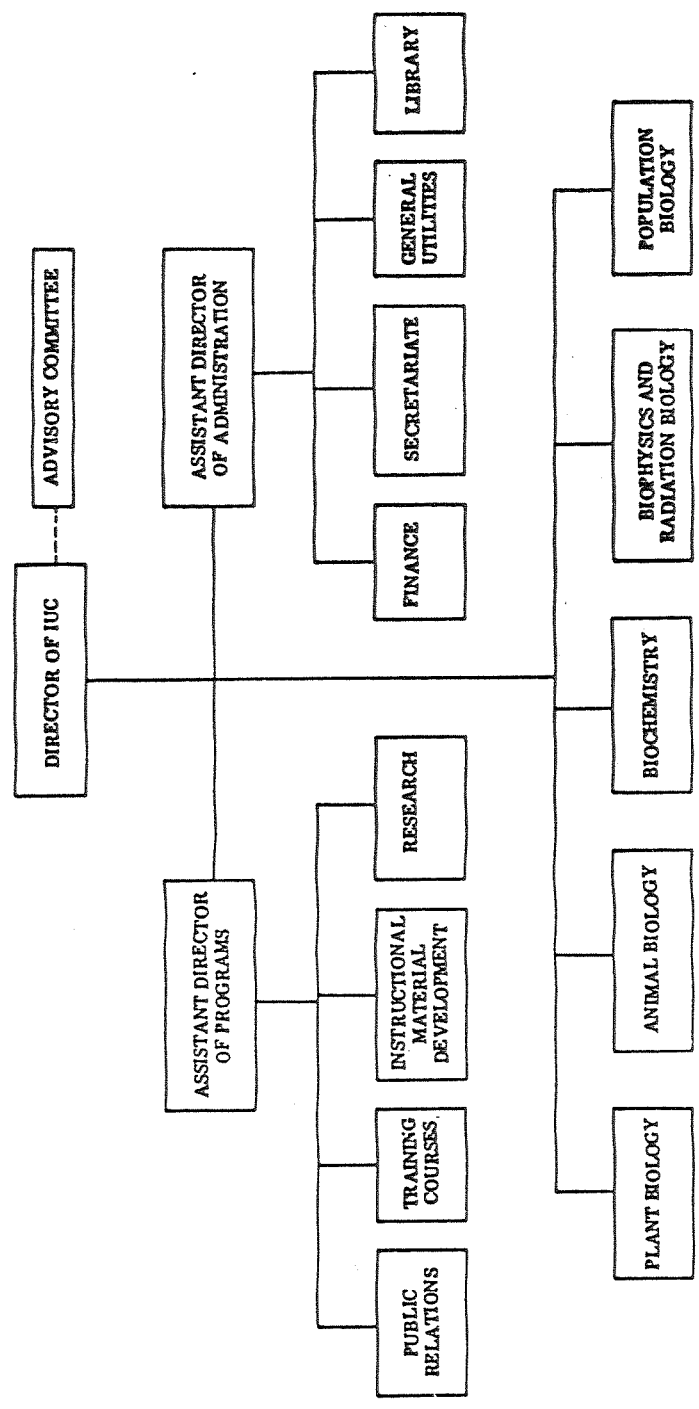
By the end of its fifth year of operation, the immediate aim of the project is to improve the capability of Institut Pertanian Bogor to execute her responsibility in the areas of instruction and reasearch in the field of life science. These will be manifested in the outputs of the center in the form of thesis, dissertation and papers as reflection of the activities in the areas of instruction and research.

The reproduction of instruction materials and manuals and their dissemination to related disciplines in other universities, particularly outside Java, is another aim of the center to assist these universities in their efforts to improve their instruction methods.

A great number of staffs of the categories of supporting staff, professional staff as well as managerial staff will receive additional knowledge by attending several activities held by the center in the forms of seminar, workshop, short courses and internships. Their knowledge obtained by participating in the activities are aimed to help them in their lines of duties.

The investments of equipments, journals and books will become dominant factors in achieving the center objectives, that is to improve graduate study programmes and to increase the number of graduate programmes output in the field of life science in the years to come.

Year: 1985 -- 1990



INTERNAL ORGANIZATIONAL CHART

In numbers the centers activities output are as follows :

Master these (number)	18
Doctoral dissertations (number)	10
Reasearch papers through open grants (number)	25
Laboratories and administrative buildings (m2)	2,415 ¹⁾
Laboratory equipment, valued at (US \$)	1,764,000
Books and and journals, valued at (US \$)	39,000
Granted fellowships (staff year)	89
The center staffing: Managerial staffs (number)	3
Professional staffs (number)	25
Supporting staffs (number)	8
Technicians (number)	15

Hundreds of instructional materials in the forms of course materials, books, monographs, manuals, models and audio visuals will be developed and thousands copies of these materials will be reproduced and disseminated to other universities outside IPB as well.

B. MANAGERIAL, PROFESSIONAL AND STAFF PLANNING.

The development of the staffs of the center is planned with smaller number at the initial year of the operation of the center. The number is gradually increased with the year to cope with the increasing activities of the center. At the first year the recruitment will be taken with the greatest part from the IPB staffs while the following years priority will be given to applicants from other places. Domestic experts will be recruited from various universities. They will be employed to prepare the various instructional material and other preparatory steps for short courses, workshops, seminars and conducting research and training.

Foreign experts will be invited to join the center through advertisement, personal contacts and shopping trips overseas at various institutions. They will be employed according to their terms of reference, either conducting research and training or setting up and run the sophisticated instruments. Fellowships will be granted on competitive basis or will be allocated to specific university teaching staff, with the purpose of motivating research programmes at their respective institutions.

¹⁾160 m2 the amount is allocated for CAL & CITS.

The generation of the centers staffs is presented in the following table:

Staff Position	Year of Operation				
	85	86	87	88	89
Managerial Staff (number)	3	3	3	3	3
Professional Staff (number)	5	10	15	23	25
Supporting Staff (number)	3	5	8	8	8
Technician (number)	5	10	12	15	15
Domestic expert (staff-month)	66	63	63	63	60
Foreign expert (staff-month)	12	9	9	9	9
Fellowship (man-year)	13	23	18	18	18

C. IUC PROGRAMMES.

A key objective of the center is to improve graduate study programme and to increase the number of graduate programme outputs in the field of life science. To achieve this objective the following activities will be conducted during the first five year operation of the center in the area of instruction and research.

The progress and achievements of the project in respect of these activities will be assessed periodically to determine if the activities have been in accordance with the agreed study programme.

- (1) Discipline : Plant Biology
 Programme : Morphological and Functional Aspects of Terrestrial and Aquatic Plant

Activity	Expected Output
(a) Exploration of terrestrial plant	Basic taxonomic data and conservation
(b) Exploration of marine and fresh water plant	Utilization of feed, food and industrial product
(c) Mutant induction	New strain
(d) Toxic and edible fungi	Health and economic
(e) Study of interaction between organism	Biological control

- (2) Discipline : Animal Biology
 Programme : Morphological and Functional Aspects of Terrestrial and Aquatic Animal.

Activity	Expected Output
(a) Behaviour study of wild life	Conservation
(b) Environmental biology	Better life quality

- | | |
|---|---|
| (c) Bionomic studies | Better husbandry |
| (d) Marine and fresh water animal biology | Cultivation of economic varieties (fisheries) |
| (e) Marine bioactive compounds | Utilization of the compounds |
| (f) Study of growth promoters | Utilization in feed |
| (g) Tissue and organ culture | Quantitative and qualitative improvement |

- (3) Discipline : Biochemistry
 Programme : Biochemistry and Functional Aspects of Biological compound and Microorganism

Activity	Expected Output
(a) Study of antibiogenic compound	Food, feed and other uses
(b) Study of biogenic stimulators	Practical utilization
(c) Enzyme assay and preparation	Enzyme application
(d) Molecular biological studies of bacteria, fungi and hormones	New economic strains and health

- (4) Discipline : Biophysics and Radiation Biology
 Programme : Radiation Biology and Agriculture

Activity	Expected Output
(a) Mutation breeding	New and better varieties
(b) Vaccine production	Vaccine against parasites in livestock and fowl
(c) Sterile male techniques	Controlling unwelcome pest
(d) Food irradiation	Prolong food storage
(e) Radiotracer technique in biology	Increasing food production, controlling animal health and providing models for environmental pollution
(f) Biological effects of radiation and electrical current	To gain basic information of the response of animal tissue on radiation and electrical current
(g) Study of biological fluid	Understanding of physiochemical effects on tissues.

- (5) Discipline : Population Biology
 Programme : Environmental Study

Activity	Expected Output
(a) Ecology	Improvement for educational process

(b) Population dynamics	Basic data of species and varieties of plant and animal
(c) Genetic population	Recommendation for natural conservation
(d) Genetic resources	Germplasm collection

D. RESOURCE PLANNING

Planning and development of human resources to implement the centers objectives has been stipulated in the earlier pages. To secure the implementation of the project other facilities such as building, equipments, books and journals are important requirements that should be met. Equipments, books and journals required by the center are listed in tables I/8, I/9 and I/10 respectively.

As in any planning and development several constraints are anticipated. From the past experiences it was noted that equipments and supplies has arrived at Bogor erratically. The order arrival, and interval from placement of order is unpredictable, usually protracted. The period has been up to 9 months or even more. If this happen, it may cause embarrassment to training and research schedule.

The reasons for erratic and protracted delivery are several. The agent may not carry stock when in some cases the origin of the article or goods is not from the country where the agent is domiciled. Forwarding agents may delay the goods in store in order to bulk them, and gain a cheaper freight rate. To solve this constraint permission to order directly to the manufacturer should be requested. Whenever possible orders to well represented brands should be taken place.

Indonesian customs procedures causing an average delay of six months. Administration should test various means to minimize other delays. Usually this can not be done quickly, because in case of certain items some delay in reasonable of manufacture or dispatch factors. A customs clerk should be employed by the center to reduce the delay. A special forwarding agent should be appointed by the central PIU at the DGHE.

Local suppliers are able to supply several items faster at times, but usually only small amounts of the total requirement is available readily in Indonesia. The cost of locally purchased items are consistently about 50% greater. There has been some local resistance to instal equipment purchased over-seas.

The process of building construction, especially for large and big building, in Bogor is usually slow. In order not to hamper the centers schedule activities available space should be fully utilized at the early phase of the programme. Whenever possible rebuilding or renovation plans for existing space or building should be adopted and normal bidding contract procedures should be by-passed.

The outstanding problem with services, especially in the IPB Darmaga campus area, is electricity and water supply. Lack of air conditioning, due to electricity insufficiency, will cause problem in some areas. In the natural tropical atmosphere fungi growth damages the optical systems of scientific instruments. This will increase the maintenance required, and the depreciation rate of the items. Accordingly a sufficient water and electrical power should enter the complex.

E. CONSTRAINTS IN IMPLEMENTATING THE PLAN.

Two main constraints are noted in the recruitments of staffs. First, the normal procedure of staff recruitment is slow. This is mainly due to the small number of vacancy allocated by the State Bureau of Administrative and Personnel Affairs (BAKN). Secondly, foreign language is another problem for most newly graduated staffs. To overcome the first constraint a request for waiver should be taken into consideration and available staffs should be appointed at the early phase of the project. The second constraint can be overcome by allocation of time and funds for intensive training on campus or elsewhere in country or at the place where the training will be conducted. Failure to do so, may cause delay in the preparation of staffs for over-seas training.

Professional staff development is a long process, while project loan is only for 5 years. By the time the critical mass is reached, the project will be terminated. Measures should be prepared to ensure the continuity of the programmes and activities to achieve the maximum benefit for the national development in the areas of instruction and research.

F. PROJECT MONITORING

To ensure the successful of the project, an evaluation may be made at times arranged between, and mutually convenient to, the DGHE-office and the Centers Advisory Committee. Such an evaluation would be undertaken by a joint investigation team appointed by the Director General of Higher Education and independent of staff involved in the project.

Other measures such as annual reviews to evaluate and to review the plan could also be implemented. Periodic reporting by researchers and other IUC activities are other ways to monitor the project progress.

Lampiran 2. Susunan Panitia Lokakarya PAU—Ilmu Hayat

Penanggung Jawab Lokakarya : Prof. Dr. Soewondo Djojosoebagio

K e t u a : Dr. Ir. Wiranda G. Pilliang

Sekretaris — Administrasi : Sutisna Taslim
Wiwid Widiana

Bendahara : Benny B. Lubis, B.Sc.

K o n s u m s i : Linda Ruslinda
Wiwid Widiana

Petugas Pembantu : A g u s
Djayana
Ashari

Lampiran 3. Jadwal Lokakarya PAU—Ilmu Hayat

Kamis, 19 Desember 1985

- 08.00 — 12.00 : Pendaftaran
12.00 — 14.00 : Makan Siang
14.00 — 14.15 : Sambutan dan Pembukaan
14.15 — 15.15 : Penyajian Makalah I
"Manajemen Institutional untuk mendukung ke-
gairahan riset di bidang biologi dan Ilmu Hayat
pada umumnya. Satu tinjauan untuk abad ke-21".
Oleh : Titiek Sastrapradja

Jum'at, 20 Desember 1985

- 08.00 — 08.30 : Penyajian Makalah II
"Peranan Organisasi Profesi untuk Pengembangan
Bidang Ilmu Hayat".
Oleh : Mien Rivai
08.30 — 09.30 : Diskusi Makalah II
09.30 — 10.00 : Penyajian Makalah III
"Peranan Ilmu Hayat dalam Pembangunan Ber-
wawasan Lingkungan".
Oleh : M. Suryani
10.00 — 11.00 : Diskusi Makalah III
11.00 — 14.00 : I s t i r a h a t
14.00 — 14.30 : Penyajian Makalah IV
"Kebijaksanaan Riset di Bidang Ilmu Hayat dalam
Pandangan Global maupun Nasional Indonesia".
Oleh : Dodi Tisna Amidjaja
14.30 — 15.30 : Diskusi Makalah IV
15.30 — 15.45 : I s t i r a h a t
15.45 — 16.15 : Penyajian Makalah V
"Peranan Ilmu Hayat menghadapi Masalah Ko-
munikasi di Indonesia pada Abad XXI".
Oleh : Sjamsoe'oad Sadjad
16.15 — 17.15 : Diskusi Makalah V

Sabtu, 21 Desember 1985

- 08.00 — 08.30 : Penyajian Makalah VI
"Peranan Bahasa Indonesia sebagai Sarana Komu-
nikasi Ilmiah Moderen".
Oleh : Anton M. Moeliono

08.30 – 09.30 : Diskusi Makalah VI
09.30 – 10.00 : I s t i r a h a t
10.00 – 12.00 : Perumusan
12.00 – 13.00 . I s t i r a h a t
13.00 : Penutupan.