



*Visit of the Honourable Prime Minister
of Malaysia*

Dato Seri Dr. Mahathir bin Mohamad

to

Universiti Pertanian Malaysia

Thursday, 3rd April, 1997

***UPM: The
University of the
21st Century***

Briefing by

Prof. Dato' Dr. Syed Jalaludin bin Syed Salim
Vice Chancellor
Universiti Pertanian Malaysia



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Commercialising Research Findings

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Background

History

Universiti Pertanian Malaysia (UPM) was founded in 1971 by merging the Faculty of Agriculture, Universiti of Malaya and the College of Agriculture, Serdang. Beginning with three faculties— Agriculture, Forestry and Veterinary Medicine— UPM remained as a traditional university focusing mainly on undergraduate education, and research in agriculture and related fields. However, in the early 1980's, UPM broadened its scope to include Science and Technology (S&T).

In 1994, UPM embarked on an ambitious plan to create the University of the Future, providing better and new delivery systems in science and technology education. Harnessing the rapidly advancing field of information technology (IT),

UPM has been rapidly transformed to a borderless campus that transcends national boundaries.

Mission

“To be a leading centre of learning and research, contributing not only towards human advancement and creation of knowledge but also to the creation of wealth and nation building”.

Facts at a Glance

<ul style="list-style-type: none">• UPM Campus: 22 km south of Kuala Lumpur• University College, Terengganu Campus: 16 km from Kuala Terengganu• Faculties<ul style="list-style-type: none">➤ <i>Serdang</i>: 12➤ <i>UKT, Terengganu</i>: 2• Academic & Support Staff: 3,600• Programmes<ul style="list-style-type: none">➤ <i>Matriculation Studies</i>: 4➤ <i>Diploma</i>: 6➤ <i>Bachelor</i>: 38	<ul style="list-style-type: none">➤ Postgraduate: 8• Student population<ul style="list-style-type: none">➤ <i>Undergraduate</i>: 22,000➤ <i>Postgraduate</i>: 1,265• Centres<ul style="list-style-type: none">➤ <i>Islamic Centre</i>➤ <i>Matriculation Studies</i>➤ <i>University Business Centre (UBC)</i>• Institutes<ul style="list-style-type: none">➤ <i>Bioscience (Research)</i>➤ <i>Distance Education and Learning (IDEAL)</i>
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Teaching

Programmes of study are offered at three levels—diploma, bachelor and post-graduate. The courses offered are tailored for on-the-job, hands-on experience and practical training in the public and private sectors.

Graduate Programmes are offered at the Master's (MS) and Doctoral levels (Ph.D). The degrees are in Science (MS), Economics (M. Econ.), Veterinary Medicine (MVM), Business Administration (MBA), Agricultural Science (M. Agri. Sc.) and Doctor of Philosophy (Ph.D).

Besides learning on-campus, UPM offers distance learning courseware and packaged courses.

Research

The goal of research at UPM is to be a centre of excellence that will provide state-of-the-art research facilities, conduct research which contributes directly to industrial development and the attainment of the socio-economic objectives of the country, and foster a research environment conducive to the development of scholastic pursuits.

Funding

UPM received almost RM 100 million for research for the period 1991-1995. Of this sum, MPKSN awarded RM 76.4 million for research under the Sixth Malaysia Plan [1991-1995] and International Agencies and the private sector contributed RM 17.1 million. UPM also earned RM 5.1 million through contract research.

Apart from government funding, UPM has received 18% of its research funds from:

- The Australian Centre for International Agricultural Research (ACIAR)
- Asian Development Bank (ADB)
- Food and Agriculture Organisation (FAO)
- International Atomic Energy Agency (IAEA)
- International Foundation of Science (IFS)
- Japanese International Co-operation Agency (JICA)
- World Health Organisation (WHO).

In addition to the existing 12 centres of research excellence, UPM is developing new centres in key technology areas such as biotechnology, information technology, robotics, aerospace, material and applied sciences, entrepreneurship and technology management. These new centres will forge effective linkages between UPM and the industry.

Priority Research Areas

UPM promotes research in both fundamental and applied sciences. The priority areas of research are:

<ul style="list-style-type: none">• Crop and Livestock Production• Environmental Quality & Pollution Control• Food Technology and Processing• Forest Rehabilitation• Industrial Enzyme Technology• Information Technology• Integrated Pest Management	<ul style="list-style-type: none">• Material and Structure• Material Sciences and Solid State Physics• Medicinal Plants and Natural Products• Plant and Animal Biotechnology• Remote Sensing/Geographic Information System (GIS)• Waste and Wastewater Technology
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Research Outputs

More than 750 researchers with Ph.D. and Master's degrees with about 1250 postgraduate students are exploring the frontiers of science in efforts to expand fundamental knowledge of human nature, society, industry and the natural world.

The reservoir of scientific knowledge available at UPM has enabled researchers to create or innovate many technologies. These new technologies have benefited Malaysia through reduced pollution of the air, water, land, better human food and health.

Three products have been patented while others are being processed. Ten products have been commercialised through joint ventures with the industry.

Biotechnology

UPM's research in biotechnology has enhanced food production and crop production, increased down-stream activities in the oil palm industry and helped to solve pollution and waste management.

Animal Vaccines

Fowl pox and Newcastle Disease are economically important viral diseases of poultry. The world's first oral vaccine for Newcastle Disease was developed at UPM and a tissue culture vaccine against Fowl Pox has been commercialised.

Status: Both vaccines have been commercialised by Malaysian Vaccines & Pharmaceuticals Sdn. Bhd

Biofertilisers

Utilisation of beneficial soil fungi such as the vesicular-arbuscular mycorrhiza (VAM) has successfully enhanced growth and yield of several crops of economic importance to Malaysia. Symbiosis with VAM has drastically reduced inputs of agrochemicals (fertilisers and pesticides) into our soil while maximising yield and quality of the above crops.

Status: Malaysian Agri Hi-Tech (MAH) Co. Ltd (a joint venture between UPM and MTDC)

Biofilter Technology for Waste Treatment

Currently, the palm oil industry uses anaerobic ponds to treat the effluent. These ponds are inefficient and occupy large areas of land. Anaerobic tanks are in vogue but are slow and expensive. The Anaerobic Biofilter System developed at UPM to treat palm oil effluent has drastically reduced the retention time from 20 to only five days. Biofill as it is known commercially costs less than the anaerobic tanks.

Status: Commercialisation supported by Malaysian Technology Development Corporation, Bach Systems and Wemley IBAE Sdn. Bhd.

Biopesticides

Research on pests and diseases of crops is aimed at finding alternatives to chemical pesticides and integrating modern with traditional pest control technologies that are in harmony with the local, social and environmental complexities.

Status: Laboratory level

Bioplastics

The plastic packaging made from petroleum sources is non-biodegradable and is detrimental to the environment. Bioplastics have been produced from palm oil wastes at UPM. Vast amount of palm oil waste effluent generated from the palm oil industry can provide a competitive edge in the production of bioplastics as compared with the petroleum-base plastics if the production cost of the former could be reduced. Besides being environmental friendly, Malaysia could be an exporter of biodegradable plastics in the future.

Status: Negotiating with Industry for pilot studies

Carotene from Crude Palm Oil

Commercial production of carotenoids by chemically converting palm oil results in the loss of edible oil. At UPM, carotene from crude palm oil (CPO) has been separated by an adsorption process without loss of edible oil. Only a chromatographic column is inserted in the present oil palm refining process.

Status: Pilot Project with Iktisas Ingenieurs Sdn. Bhd., Pending Patent (Pl 9501562) Malaysia

Enzymes

The thrust of the enzyme and microbial technology is focused on the modification of oils and fats, specifically palm oil, using enzyme and cells to produce high-value products. The proteases, extracted from fungi and bacteria isolated from palm oil mill effluent, can be used in detergents, food and textile processing. On the other hand esterification using lipases or proteases could be used for the production of high-value added products such as surfactant emulsifiers in food, detergent and cosmetics.

Status: Laboratory level

Food Ingredients

Health and economic considerations have lead Malaysian food industries to examine the potential of indigenous resources as substitutes for imported food ingredients. An important innovation at UPM has been to transform palm oil by enzymatic modification to produce fats that have functional properties similar to those of cocoa, butter and milk fat.

Status: Adopted by the food industry

Natural Products

The primary interest at UPM is to isolate, identify structure and modify natural products with biological activities, and eventually commercialised for pharmaceutical, cosmetic or agricultural uses. Active principles in ten medicinal plants with cytotoxic, analgesic, antimicrobial and hypoglycaemic activities have been identified. The active principles in Haruan fish and petai could be utilised in skin lotions and antidiabetic agent.

Status: Negotiating with Pharmaceutical Companies

Probiotics for Poultry

Food safety is of great concern to the public. Probiotics (direct-fed microbials) have been shown to increase the natural defence mechanism of chicken, thus it can be used as an alternative to antibiotics in poultry production.

The probiotic developed at UPM consists of a mixture of 12 *Lactobacillus* strains. Probiotic-fed chicken grow more rapidly, consume less feed, deposit less body fat and lower mortality due to bacteria such as *Salmonella* and *E. coli*. Since probiotic-fed chickens grow rapidly and consume less feed, the cost of production is lowered. Probiotic-fed chicken are also antibiotic-free and are considered a safe food.

Status: Completed pilot trial. Negotiating Joint-Venture with MTDC

Sago Starch

Starch is an important ingredient and has many important functional properties. Sago starch is an important economic crop in Sarawak. Sago starch for the production of high fructose syrups, maltodextrins, bioplastics, and as an encapsulation agents are being investigated.

Status: Sago Starch has been commercialised by SEDC, Sarawak

Transfer of Xylanase/Cellulase genes to Lactobacillus

The xylanase/cellulase genes from a very cellulolytic bacterium have been isolated from the rumen of cattle. Research is in progress to transfer and clone the genes to a *Lactobacillus* species from chicken. If successful, the transformed *Lactobacillus* will enable chicken to break down the cellulose in the feed material, which will enhance feed efficiency and lower production cost.

Status: Laboratory level

Publications

UPM's contributions to scientific research and development have received worldwide recognition. During the past five years, 550 of the 2186 publications are in refereed international journals.

Postgraduate Training

Currently, UPM is training more than 1250 postgraduate students, about 300 are from 36 developing countries.

Prizes/Awards

UPM

- Best Research and Development Institution in Malaysia (MPKSN) [1996]
- Anugerah Khas Perkhidmatan Awam - Anugerah Pengurusan Teknologi Maklumat [1996]
- PIKOM IT Achievement Award [1996]

Researchers

- The National Academy Science Awards [1985, 1993]
- The Young Scientist Award [1985, 1989, 1996]
- The Third World Academy of Sciences [1991]
- The Distinguished Service Award of the Asian -Australasian Association of Animal Production Society [1992]
- Svon Brohult Award, International Foundation of Science (Sweden)[1984]
- National Inventors Award [1996]
- Seven professors (past/present) were inducted as founding Fellows of the Academy of Sciences Malaysia

Challenges

Building the University of 21st Century

The Need for a Shift in Paradigm

The task, which lies ahead, is for universities to play an effective role in the production of an excellent, highly skilled and motivated workforce as well as to generate industrially and economically useful research. Universities are being challenged to defend what they are doing and how well they are doing it. As competition for finance increases, universities are being asked to do more with fewer resources.

Clearly, a shift in paradigm is necessary. Local universities require strategies for transforming them from being mainly national education centres to an international or at least a regional institution of higher learning.

It is therefore inevitable that universities be restructured to bring about de-regulation with the aim of compelling the universities to attain greater financial autonomy. Although public funding for the universities is essential and must be

maintained at a certain level, as has been practised, income from other sources must be generated and enhanced so that the universities are less reliant upon public funding.

Democratisation of Education

The task ahead for the university is to bring about greater democratisation of education by: (a) increasing full-time enrolment at Serdang to 30,000, at University College Terengganu to 10,000, and at Bintulu when activated to 10,000. (b) establishing partnership with State and independent colleges, and (c) bringing education to the doorstep in Penang, Kuantan, Serdang, Melaka, Terengganu, Bintulu, Kuching.

Financial Implications

One of the main purposes of transforming the universities is for the attainment of greater financial autonomy. Universities have to develop strategies to drastically enhance their utilisation of assets to generate revenue and at the same time strive for higher efficiency. The income generating activities, besides tuition fees, is expected to reach 40% of operating expenditure in the case of UPM. Since contribution from tuition fees will remain at current level, the difference between income and expenditure will be met through normal budgetary means.

Devolving the University from its existing setting leads towards greater autonomy, lessening the financial burdens of stakeholders and to the improvement of the reward and compensation system. The University is also expected to increase its income from the substantial ownership of the valuable properties and optimising the intellectual assets as well as expertise at its disposal. The University should operate in a business-like environment and become an enterprise entity if it were to succeed in the future.

Globalisation of Education

The world is fast becoming a global village where borders are being blurred and where competition is the order of the day. Currently about 300 postgraduate students from 36 countries are pursuing MS and Ph.D degrees at UPM.

UPMNET

The UPMNET is UPM's first step in transforming the university into an enterprise and a University of the Future. It was only in 1995, that a high capacity fibre optic network based on Asynchronous Transfer Mode (ATM) was laid around the campus to create the Campus Information Superhighway that allows for global networking through Jarring/Internet.

University of the Future

Knowledge Centre

Universities, as knowledge centres, can be a source for technological innovation. To do this, it must have the enabling features such as an efficient IT system for easy and rapid access to information. The UPM computer network provides the means for the university to synergise with outside organisations.

Venture Partnerships

The role of universities is critical in developing high technology industries. However, only a university with very specific set of linkages to industrial and commercial development can play the lead role. The university-industry link must inevitably lead to synergy and provide the source as well as the infrastructure for technological innovation.

R & D Clusters

Companies on their own cannot possibly innovate because of internal constraints for generating new ideas and breakthroughs. By linking up with universities, an innovative milieu is generated whereby companies are well-positioned to use the scientific achievements and new ideas emanating from university laboratories.

For this purpose, UPM has established R & D clusters. The IT and High-Tech clusters are located at Serdang whereas the Biotechnology and Bioindustry clusters are at Puchong.

Information Technology

Information technology (IT) has ushered in a whole new era of teaching and learning at UPM. It has enabled UPM to become a borderless campus and to develop new education delivery systems that are not only cost-effective but also, more importantly, easily accessed.

IT and Administration

"On-line", Office Automation, and Executive Information System (EIS) – expedite forecasting and decision-making by top management at UPM. Computer technology helps to track students' records more efficiently using databases. Students' progress can be monitored and remedies provided, where needed. UPM has also introduced a new system to provide quick information to students through telephone and fax machines. The system allows students and parents to call a number linked to a computerised answering machine, which provides information regarding intakes, scholarships and examination results.

IT and Higher Education

At UPM, academic staff regularly interact with students, conduct research, publish, develop new courses and communicate with collaborators inside and outside the campus. As teaching becomes more integrated, university lecturers are teaming up in work groups to design courses using IT, thus eliminating duplication and at the same time accomplishing more in a shorter time. The technology has given lecturers new opportunities to illustrate course materials with graphics, animation and even full-motion video resulting in interesting courses and teaching that is more effective. Furthermore, it enables lecturers to develop software packages relating to their special fields for immediate use and for later marketing and sales.

IT and Research

Every university strives to become a leading centre of excellence but do not possess all the scientific manpower needed for inter- and multi-disciplinary research. Such research is often mission-led and market-driven. Collaboration among research teams and universities can be achieved through computer networking. Such col-

laboration develops the workgroup culture, thus accelerating the formation of centres of excellence.

IT and The Virtual University

Increasing demand for higher education by non-traditional students who are unable to commute to the physical campus or fit university schedule into their work schedule has created "education bottlenecks". The time cost for working students to be present in classroom has escalated and this may limit their opportunities to acquire higher education or inhibit it altogether. Classroom learning is not cost-effective.

UPM has adopted a bold plan designed to make the most use of information technology in teaching and learning. Through the UPMNET, UPM can implement distance learning and enhance the teaching-learning environment thus transforming it from the traditional classroom learning to the virtual learning environment.

UPM is developing a "virtual library" and "virtual laboratories" through which students from distant locations can electronically gain access to UPM's resources.

Commercialising Research Findings

Recognising that less than 10% research findings reach the market place worldwide, UPM has established several mechanisms to accelerate the commercialisation of UPM's research findings.

University Business Centre

In 1996, UPM established the University Business Centre (UBC) to sustain and fully utilise the precious research and technological expertise. UBC introduces UPM's commitment to commercialising technology and assisting its academia to move technology and expertise into the industry.

Institute of Bioscience

In 1996, UPM established the Institute of Bioscience to provide the leadership and multi-user core facilities to boost research and postgraduate training in pri-

ority areas. The Institute is a platform for fundamental research that could generate useful products and processes for the industries. The research is market-driven and top-down in key areas such as food, crops, health, aquaculture, genetic resources and conservation, natural products and forestry. It also offers MS and PhD degrees.

Institute of Software Development

UPM's proposed Institute of Software Development will utilise in-campus expertise jointly with software development companies to produce world class applications for realising the needs for the MSC.

The Technology Park

The park represents a joint venture with the private sector to facilitate research projects carried out in tandem with technical and collaborative assistance from UPM.

The UPM-MTDC Technology Incubation Centre

This centre will encourage and facilitate the formation and growth of new technologies based upon the facilities and expertise available within UPM.

Revitalising the Food and Agriculture Sectors

There is an urgent need to revitalising the food and agriculture sectors. UPM aims to use biotechnology to increase agriculture productivity and quality, and down-stream activities resulting in value-added products, so as to provide a lead and competitiveness in the global market.

The Biotechnology Park located at Puchong will play a major catalytic role in converting research findings to technologies and solutions. In addition, the Asian Food Centre to be located at UPM will research on new products utilising UPM' expertise. In return, the centre will provide hands-on training for UPM students.

Precision Agriculture: The recent development of satellite -remote sensing technology and Geographic Information System (GIS) to monitor, quantify and map soil and crop variability, and vary the application of agronomic inputs, has allowed a new approach termed "Precision Agriculture". It is now possible to farm

areas within a field differently according to their potential for crop production and a specialised management goal such as to maximise yield or minimised environmental impact.

Multimedia Super Corridor

The mere existence of companies and universities within a locality may not necessarily guarantee a synergetic development.

If Malaysia is to succeed economically in the future, it must have the capacity to innovate the growth of high technology industry. Presently, Malaysia relies heavily on the manufacturing industry but this must give way to a future industry, which is informational in nature.

The Multimedia Super Corridor (MSC) is envisaged to become a high-tech R&D and marketing hub for international telecommunications, IT and multimedia firms. MSC is intended to be the new engine of economic growth that will propel Malaysia into the 21st century as a fully developed nation. This corridor has the prerequisite of a technopolis comprising universities, research institutions, technology parks, industrial zones, sport and recreation facilities and excellent transport and communication infrastructures. Besides, the location is on the periphery of a dynamic metropolitan area of Kuala Lumpur and Petaling Jaya.

The Multimedia Centre at the UPM Serdang campus will serve as a mini-platform to support the MSC concept. It comprises Technology Incubation Centres for the IT and high-tech industries. UPM's role is to be a venture partner, providing the creativity and ideas, and interphasing with industry to achieve synergy.

Concluding Remarks

UPM is being transformed into an enterprise institution and a Super Tech Campus. This is achieved through investment in an extensive computer network system. The computer network will help to increase productivity and efficiency of the administrative, teaching and learning functions. The IT system and the Multimedia Centre will also quicken the convergence of UPM and the industry leading to greater economic growth and wealth creation. We hope to make UPM a University of the 21st Century with the most advanced IT and Multimedia systems in Asia.

Published by
Universiti Pertanian Malaysia
Serdang, Selangor D.E.
MALAYSIA

Layout & Cover Design: Nayanadeep Singh