

A Unique Contribution to Engineering Education in Asia: The Asian Institute of Technology*

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1. INTRODUCTION

UNIVERSITIES, and institutions of higher learning, take a variety of forms and serve a variety of purposes. However, we know of no other that has the same singular mission, peculiarities of foundation and international character as the Asian Institute of Technology (AIT). It is, in short, an autonomous international post-graduate school of engineering and technology, founded to serve the technological development of all the countries of the Asia Pacific Region.

2. FOUNDATION

In the late 1950s, discouraged by the Korean War and alarmed by the spread of communism through East and South-East Asia, five western (USA, UK, France, Australia and New Zealand) and three Asian (Pakistan, Philippines and Thailand) nations formed the South-East Asia Treaty Organization (SEATO). The Pacific analog of NATO, this fundamentally military alliance was intended to contain the spread of communism in the region.

However, one Secretary-General of SEATO (Dr Pote Sarasin of Thailand) saw clearly that the opposed ideology could not be thwarted by bombs and bullets alone, but required an increased prosperity for the people, and particularly the rural people, of the region. The first steps in such economic development were seen to be the construction of infrastructure such as irrigation and communication systems, buildings and utility supplies. At that time there was a dearth of qualified engineers to lead such projects, while all the brightest Asian first-degree engineering graduates went overseas for further study, and never came back. The principal Mecca for these graduates at that time was the USA. Dr Pote reasoned that if, instead of sending the graduates to American

professors, those same professors could be brought to teach the best Asian graduates in Asia, the 'brain drain' could be stemmed. So in 1959 was formed the SEATO Graduate School of Engineering, in which professors (first from Colorado State University) came to teach water resources (hydraulic) engineering to 18 graduates from Thailand, Philippines and Pakistan.

From that small beginning has grown the AIT of today, teaching over 1000 graduate students from more than 35 countries, employing professors from all over the world, covering a range of technological disciplines, and drawing financial support from a large portfolio of donors. Becoming independent of SEATO in 1967, the AIT is not a formal part of the university system of any country. The major part of its funding comes from the overseas aid branches of the governments of developed countries, while its authority and autonomy are vested in an international board of trustees.

Legally, too, it is a true international agency, possessing a charter approved by the eight former SEATO nations. It is based in the host country, Thailand, by way of an Enabling Act recognizing its international status and granting certain diplomatic privileges and immunities. Its degrees are recognized throughout the world.

3. DEVELOPMENT NEEDS IN ENGINEERING

In order to serve 'development needs in engineering' it is necessary to appreciate how these vary between less-developed countries (LDCs) and more-developed economies, often called newly (or almost) industrialized countries (NICs).

In LDCs the provision of physical infrastructure (water supply, communication systems, buildings) remains a very high priority, while the sustainable development of natural resources (agricultural improvement, forest and mineral management, development of energy sources) is

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also a major requirement. While these needs call for progressive expansion in NIC or 'almost NIC' economies, added to them come important requirements in manufacturing and 'value adding' technologies, together with attention to the environmental problems associated with rapid industrial development. In both situations management and planning skills are required, although covering different management issues in the different economies. It is a sad reflection of the Asian scene that in the past much of the skill of its engineers has been wasted through inadequate planning and incompetent management.

These development needs translate into various political, economic, technology transfer and human resource development components. AIT, of course, is a vector in the last of these. In engineering the needs (as elsewhere) can be categorized on three levels (see Table 1).

The numbering of the levels does not signify any relative importance. Indeed neglect of any level, as of the supporting workforce—much of which will possess vocational technical skills—can be disastrous. Nevertheless, a small institute serving a region of more than 2 billion people must address itself to the sector providing the maximum 'multiplication of effect'. In other words it must be selective and concentrate on the clientele and academic areas that will be most likely to provide influential decision-makers or teachers. The students meeting this requirement are found in those preparing for level 3, i.e. in post-graduate education.

A word of explanation is necessary here. Asian culture differs from European, North American and Australasian cultures in many ways. One such is the Asian reverence for education and hierarchical respect for university degrees. An engineer without a higher degree cannot easily command the same respect as his or her peer with a masters or doctoral qualification. Further, in Asia, many of the brightest school-leavers enter engineering although aspiring to positions of high management. Consequently an institute of technology that provides the requisite post-graduate education can command great admiration as well as benefiting from a highly intelligent, dedicated student body. For example, the first two very small SEATO classes produced for Thailand two cabinet ministers, the director-general of the highways department, and a deputy director of the government irrigation bureau, the heads of the major corporations establishing petroleum resources, telecommunications and

urban expressways, the most senior professor or computer science and other agency directors.

4. MISSION AND OBJECTIVES

When AIT was formed from its precursor SEATO Graduate School it was almost unique in being structured around a set of defined 'objectives'. Although by today's standards these seem to be somewhat amateurish in wording, nevertheless the whole Institute, faculty, staff and students was thereby set to consider and work towards the mission of the AIT. In the 1960s few universities did the same.

As the Institute has grown, but more as the needs of Asia have changed, so the original 'objectives of the institute' have been rewritten into a 'mission statement' and 'implementation objectives'.

The mission statement now reads

AIT will take a leadership role in the promotion of technical change and its management for sustainable development in the Asia and Pacific Region, through high level education, research and outreach activities which integrate technology, planning and management. The focus of the Institute's activities is in technology with special emphasis on the interdisciplinary interface among the above three fields, and will include attention to environmental and socio-economic considerations.

The list of objectives, each with rationale, is lengthy but includes, *inter alia*:

1. Teaching program objectives covering post-graduate degrees and short courses, preparatory pre-degree programs and interdisciplinary programs.
2. Research objectives covering provision of a regional focus for research and its application, and fostering collaborative research with sister institutions in the region.
3. Outreach and dissemination objectives including provision of consultancy services, providing a site for international conferences, workshops and courses and helping the formation of regional library and information services.
4. Provision of facilities such as information networks, computing capability and standards and testing facilities.
5. Attitudinal objectives relating to the purpose

Table 1. Human resource requirements in engineering in Asia

Level	Activity	Required skills in	Qualifications
3	influential decision makers	engineering, planning and management	higher degree, work success record
2	professional engineers	engineering, project management	engineering degree, learning on the job
1	technical engineers	engineering practice	engineering degree or vocational diploma

and development of the institute and the obligations of its graduates.

Running through all the objectives is the ambition to provide the region with a corps of competent, confident practitioners, knowledgeable about the problems of the region and skilled in the methodologies required for their solution. In other words practice and problem-solving figures prominently in all AIT curricula!

5. ACADEMIC STAFFING

The mission and associated objectives place two requirements on the academic staff. First, they must be technically competent within state-of-the-art technologies as researched, developed and taught in the world's leading universities and as practiced. Secondly, they must be familiar with the requirements and capabilities of the Asia Pacific region. This is achieved by blending, in almost equal proportions, academic staff (the American word 'faculty' is used for this cohort) drawn from the universities and research or consultancy agencies of fully developed countries with their Asian counterparts. The former group is, in the main, supported financially and seconded to the Institute by the overseas aid bureaux of their governments. The latter component is (again in the main) directly hired by the Institute.

All the teaching faculty have the necessary degrees (or related qualifications) to stand with credibility in front of demanding post-graduate students. They are expected to be active in research and outreach activities as well as in teaching. In this context, as in most British universities, both personal and institutional consultancy activities are given positive encouragement.

Faculty ranks and career structure reflect the strong American influence in the foundation of the Institute (as does nomenclature and spelling). Annual reviews of faculty progress examine all the activities mentioned above, while promotion to the supra-career grade of 'professor' is made only on the positive recommendation of international assessors. In this way faculty standards are maintained at the level of peer groups world-wide.

Using publications as a measure of research activity, in any year about 130 faculty members (on appointments longer than three months) produce over 200 papers in refereed journals, over 300 conference papers (most refereed) and between 30 and 40 book chapters. Teaching loads, being at post-graduate level, involve a faculty to student ratio of 1:7 and an average formal scheduled lecture load of 3 h/week over the whole year (no long vacation!). Laboratory, fieldwork and student supervision loads are variable and difficult to quantify, but probably bring the total to around 30 h/week (again averaged over the whole year).

6. ACADEMIC ACTIVITIES

6.1 Programs

Having analyzed regional human resource development needs (Section 3) and devised in abstract the mission and objectives to meeting them (Section 4), it is now time to describe the ways in which the activities of the AIT are matched to these.

About 80% of the registered students are pursuing the masters program. Interestingly, in the early days of the SEATO Graduate School the Americans wanted 'an instructional curriculum providing the in-depth information missing in Asian first degrees', while the British preferred 'a research study covering the lack of practical and problem-solving skills in Asian graduates'. Asian judgement, that both rationales were sound, prevailed. So the present degree covers five terms (trimesters), lasts 20 months full time without break, and includes more than two terms of instruction followed by more than two terms of research.

The doctoral degree, pursued by a growing number of students, closely resembles a North American Ph.D. with required instructional elements followed by thesis research. Like the British Ph.D., the thesis is subject to external examination with almost all the examiners being drawn from developed countries. Since it requires three years of study after the almost two year masters degree (or equivalent from elsewhere), the final doctoral graduate compares well with peers from the rest of the world.

A small number of students are registered on external and part-time degrees, as on joint degrees with other institutions.

Standards are high. Often AIT masters graduates refused admission to the AIT doctoral program are later accepted for Ph.D. study in North America, Europe and Australasia. The overall demanding academic selectivity is made possible by the high ratio of applicants to scholarship and places. This is currently 10:1 on the masters program.

6.2 Leadership by example

The Institute endeavors to provide an academic and physical environment as good as that which students might meet in the most attractive developed-country universities. In so doing it endeavors to lead by example.

Thus, considerable money is spent on regular building maintenance, the campus grounds are attractively landscaped and kept litter free, and the Institute attempts to conduct its operations (particularly in the handling of waste) in an environmentally acceptable way. Attention to safety, health and the role of women is also consciously pursued as part of the 'education transfer' to the region.

6.3 Structure

When the AIT was founded, in order to encourage interdisciplinary programs and avoid the interdepartmental boundaries so common in classi-

cal university structures, it was divided administratively into a number of units, each representing the sequential learning program of a student cohort. These were then styled 'Divisions of the Institute'. As the years passed these Divisions grew in size and number, developed additional fields of study, and slowly assumed the mantle of small departments. Although these units were, in many cases, interdisciplinary, nevertheless interdivisional study became inhibited and inflexibility developed both in student learning programs and in the cost-effective use of faculty resources. As a result the Institute is presently amalgamating 10 'Divisions' into three 'Schools'. While retaining most existing student fields of study, new combinations are being made possible.

6.4 Subject coverage

It is inappropriate to list all the fields of study open to students, so only the broad subject areas are presented.

First, reflecting the origins of the Institute, is the area of civil or infrastructural engineering. This includes environmental engineering (specializing in water supply and waste water removal), geotechnical and transportation engineering, structural engineering and construction, and water resources engineering.

Looking to natural resource development (see Section 3), we find agricultural and food engineering, energy technology, irrigation and drainage engineering (jointly with water resources engineering), and an interdisciplinary program in natural resources development and management.

Turning to new and industrially oriented technologies, there are programs in computer science, industrial engineering (including manufacturing systems engineering), and telecommunications.

Finally in the area of management and planning are a School of Management (in which the special program is management of technology), urban and rural-regional planning, and gender in development.

6.5 Outreach centers

As stated in Section 4, the mission of the Institute has given rise to a number of 'outreach' objectives, which in turn have led to the formation of a number of 'outreach centers'. These specialize in client-oriented short courses (where the curriculum is specifically fitted to the needs and capabilities of client professionals in employment), consultancy and organizing sponsored research projects.

Regular short courses are provided annually by the Computer Center and the Library and Regional Documentation Center, though the first priority of both is to service the AIT academic community. The latter also provides regional information services through bibliographies, abstracts and journals covering subject areas and sources not well served by the libraries of the developed world.

Regular courses, too, are presented by the Asian Disaster Preparedness Center and in remote

sensing (this latter by the Natural Resources Program). The largest number of *ad hoc* courses, each individually meeting a perceived professional client group need, and lasting between 2 and 12 weeks, is presented by the Continuing Education Center.

All of these courses draw on the expertise available in the Institute, as well as calling on external resource persons as the need arises.

Putting this in perspective, each year about 2000 persons pass through such upgrading short courses by comparison with about half that number on degree programs

6.6 Branch centers

This year the Institute will be opening a center in Vietnam with branches in Hanoi and Ho Chi Minh City. These will concentrate first on short course training for professional improvement of persons in employment and will also offer preparation for entry (with some credit transfer) to the degree programs of the main campus. They will also form a 'home base' for students who may carry out part of their research work in Vietnam.

The first subject area in both centers will be 'Management for the Market Economy' with the Ho Chi Minh Center concentrating on teaching staff of the universities (and polytechnics). In Hanoi, subject coverage will spread to encompass manufacturing engineering and agricultural engineering. Foundation of the two centers is being supported financially by the governments of Switzerland and Finland, respectively.

The creation of these centers exemplifies a firm policy dedicated to helping the Indo-Chinese countries of Laos, Cambodia and Vietnam.

7. OUTPUT

An aid-oriented institution with the mission of the AIT must conduct regular examinations of its effectiveness. Indeed its many donors carry out their own evaluations of their 'project achievements', and these form a very helpful input to the self-assessment. However, the principal measure is obtained through a detailed tracer study of the graduates.

There are now over 6000 alumni, of whom 90% are working in Asia—a considerable contribution to the anti-brain drain ideal! Of these, roughly one-third each are in government service, the private sector and education. On average, after five years AIT graduates are in decision-making offices of upper-middle and senior management. Alumni and their employers affirm the contribution that the AIT degree made to their progress.

Significantly, the proportion of women graduating from AIT is 20% and rising. How many post-graduate schools of engineering or technology in the developed world can say the same?

Finally, there is the question of appreciation of the Institute by the countries that receive its gradu-

ates. Almost all of these give financial grants which, although small in comparison with those coming from the developed world, are significant in terms of moral support. How many other international agencies get cash grants from the governments of Bangladesh, Nepal or Vietnam, to name but three countries with low per-capita incomes?

8. EXPERIENCES

The 33-year history of the AIT has provided a number of personal and educational experiences.

Starting with the personal, and possibly most remarkable aspect, everybody who comes to AIT, whether to teach or to be taught, is affected by the ambience of its international character. Every nationality group is in a minority and has to come to terms with the cultures and mores of many others. Although overt political activity is rewarded with an immediate air ticket home, the ban never has to be used and reference to it is made only occasionally. Communists and capitalists, Muslims and Hindus, extroverts and introverts live and work in harmony with fewer interpersonal disputes than exist in mono-national institutions. There is no sign, either, of the internationality jealousy that disturbs so many UN agencies. Given the right circumstances and a shared dedication, international living (all students, including the 20% who are Thai, live on campus) can work very well

indeed. Many find that the spirit of the AIT provides a distinct emotional uplift.

On the more academic aspects, the value of having well-defined mission and objective statements becomes ever more apparent as the years pass and as Asia changes. I know of no other university institution with so clear, and so stimulating, a *raison d'être*. Staff and students, and of course the corps of donors, are united by its spirit.

The successful history, too, proves that at least in engineering and technology it is possible to establish a high standard path in the multidimensional space of theory and practice, 'low' and 'high' technologies, relevance and local applicability, and student learning progression. It has been proved many times over that curricula carefully constructed so as to be of relevance in Asia are not of lower academic standards than those ostensibly oriented to serving more developed nations.

This is not the stuff of which academic Nobel prizes are made, but then that is exactly true of engineering as a subject. However, in 1989 the Institute was honored with a Magsaysay Award, a distinction carrying great prestige in the region. The award citation included a phrase that gave me great personal pleasure and which sums up the AIT and the experience we try to give all our students:

learning in 'an atmosphere of academic excellence and international camaraderie'.

Alastair North received his B.Sc. in chemistry from Aberdeen University. After receiving a Ph.D. from Aberdeen he served as lecturer there. After spending a period at the University of Liverpool he was appointed to the Burmah Chair of physical chemistry at Strathclyde University in 1967. This appointment was complemented by the posts of Chairman of the department of Pure and Applied Chemistry, Dean of the School of Chemistry and Materials Sciences and Vice-Principal and Deputy Principal of the University. His interest in polymer science and science education led to committee and advisory work with the Science and Engineering Research Council and other bodies. Dr North has received honorary degrees from Aberdeen and Lodz universities for his research work. Dr North was appointed President of the Asian Institute of Technology in Bangkok, Thailand, the post he now holds.