Akademika, Bil. 14/1979, 13 – 29

TRANS-SOCIETAL LINKAGES OF THE MALAYSIAN ACADEMIC SCIENTIFIC COMMUNITY

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SIPNOPSIS

Diwasa ini terdapat dualisma dalam sistem interaksi di antara komuniti saintifik negara-negara membangun dengan negara-negara dunia yang lain. Sistem-sistem interaksi ini adalah sistem interaksi dalaman dan sistem interaksi luaran. Kesan daripada pola-pola interaksi dalaman dan luaran yang berbeda itu mengwujudkan pula penempatan individu saintist ke dalam struktur sosial. Struktur sosial ini pula mengadakan sosialisasi ke atas individu-individu saintist, mempengaruhi kumpulan-kumpulan referensi dan **significant others**, *serta pembinaan jaringan-jaringan* **interpersonal** *mereka dengan rakan-rakan saintist yang lain. Kertas ini adalah satu usaha untuk membincangkan paradigma budaya sains ketiga, terutamanya, mengenai dua dimensi ikatan dan interaksi di antara komuniti saintifik akademik Malaysia dengan sistem sains dunia.*

SYNOPSIS

There now prevails a dual system of interacting internal and external relationships which differentially connect the scientific communities of developing countries with the world scene. As a result of these patterned relationships, the individual scientist is placed in social structures which socialize them, influence their reference groups and significant others, and generate new kinds of interpersonal networks with colleagues. This paper, therefore, attempts to discuss the paradigms of a third culture of science especially about two dimensions of the interrelations between the Malaysian academic scientific community and the world system of science.

Introduction

The interest in comparative study of science and the scientific community has emerged and crystallized particularly in the last ten years. This is partly in response to the parochialism of Western sociology and the realities of an increasingly complex interdependent world. An important reason for emphasizing this perspective is the significance of science — logically, technologically and ideologically — for industrialization, modernization, and social change in general at societal and global levels (Restivo and Vanderpool, 1974:3). Contemporary scientific networks are linked to each other by more or less well-developed systems of transportaton, communications, and

exchange that cut across geographical, political and cultural boundaries: these networks are part of a supra-societal system variously referred to as the international scientific community, the third culture of science, the scientific superculture, and the scientific lateralization (Restivo, 1971: 187–205).

Scientific activities at this level are primary links between and among societies. These links are created and shaped by increasing interdependence between world-wide societies for resources, technology, markets, audiences, capital, information and social knowledge, and the continuing coalescence of domestic and foreign affairs. Our primary organizing sociological conceptualization in this study is the "third cultures" of science.

The working definition of the "third cultures" is "the cultural (including intrascientific) patterns inherited and created, learned and shared by the members of two or more different societies who are personally involved in relating their societies, or segments there of to each other" (Useem, 1971:14). Such a construct is an attempt to conceptualize patterns created by the increasing relationships among and between persons across cultures who, by virtue of shared interests which bring them together, generate new human groupings (Useem and Useem, 1963: 481–98). These groupings arise out of the interaction of people who share some common interests, and who in the process of interacting increase the scale of scientific activity and consciousness, create and establish new values, outlooks, life styles, and behavior patterns which are generic to none of the parent cultures involved. Third cultures are not closed, but open-ended cultures which

> depend for their existence and meaning on the larger collectivities of societies, countries and the international world. Consequently, they are subject to constant changes, intermittent conflicts, and numerous specific accommodations, as the larger human groupings on which they depend change. The world-wide political and economic forces, the shifting alignments of power and within nations, the ideas and ideologies which originate in some parts of the world and then quickly spread round the globe, all these impinge on anyone third culture. (Useem, 1971:61).

To explore further a specific instance of the "third cultures" the following analysis is focused on the academic scientific community in Malaysia and its relationship to the scientific collectivities of the wider world. It is designed to empirically discuss the shared norms, behavior, experiences, patterns of interactions and values of the academic scientific community in their third cultural networks with scientists in other societies around the world.

Study Design and Description of Sampled Scientists

a. Study Design

In order to get an understanding of the social structures and related cultures of academic scientists in Malaysian developing society, my fieldwork con-

sisted of two types of information gathering. One was ethnographic fieldwork and the assembling of aggregated data, much of which is unpublished and scattered in a variety of localities and offices. This included interviewing key informants and prominent scientist — administrators important in the growth of the scientific communities; conferring with representative academic officers at every major academic institutions in Greater Kuala Lumpur, systematically covering international agencies and domestic foundations which support academic science programs; doing participant observation at national science conferences and professional societies' meetings; talking with those in the governments involved in science policy questions.

The second type of information gathering was interviewing a sample of 80 academic-based scientists in Malaysia. From each scientist a bio-data sheet was secured and this was followed by a one to two hour interview.

b. Population of Academic Research Scientists and Characteristics of Malaysian Samples

The definition of who is an academic scientist varies significantly according to the purposes of particular gathering units and the methods used for collecting information about a population of scientists (cf. Harbison and Myers, 1964; UNESCO, 1968). In this an academic scientist is defined as one who is primarily attached or closely related to an institution of higher education who is actively, although not exclusively, engaged in scientific research and who is the author of at least one published article or the equivalent. As can be seen in Table 1, over half of Malaysian academic scientists fall in the population of our definition of research scientists. The four universities located in Greater Kuala Lumpur were selectd. The one provincially located university was omitted.

In Malaysia, the life sciences are the leading fields and the most active in research and publishing. As can be seen in Table 2, almost one-half of the

TABLE 1
PERCENTAGE OF MALAYSIAN ACADEMIC SCIENTISTS IN THE PHYSICAL, ENGINEERING, LIFE AND SOCIAL SCIENCES ENGAGED IN RESEARCH

Scientific Fields	Academic Scientists*		Researchers	
	No	*%*	*No*	*%*
Physical Sciences	119	100.0	62	52.1
Engineering Sciences	246	100.0	58	23.6
Life Sciences	302	100.0	220	72.8
Social Sciences	195	100.0	110	56.4
Total	862	100.0	450	52.2

* These figures are for only four of the five universities in Malaysia. Missing is a provincially — located university which was not included in the study.

Malaysian productive scientists are in the life sciences. We suggest that a scientific community in a developing country which has as its leading fields the life sciences, differs from a scientific community in an industrialised society in which the physical sciences are the predominant fields. The overall scientific community differs with respect to: its orientation to the study of "nature"; it's leadership patterns; the setting of priorities for research; relating the scientists to the domestic sectors of society; and articulating the scientific community to foreign sectors and groupings. We cannot fully examine this hypothesis in this paper and shall select only those aspects which are immediately relevant to trans-societal linkages.

In contrast to the West, the physical sciences lag both in terms of their numbers and the proportion engaged in research. In Malaysia, they are but 14 percent of the academic scientists and 14 percent of the academic researchers. The engineering scientists form 28 percent of the Malaysian academic scientists but only 13 percent is engaged in engineering research. The social sciences make up 32 percent of the academic scholars and 25 percent of the researchers.

TABLE 2
DISTRIBUTION OF TOTAL MALAYSIAN ACADEMIC SCIENTISTS AND OF RESEARCHERS BY SCIENTIFIC FIELDS

Scientific Fields	Academic Scientists		Researchers	
	No	*%*	*No*	*%*
Physical Sciences	119	13.8	62	13.8
Engineering Sciences	246	28.5	58	12.9
Life Sciences	302	35.0	220	48.9
Social Sciences	195	22.6	110	24.4
Total	862	100.0	450	100.0

Thus in Malaysia, we drew a disproportionate, stratified, cluster sample of the published academic research scientists. The completed sample of 80 academic scientists constitutes 18 percent of the published academic scientists in the four selected institutions for the year 1976.

The sampled academic scientists were sub-categorized in order that they represent: the primate and the newer universities; six scientific fields—physical, engineering, life-general, life-agriculture, life-medical, and social science; generation, ethnicity, and gender.

TABLE 3.
CHARACTERISTICS OF THE MALAYSIAN SCIENTIFIC COMMUNITY SAMPLES OF ACADEMIC SCIENTISTS

Institutional Affiliation	No	%
Primate University	51	63.8
Newer Universities	29	36.2
Scientific Fields		
Physical	12	15.0
Engineering	13	16.2
Life-General	14	17.5
Life-Agriculture	13	16.2
Life-Medical	13	16.2
Social Science	15	18.8
Generation		
Received Bach., M.B.B.S. Between		
1945–1956	8	10.0
1957–1961	14	17.5
1962–1968	47	58.8
1969–1975	11	13.7
Ethnicity		
Malay	27	33.8
Chinese	36	45.0
Indian	17	21.2
Gender		
Male	65	81.3
Female	15	18.7
Total	80	100.0

In Malaysia, the first affiliation of scientists with an institution of higher education normally is enduring for their academic careers. This contrasts sharply with the reported inter-university mobility in the career of American scientists. (see National Academy of Science, 1963). Scholars who leave their original institution of affiliation before retirement when reaching 55 years enter into the private sector or the national government, or join an international organization.

The diffusion of the European-American academic institutions and scientific disciplines to the social situation and ecological environment of developing Malaysia is a continuing and many-sided process. Nearly all of the Conventional disciplines are present in the academic institutions. As new scientific specialties within various disciplines come to the fore at the world centers of science, they are introduced into Malaysian Universities and adopted to the local scene in general ways. The new returnees with foreign education bring their recently acquired specializations into their research which must come to terms with the local environment and, because most researchers also teach, they introduce new approaches into their courses of instruction. Most try to

assemble local data and research to complement the foreign-derived generalizations. There seldom are institutionally imposed constraints on academic scholars to stay within a fixed disciplinary boundaries in their research. Often the incentives of a succession of new internationally (and occasionally domestic) sponsored and funded research opportunities encourages researchers to shift the emphasis of their work to development oriented projects. Some even change disciplines.

Over ninety percent of the Malaysian sample scientists have had foreign education. A slightly less than half, however, secure their undergraduate education in one of the local universities, are employed upon graduation as tutors or research assistants in the same institution, and only then go abroad for advanced graduate work or post graduate specialization while on leave from the employing institution. The other half secure their undergraduate as well as their graduate education in foreign countries.

We have classified the scientists into generations according to the period in which they received their first academic degree (Bachelors, M.B.B.S.) and took their initial steps into the academic scientific community. The concept of generation, as we use it, refers to a group of scholars who enter into their professional field at a particular point in time with reference to the historical development of their own societies, the relationship of their own society to other societies, and the changing character of the world system of science. There are four distinguishable generations in the Malaysian sample.

Independence did not come to Malaysia until 1957 and the pre-independence period was characterized by extremely limited participation of Malaysians in the one existing colonial university. As a result, the pre-independence generation is small. The transitional years of 1957–1961 saw some quickening in the process of developoing undergraduates who later went on for higher education as Malaysia began to recognize the value of science growth and of having their own scientists available. Malaysia's third generation (1962–1968) grew quickly in response to the opening of new opportunities for higher and professional education abroad as well as the establishing of new academic institutions and support systems for science at home. The youngest generation (1969–1975), many of whom have only recently returned from a foreign education, have yet to fashion their own professional lives in ways distinctive from the prior generations.

Ethnicity in Malaysia is unevenly interwoven into the patterning of the modern-educated middle classes, secondary and higher educational institutions, the newer organizations in the public and private sectors, and in the cultural definitions of personal identities. The lineaments of ethnicity are more openly evidenced in Malaysian historical development and present development policies with respect to the academic and scientific communities. Malaysian urban Chinese of both genders have long had easy access to quality high school instruction and facilities in the sciences and mathematics, which

has encouraged them to pursue university education and subsequently enter into a variety of professional occupations. They number 36 percent of the total population and 45 percent of our sample of the scientific population. The Malays, who total 53 percent of Malaysia and 34 percent of our sample, are largely newcomers to the world of science. Their interest in higher education and especially in the sciences, other than the social sciences, was not vigorously activated until the 1960s. Previously, only a few amongst the Malay elite had the experience of attending secondary level schools with adequate libraries, laboratories and instructional staffs in the sciences. Talented Malays often were directed into civil service rather than into scientific careers. The Indians, though a minority of 9 percent in Malaysia, have customarily attached great status and value to education. They comprise 21 percent of our sampling of the scientific community. These demographic trends have precipitated a disproportionately larger Chinese and Indian group of scientists in the senior generations. Since independence, the stress in educational and science policy, backed by expanding educational opportunities, has been to increase the relative number of Malays. This had made for a high concentration of Malay scientists in the newer universities and among the younger generations.

Malaysian women, with but a few outstanding exceptions, have entered into the academic science in significant numbers only since the 1960s and most still occupy a lower status in the stratification system of higher education and the scientific community. In most societies for which there are records, women constitute under ten percent of the academic scientists. Malaysian women scientists now approximate the ratio in most societies; 12 percent of the Malaysian academic scientists are women. The newer Malaysian science generations contain proportionately larger percentages of women than the earlier generations, and there are indications of their greater acceptance than occurred in past decades.

Inter-relations Between the Malaysian Scientific Community and the World Systems of Science: Two Dimensions

Our general sociological construct is that there now prevails a system of trans-societal networkings which differentially relate the scientific communities of developing societies with the world scene. As a result of these patterned social relationships, the individual scientist is embedded in social structures and their related cultural contexts which socialize them, influence their reference groups and significant others, enter into their sources of recognition and where they publish, generate new kinds of interpersonal networks with colleagues, and contribute to their self-conception of what they value in their roles as research scholars. Accordingly, these trans-societal lingkages contribute significantly to the defining characteristics of the institutionalized roles of the scientist and the character of the scientific community in a developing society.

We shall confine this analysis to our findings about two dimensions of the inter-relations between the national scientific community of Malaysia and the world systems of science:

A. Cognitive Maps of the World Epicenters of Science;
B Scientists in Foreign Countries in Similar Fields of Research Known Personally by Malaysian Scholars and With Whom They Interact.

A. Cognitive Maps of the World's Leading Centers of Science

On starting point in a search for the metrices of trans-societal networking is to examine the responses of the Malaysian sample academic scientists to the broad question: "Where are the leading centers in your field of specialization?" While our sample of scholars differs among themselves in their cognitive mapping, but no one had difficulty in identifying particular countries and regions of the world in which were located the leading research centers and outstanding scholars in their own professional field. Most could specify the part that their selection of leading centers have played in the recent development of their own field, describe studies carried out by specific centers, scholars, and research groups which have made significant contributions to the growing edges of knowledge or the creation of new paradigms in a specialized domain of research.

As we listened and further probed, we discovered considerable differences in how well informed each person was and the sources of their personal knowledge — The most fully informed usually offered detailed accounts of the current work underway in specific laboratories and institutions; whether a well established research center was currently at the forefront, stagnant or slipping, and the potential value for their field of the studies being done by individual scholars. This knowledge and appraisals were based on past experience as graduate and post-doctoral students, visits to centers of interest to them at different stages in their career histories, recurrent participation in international conferences, regular reading of the main journals and the sending for reprints of articles in journals to which they had no direct access, occasional visits to their group by foreign scholars in the same field, and the exchange of news in correspondence with colleagues. Without any hesitation, many would strongly recommend their own best students to study for their graduate training at these particular science centers. The less aware on the other hand were commonly well informed about the places where they had studied, but not that of other institutions and/or research groups. The responses are summarized in Table 4.

TABLE 4

PERCENTAGE DISTRIBUTION OF THE RESPONSES BY SCIENTIFIC FIELDS OF THE MALAYSIAN SCIENTIFIC COMMUNITY SAMPLES TO THE QUESTION, "WHERE ARE THE LEADING CENTERS IN YOUR FIELD (SPECIALIZATION)?"

Leading Centers	Scientific Fields						
	Physical %	Engineering %	Life-General %	Life-Agric. %	Life-Medical %	Social Science %	Total %
U.S.A.	28.6	30.6	33.3	43.3	35.3	46.2	36.2
U.K.	34.3	52.8	45.5	13.3	35.3	23.1	34.3
Australia/ N. Zealand	5.7	5.6	3.0	16.7	14.7	7.7	8.7
Canada	8.6	2.8	6.1	6.7	5.9	0.0	4.8
Europe	17.1	5.6	6.1	3.3	2.9	7.7	7.7
U.S.S.R.	2.9	2.8	0.0	0.0	0.0	0.0	0.5
India	0.0	0.0	6.1	10.0	5.9	7.7	4.8
S.E. Asia	2.8	0.0	0.0	6.7	0.0	7.7	2.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Responses	(35)	(36)	(33)	(30)	(34)	(39)	(207)

0.0 indicates these places were mentioned by someone in the country sample but by no one in this scientific field.

When we add together the total appraisals made of all the scientific fields, the American and British scientific communities and institutions are perceived as being foremost in the present world of science in nearly three-fourths (75 percent) of the Malaysian responses. Slightly more than one-third of the responses given by this same group of scholars (36 percent) identify the United States as the leading center in their own particular field and another third cited Great Britain. The Malaysians look mainly to these two countries for their paradigms and models for scientific roles, for the books, journals, reprints, preprints etc., they read, for the professional forum in which their own work is critically appraised for its contribution to science and world respected recognition accorded for scientific accomplishments. Beyond the U.S. and U.K., the Malaysian reveal a cognitive map of the most important centers of world science that is confined primarily to Western Europe and the Commonwealth countries (Australia, New Zealand, Canada, India) and to an extent, Southeast Asia. The West European countries, in the aggregate, are seen as containing outstanding science centers in everyone of the delineated fields and they comprise, after the U.S. and U.K., the next largest modal grouping of Malaysian (7 percent) responses.

Neither Russian nor mainland Chinese science has been directly accessible to most Malaysian scholars. Research works of the USSR in any field were mentioned in only one percent of the Malaysian responses. Apart from a bit of speculation, stressing they know little about it, no one listed any in the People's Republic.

Japan and the cooperating Southeast Asian countries are two special places in the mapping of world science. Japan is the major Asian country in higher education and research which is fully tied into the international scientific community. It is also a major economic power with large and growing investments in Malaysia. Nevertheless, there are ambivalent reactions in the country to Japan's academic and scientific communities. These stem from historical experiences of wartime occupation, language barriers and divergent culturally prescribed attitudes and behavior. No Malaysian put Japan on the map as preminent in their field. However, the absence of these regions on the Malaysian scholar's cognitive mapping may be explained to some degree by linguistic barriers, political and economic isolation, and weak cross-cultural lingkage between Malaysian and countries with viable scientific communities (i.e., Japan, U.S.S.R., and mainland China).

The newest reference group, as previously noted, is Southeast Asia as a region. During recent years, some of the older, higher educational and research organizations and a few new regional research and training centers have assumed responsibility for providing regional leadership in particular scientific and technological fields. Malaysia has more recently begun to emphasize regional networks in higher education and science. The Malaysian sample's responses include but three percent of all the prominent centers as being in Southeast Asia.

Taken altogether, in Malaysia, the life sciences have greater depth and better established research traditions than have the physical, engineering and social sciences. The latter see the leading centers of science primarily as outstanding universities for advanced training. The life sciences exhibit a more sophisticated awareness of research centers and the specializations of particular universities and include places in countries with whom they would exchange knowledge as well as sending outstanding students to pursue advanced degrees. For example, for Malaysia, with limited American involvement in the agricultural sciences and the agricultural sector of the national society, almost half (43 percent) of the centers named by the Malaysian agricultural scientists are in the U.S. The agricultural research and developing fields in Malaysia are relatively new and they are looking to American scholars and support systems for specialized training in the various aspects of the agricultural sciences in the building of their "second generation" of agricultural scientists.

B. Scientists in Foreign Countries in Similar Fields of Research Known Personally by Malaysian Scholars and With Whom They Interact

An important sociological basis for trans-societal linkages is a network of informal contacts between scientists which allow for a continuous easy flow of ideas and information. Personalized contacts between scholars from developed and developing societies are one of several ways in which knowledge transfer can take place. The amount of information which is being

exchanged at international conferences, at meetings of scientific societies, orally or through private letters and personally circulated preprint is seemingly much larger than that which goes through more formal channels of communication. Most scientists informally exchange their research ideas with others long before formal publications takes places. Similarly Malaysian scholars have built up informal and sometimes elaborate systems of networking for the exchange of information through letters, conference schedules, preprints and reprints with their colleagues abroad. More than three-fourths (84 percent) of our sample scientists know, communicate with and maintain interpersonal ties on a continuing basis with "significant colleagues" in foreign countries. Among those who have no ties with foreigners, almost a third (31 percent) are medical scientists and slightly less than a fourth (23 percent) agriculturalists. The lower proportion of ties of the medical community may reflect its greater internal strength in Malaysia, whereas the agricultural sciences may be too young to yet have pervasive networks.

The countries of the foreign scholars with whom members of the Malaysian scientific community communicate and have personal ties are given in Table 5. There are several modal patterns. Taken altogether, more than two-thirds of the scholars have ties with counterparts in Great Britain. The proportions having interpersonal networks with British scientists varies by scientific fields. It is high for medical scientists (92.3 percent), physical scientists (91.7 percent) the general life scientists (85.7 percent), and the engineering scientists (69.2 percent). The binational British-Malaysian third cultures remain strong in these fields. It is low for agricultural life scientists (15.4 percent). The British during the colonial period did not have a high development in agricultural sciences, nor has it since independence. The expansion of cross-cultural relations in recent years between Americans and Malaysians is expressed in figures that 42.5 percent of our sample scientists have personal ties with Americans in the United States. The incidence of these particular ties are especially large in the life-general (85.7 percent) and the social sciences (80 percent).

While these findings strengthen the earlier hypothesis, we now need to add some qualifications. Close to a third of our sample (33.8 percent) report have personal ties with colleagues in Southeast Asia (Thailand, Singapore, Indonesia and the Philippines). Personal networkins are proportionally numerous among social scientists (60 percent), life-general (42.9 percent) and agricultural (38.5 percent). All told, they represent the outcomes of newer organized efforts to foster regional cooperation in higher education with respect to some of the sciences and the emergent interests in some scholarly circles to generate regional networks and a sense of commonality among the Southeast Asian countries.

The discrepancy between the sample's identification of Australia-New Zealand as an epicenter of work in their field (5 percent) and the proportion of

TABLE 5

DISTRIBUTION OF FOREIGN SCHOLARS WITH WHOM MEMBERS OF THE MALAYSIAN SCIENTIFIC COMMUNITY HAVE PERSONAL TIES, BY PLACE OF RESIDENCE OF FOREIGN SCHOLARS AND BY AREA OF SCIENCE OF MALAYSIAN SCHOLARS.

Major Area of Science	Total Sample	Home Country of Foreign Scholars with Whom Scientists Have Ties																			
		Great Britain		United States		Austr. /N.Z.		Canada		Europe		India		Japan		S.E. Asia		No Foreign Ties	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Total	80	100.0[a]	55	68.8	34	42.5	30	37.5	12	15.0	11	13.8	3	3.8	2	2.5	27	33.8	13	16.2
Physical	12	100.0	11	91.7	2	16.7	5	41.7	3	25.0	2	16.7	0	0.0	0	0.0	0	0.0	2	16.7
Engineering	13	100.0	9	69.2	3	23.1	6	46.2	3	23.1	0	0.0	0	0.0	0	0.0	4	30.8	1	7.7
Life-Gen.	14	100.0	12	85.7	12	85.7	5	35.7	0	0.0	6	42.9	1	7.1	2	14.3	6	42.9	1	7.1
Life-Agr.	13	100.0	2	15.4	4	30.8	7	53.8	1	7.7	1	7.7	0	0.0	0	0.0	5	38.5	3	23.1
Life-Med.	13	100.0	12	92.3	1	7.7	3	23.1	2	15.4	1	7.7	1	7.7	0	0.0	3	23.1	4	30.8
Soc. Sci.	15	100.0	9	60.0	12	80.0	4	26.7	3	20.0	1	6.7	1	6.7	0	0.0	9	60.0	2	13.3

[a]Percentages do not add to 100.0 percent because some have linkages with foreign scholars in more than one country.

them who have personal ties with fellow scientists in this part of the world (37.5 percent) can be explained, by inference, to the exceptionally rapid growth of opportunities for Malaysians to go for advanced studies, conferences, or scholarly tour visits to these countries. The two largest centers of science in Asia today, India and Japan, do not loom large on our sample's cognitive map and only 3.8 percent of them have personal ties with any scientists in India and 2.5 percent with fellow scientists in Japan.

Although the total with ties to scientists abroad is large there are graduations in these figures by disciplines. The general life scientists (92.9 percent) and engineering scientists (92.3 percent) contain the greatest porportion of their members with ties to foreigners abroad; the social scientists (86.7 percent) and physical scientists (83.3 percent) rank close to the median, while the agricultural (76.9 percent) and medical (69.2 percent) are the least involved. Perhaps this is due to the fact that agricultural and medical sciences to a large degree have stronger supporting systems within the national scientific community. For some in these fields, maintaining ties with foreigners abroad is not considered as their foremost concern.

A higher percentage of men (86.2 percent) than women (73.3 percent) have network ties with scientists abroad. This is not unexpected since women have marginal roles within the Malaysian scientific community, thereby limiting the range of their interpersonal ties with scholars abroad. By ethnicity, the rank order from high to low in having personal ties with individual scholars in other countries is Chinese (88.9 percent), Indian (88.2 percent) and Malays (74.1 percent).

To probe beneath the surfaces of these personalized relationships between members of the Malaysian academic scientific community and their foreign associates, we now consider how these ties were created and the different status levels of the foreign scholars, and the specific dyadic exchanges of science materials and services taking place between them.

Turning to the way in which these dyadic interactions are built and the status levels of the foreign scholars, our findings indicate some interesting clues. The most frequent sources of binding stem from an earlier relationship with professors and other graduate students in the same field in a foreign university or research center. One in five continue in regular interaction with their former professors in the country where they studied. We would stress that a good intellectual relationship had been worked out when they were graduate students. They understand each other's manner of thinking and can quickly zero in on the points of intellectual exchange. Besides former professors, some scientists also retain ties with their former graduate student cohorts whom they knew and had worked with before (33.8 percent). This is especially the case for medically related scientists (61.5 percent). Next, 15 percent have personal ties with individuals whom they had met while visiting research centers or while doing post-graduate work during a sabbatical leave at foreign institutions. The remainder established ties either during the foreign scholar's

visit to Malaysia (7.5 percent) or at professional and scientific meetings abroad (7.5 percent).

Looking closely at our sample of scientists at work, there is a web of reciprocity and exchange which links the Malaysian scientific community and their foreign counterparts. We have asked each of them to indicate "how these foreign scholars have helped them in their scientific work" and, similarly, "how they in turn have helped their foreign colleagues". Table 6 provides the patterns of the scientists' responses to our questions.

The kinds of scientific help obtained by Malaysian scientists from their foreign counterparts include initiating collaboration in research, reading and commenting on research manuscripts, securing publications, equipment, specimens, post-graduate placement, hosting during visits, and exchanging research data. The aggregate suggests that the most common role of the foreign scholars is to read and comment on the manuscripts sent to them by their Malaysian colleagues prior to formal publication. More than one-half of the total sample (59 percent) mention this. Furthermore, these foreigners often eventually help in the placing of these manuscripts for publication in foreign scientific journals.

TABLE 6
NATURE OF SCIENTIFIC HELP EXTENDED BY FOREIGN SCHOLARS TO MALAYSIAN SCIENTISTS AND BY MALAYSIAN SCIENTISTS TO FOREIGN SCHOLARS

Nature of Scientific Help	Extended by Foreign Scholars to Malaysians		Extended by Malaysian Scholars to Foreigners	
	N	%	N	%
Initiate Collaboration in research	36	45.0	19	24.0
Read manuscripts	47	59.0	14	18.0
Secure publications	28	35.0	12	15.0
Secure equipment/ apparatus	10	13.0	1	1.3
Secure specimens	11	14.0	16	20.0
Secure post-doctoral appointments	5	6.3	1	1.3
Hosts during visits	20	25.0	24	30.0
Exchange research data	2	3.0	2	3.0
Total	80	100.0[a]	80	100.0[a]

[a]Percentages do not add to 100.0 percent because some extended more than one type of scientific help.

The most highly involved in this process are the general life-scientists (79.8 percent), closely followed by the social scientists (67 percent), engineering scientists (62 percent) and physical scientists (58 percent). The medically

related scientists (46 percent) and the agricultural scientists (39 percent) are less involved. The next most common role of the foreigners is to initiate collaboration in research with their Malaysian colleagues. Slightly less than one-half of the academic scientific community (45 percent) were approached for such activities. The largest proportionate amount of collaboration occurs among the life-medical scientists (69 percent) and the general life scientists (50 percent). It is less frequent among the other disciplines: physical science (25 percent), engineering (23 percent), agriculture (31 percent) and the social scientists (27 percent). The third role-related activity is rendering assistance for securing publications. Roughly 35 percent of Malaysian scientists received such help from their foreign associates. This occurs more often for the general life scientists (50 percent) and social scientists (47 percent) than for agricultural scientists (38.5 percent), physical scientists (25 percent) engineering (23 percent) and medically related scientists (23 percent). The fourth activity consists of the foreigners becoming a host during visits made by their Malaysian colleagues. A fourth of our sample have been the guest of a foreign scientist in the years since they completed their foreign education and subsequently returned to Malaysia. Other activities of the foreigners, such as providing help in securing equipment/apparatus, specimen, materials, post-doctoral placement, and exchange of research data, are less often cited by the sample.

In exchange for the supporting services extended to them by their foreign colleagues, Malaysian scientists provide other forms of help to their foreign colleagues. Table 6 reveals that the most typical help given is being hosts during visits of their foreign "significant colleagues" to Malaysia. Almost a third of the scientists (30 percent) have hosted foreign scholars during their visits to Malaysia. The highest proportion were the agricultural scientists (46 percent), general life scientists (43 percent) and social scientists (33 percent).

The second important role is collaboration in research. Slightly less than one-fourth (24 percent) indicate they extended research opportunities to foreign colleagues. The most prominent participants in initiating joint studies are the agricultural and medical life scientists. One out of five scientists (21 percent) in both of these two fields have shared at least one of their studies with foreign associates. The third important role is that of securing agricultural, zoological and botanical specimens requested by foreign scientists. One out of five scientists in our sample has responded to such requests, made special collections and sent them to their foreign colleagues, most of them are in general (43 percent) and agricultural (23 percent) life sciences. Reading and commenting on research manuscripts written by foreigners before they submit them for publication has been done by nearly a fifth of the sample.

We can therefore conclude that while the norms of reciprocity between them endure, a large majority of the sample are more frequently dependent on their foreign associates than their foreign counterparts are on them for scientific help and services. We can also conclude that the life scientists, particularly the general and medical and, to a lesser extent, agricultural, are the dis-

ciplinary groups most actively participating in exchange with foreigners. The social scientists fall at midpoint in most of these activities. The least engaged in a system of reciprocity and mutual exchange with foreigners in their work roles are physical and engineering scientists.

SUMMARY

In the preceding analysis I have attempted to discuss the paradigms of a third culture of science especially about two dimensions of the inter-relations between the national scientific community of Malaysia and the world system of science. Briefly reviewed, then, third cultures occur in trans-societal networks, they interweave, change and develop as active scientists with similar interests come together, interact, exchange journal articles and pre-prints, share knowledge, collaborate in research, help each other in their world of work and maintain professional ties.

A third culture of science from the view point of Malaysia can occur inside a society when there exists local binational or multinational networks of indigenous and foreign scholars, and among scientists who live in two or more different societies but who may have interacted in either setting. The Malaysian academic scientific community is neither autonomous within its own society nor separate from the world system of science. The variables used in this brief account point to some commonalities and also to some significant differentials among the Malaysian academic scientists in their professional identities, reference groups and trans-societal networks. The evidence seems strongly to suggest that the Malaysian academic scholars are not a homogenous group of working scientists whose characteristics can be simply generalized. Instead, each group of academic scientists has roles and relationships in a complexly patterned series of interconnected social structures and cultures.

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