SCIENCE POLICY MANAGEMENT*

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Development of the Pacific region depends upon communication and education of scientific and technological manpower as one aspect of human resource development. Statistical data to guide policy are lacking. Co-ordinated efforts within the Pacific community are needed to collect data and develop appropriate policies.

Keywords: communication, regional educational exchange, human resource development, scientific and technological manpower, brain drain, lack of data

Please celebrate with us the first full term of existence of the PSA Science Comunication and Education Committee. The theme of this XVIth Congress is *New Dimensions of Science, Manpower and Resources in the Pacific.* Education and communication stimulate us towards these "new dimensions". This paper is about us, here at the Congress. It is about us as scientists, engineers, teachers, diplomats, managers, leading citizens, people with interests in the Pacific. It is about policy on overseas study for scientists and engineers and subsequent communication support. Decisions on these by policy makers are difficult. Good data are lacking.[1]

Within this paper there are three questions. One question is, "What do we know?" There are dangers in proceeding with policy decisions based on the inadequate social science knowledge presently available. In this condition all of us may lose. Another question is, "Where are we?" Governments are collecting more sophisticated demographic data on overseas guests. These will surely benefit the individual country. A stronger nation may win; the less powerful lose — an old story. The third question is, "What can we do together?" Here the emphasis is on cross-sector co-operation within the entire community called the Pacific. Policy decisions are based on the well-being of the whole Pacific family. New mechanisms, new forums, are not needed. The structure is already there in the Pacific Science Association. The focus of this paper is on regional education exchange as one means of communication for development.

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WHO ARE WE?

The call has gone out from Seoul for the XVIth Congress. The community of Pacific science responds to this gathering. We share similar goals for Pacific peace and prosperity. Our principles are: open communication, co-operative change; and agreed responsibility. Who are we? Individuals who seek a Pacific process for development, a Pacific structure for co-operation.[2] Our form is people. People who work, not for themselves, but with and for others. Our initiatives are people's initiatives.

In the past, it was rather simply thought that knowledge and its application were enough to promote well-being and prevent disaster. Now, we are faced with problems that are regional as well as local; for example, energy, pollution, population growth and movement, unemployment, management of space, and health. While knowledge is essential, it is not enough. Our welfare depends not only on technical expertise but on human relations across cultures and their development. Attention to human relations *and* the task itself is the feature of human resource development (HRD).

The basis for Pacific development in people is well understood by the foreign ministers of ASEAN. In a Jakarta dialogue, July 1984, with their Pacific partners — Australia, New Zealand, Japan, Canada and the United States — Foreign Minister Mochtar of Indonesia suggested Human Resource Development (HRD) as a co-operative activity. It could shape the region yet to come.[3]

HRD improves people and the region through education and training. It involves:

- learning specific task related skills;
- mastering a domain of knowledge;
- acquiring capability for service to a future yet unknown;
- creating communication networks to nourish these goals.

The HRD project was chosen by the dialogue partners as it sets the pace for all nations of the Pacific, great and small.

Clearly, development of the Pacific region depends on communication and education of scientific and technological manpower as one aspect of HRD. Teams of scientists and engineers from more than one country must speak the same task language and interact well together. Education and favourable experience with colleagues of a country other than one's own, provides one condition for:

- continued communication,
- co-operative research,
- scholarship, and
- mutual understanding.

WHERE ARE WE?

Education and communication is a serious issue for us as scientists. Throughout the region we are making spontaneous and/or planned visits to other countries for education and work reasons. Governments are collecting data. It is estimated that, world-wide, over one million students of all interests are studying in countries other than their own. The United States is the dominant host country followed by France, England and Canada.[4]

South and East Asian students in the United States are increasing dramatically. Numbers rose 9 per cent last year to 143,680 students. The largest number of students for the second consecutive year is from Taiwan. Second, with 21,730 students, is Malaysia. Of the top fifteen countries with students there, nine are Pacific countries, including Indonesia, Thailand, Republic of Korea, China and Hong Kong.[5]

In the Pacific development context of necessary technical manpower and communication across cultures, South and East Asia supply the largest numbers of engineering students to the United States. That is, 42 per cent of their students in the United States, or more than 18,000, are engineering students. Taiwan sends the greatest number, 3,000, followed by India and Korea not far behind.[6] The total number of scientists and engineers educated outside the home country since World War Two and working at present in the Pacific region, can only be guessed. The combined number must be substantial — the communication networks and information flow, significant.

So much human energy and resources are committed to regional exchange that more information is needed to chart these patterns. This was the focus of a working seminar on international education exchange, convened within the Fifteenth Pacific Science Congress of the Pacific Science Association in New Zealand, February 1983 and chaired by Paul Pedersen.

PACIFIC EDUCATION EXCHANGE: FIFTEENTH PACIFIC SCIENCE CONGRESS

Representatives to the meeting from the Philippines, Indonesia, Malaysia, Thailand, Singapore, Korea, Australia, Canada and the United States expressed concern about the practice of educational exchange. The reasons were varied and complex. Some worried about erosion of national culture. Others worried about the financial cost to the sending country. Many stressed the reliance of universities on overseas students as a source of tuition, enrolment and teaching assistants. This was seen to be the cause of increasing recruiting trips by university administrators to other countries. As a consequence, standards of performance expected by overseas students are becoming suspect. Universities being built as much for the profit motive as for scholarship enchancement are a worry.

Political and educational systems of the sending country are often affected on return of large numbers of overseas students. Communication through alumnae groups exists but is weak. Information about the strengths and weaknesses of overseas institutions is frequently unavailable. Constant updating of knowledge is often costly, delayed and dependent on career variables.

A formal statement of the gaps in knowledge, research and practice of Pacific educational exchange was issued to the Science Communication and Education Committee of the Pacific Science Association.

> The consensus of the symposium/workshop at the Fifteenth Pacific Science Congress, Dunedin, New Zealand is that:
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> 1. Research should address co-operative science and technology exchange programs as the highest priority.
> 2. Future trends and deficiencies of exchange programs need to be anticipated.
> 3. Information on education exchange throughout the region needs to be more readily accessible.
> 4. The decision making process on educational exchange by governments throughout the Pacific region needs to be commonly understood. Mutually beneficial exchange policy should be derived.
> 5. A need exists for a 'brain plan' for more effective use of scientists and technologists who return home.
> 6. A network of expertise on regional education exchange needs development.

BRAIN DRAIN

Research on educational exchange in relation to development has often been motivated by the deficit notion of 'brain drain'. The concept, 'brain drain', emerged in the mid-1960s from discussions within the United States system. Within this perception, overseas study and economic development are viewed as strongly linked. The fear is that developing countries are losing their scientists who are educated abroad to the more developed countries.

The benchmark study of migration of professionals who study abroad, was a multinational, comparative research project initiated by UNITAR. It adopted a sociological approach and was conducted by William Glaser, Director of the Program on International and Comparative Research at the Center for Social Sciences, Columbia University. Glaser concluded that most students actually return home after their study abroad for most countries and in most areas of study.[7] The fear of a brain drain seemed to be unfounded. Hans Weiler, Director of the Stanford International Education Center, and others also maintain that the majority of overseas students tend to return home.[8]

Yet William Greer in the *New York Times* (March 27, 1983) announced that the 'brain drain' did exist. One-third of the overseas students in the United States, he said, did not return home.[9] This is a considerable number of non-returnees. Is there or is there not a 'brain drain'? Discrepancies in interpretation of 'brain drain'-related information appear to be due to exaggerated statistics. When country and majoring subject are analyzed, differences in return rate do appear. For example, a NAFSA/AID survey reported the *intentions* of overseas students in the United States to return home by field of study and country of the student. Engineering and business management students were more likely to remain in the United States than those from agriculture, social, natural or life sciences. South and East Asian students were the most likely to remain after the study period.[10]

The NAFSA/AID study surveyed intentions to return home. The Glaser research reported the reasons behind intentions to stay in one's own country or leave. Information on those who actually do not return home is missing and difficult to acquire. Thus, Beverly Porter, at the Symposium on The International Flow of Scientific and Technical Talent, sponsored by the National Academy of Sciences, USA, May 1985 concluded that "consistent and reliable data in this area are not easy to obtain; many — sometimes crucial — gaps in the information exist."[11]

Recently, a rather sophisticated research study on overseas scientists and engineers was conducted by Oak Ridge Associated Universities. The data included self-reported social security numbers. The result was that 50 per cent of the Ph.Ds awarded in engineering in the United States have gone to overseas nationals and of those, 62 per cent stay on for work there. Further, one half of the students on temporary visas in engineering and computer science remain.[12] How *long* these engineers will remain is still a question.

In January 1986, the Third National Science and Technology Conference in Taiwan focused on scientific and technological manpower. It was disclosed that the number of engineer returnees does not approach what is required by the job market. At least one-third of the returnees did not have work experience and less than one-fifth had doctoral degrees. The report states that a reasonable policy for study abroad is imperative.[13]

The Science Communication and Education Committee of the Pacific Science Association sponsored a pilot co-operative research study to investigate the reasons behind the choice of engineers to work in Taiwan or abroad.[14] Questionnaire and interview data were gathered from returned engineers and scientists for the years 1980-1985. Dr Hwang, National Taiwan University, Taipei, Taiwan, managed this aspect of the study.

A full report of the results will be made during the Sixteenth Pacific Science Congress. However, evidence does concur with the resolution to the Executive Yuan, Third National Science and Technology

Conference in Taiwan. More flexible policies are suggested in the activities indentified as Human Resource Development or HRD, among others. Neither the Taiwan-USA co-operative research study nor the Executive Yuan Conference report detailed the number of engineers or scientists who returned home, but subsequently left.

WHAT DO WE KNOW?

Few would dispute the trend toward faster trans-Pacific travel, inter-dependence of growing Pacific economies, and more widely distributed microcomputer/telecommunication facilities. As we move from national to regional development, the numbers of scientists or engineers staying abroad or leaving the home country may no longer be relevant. We are caught with a static concept in an ocean that laps many shores. Research on education and communication of engineers and scientists has been one-directional. A balanced perspective is lacking. Indeed, we may be asking the wrong questions.

- Does knowledge acquired abroad lead to regional development? Little systematic research or concrete evidence has been offered at the national, not to mention regional level, that relates economic and political development to overseas study.[15]
- Is communication skill across cultures a significant variable for successful regional development? How does cross-cultural skill relate to the formation of regional, person to person, communication networks?
- How do the home countries and the region view the choice not to return home in the short time frame? In the long term?
- What are the conditions that push nations to create policies to slow a perceived 'brain drain' to countries of the Pacific region? Although there are national differences in the numbers of students studying abroad in a particular country, no serious attempt has been made to explain them.[16]
- Finally, personal, national and regional development concerns are many. They sometimes conflict. These need study.

With such data lacking, policy makers are pushed back to personal study/work experience or observation of regional commerce in the broad sense. The consequence may be unanalyzed bias or prejudice toward policy alternatives concerning Human Resource Development for scientific and technological manpower in the Pacific.

WHAT CAN WE DO TOGETHER?

There are three clear choices for those interested in educational exchange, regional scientific communication and policy-related research.

1. The first is to settle on no change in our social science scholarship or its application. We can continue to move along in an unsteady fashion with untested assumptions, sporadic research, samples of opportunity, and, perhaps outmoded concepts;
2. The second choice is to tighten up our statistical data bases, government by government. The greatest benefit will surely accrue to the dominant power; or
3. We can co-ordinate efforts within our community of people interested in Pacific development. We can plan for opportunities in development of the Pacific as a whole, not as fragmented parts. The Communication and Education Committee of the Pacific Science Association is at the service of this goal.

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