IX. TAXONOMY, BIODIVERSITY AND MANAGEMENT OF KNOWLEDGE IN ASIA

F.S.P. NG

938 Lorong Kuang Cermin Satu, Taman Kepong, 52100 Kuala Lumpur, Malaysia
(e-mail: fng@pc.jaring.my)

At the Biodiversity 2000 Kuching Conference in November 2000, I put forward the thesis that biodiversity is a knowledge resource, and that Asian societies have an attitude problem with respect to the management of knowledge (Ng, 2001). I offered the following evidence:

In AD 304, Chi Han published his famous monograph on the Flora of Southeast Asia (available in English translation by Li, 1979), covering about 80 species of plants from what is now Vietnam and S China. Chi Han covered 18 edible fruits and nuts, 5 useful palms, 3 vegetables, 2 other food crops, 5 spices, 2 masticatory plants, 2 dye plants, 5 fibre plants, 6 perfume plants, 7 drug plants, 11 wood and wood-products plants and 10 ornamental plants. Chi Han's book became a classic in the Chinese scientific literature.

1400 years later, the Portuguese missionary Jaõa de Loureiro (1717–1791) described 1300 species in his 'Flora Cochinchinensis' (1790), covering exactly the same geographical area as Chi Han. Loureiro's 1300 species completely dwarfed Chi Han's 80 species. The big difference between Loureiro and Chi Han was that Loureiro's agenda covered all plants, whereas Chi Han limited himself to plants of economic importance. If we define knowledge as facts that are discovered and published, Chi Han's contribution to knowledge was incremental, whereas Loureiro's contribution was explosive.

Loureiro was not the only one with a big knowledge agenda. Before him, Hendrik Adriaan Rheede van Drakenstein (1637–1691) had produced the 'Hortus Malabaricus' (1678–1703) for the Malabar region of India and Georg Everhard Rumphius (1627–1702) had produced the 'Herbarium Amboinense' (published 1741–1750) for the Moluccan region of Indonesia. At the same time, other western scientists were gathering knowledge about the universe in all directions and in all areas, from astronomy to zoology, inventing instruments and methodologies as they went along, and thereby building up a universal body of knowledge, making no distinction between useful and useless knowledge. Through relentless exploration and publication, they were contributing to the total understanding of the universe, which is one of the major attributes of modern science.

With the sole exception of the Japanese, Asian scientists are, even now, constantly reminded by their institutions and governments not to waste resources on non-useful research. As a further twist, any money allocated has to be spent on 'national' topics, not 'wasted' on the problems of neighbouring countries. There are almost no contributions from Asian national botanists to the international Flora Malesiana project. No Thai botanist is familiar with the plants of Malaysia. No Malaysian botanist has studied the flora of Sumatra. But western and Japanese scientists come and go all over the region and the world.

It is not only botany that has been affected by this attitude. A couple of years ago there was a big scare in Malaysia over mosquito-borne diseases, so I undertook to compile the

information available on mosquitoes and mosquito-borne diseases (Ng & Yong, 2000). We had experts in Malaysia, but I found they were only expert on 'Malaysian' mosquitoes and diseases. For regional taxonomic and ecological overviews, we had to invite Japanese scientists. The Japanese had made it their business to pursue their studies throughout the Asian region, so they had a bigger overview and a higher level of expertise. Asian biodiversity-rich countries hope to be able to cash in on biodiversity. But I do not see legions of eager young Asian scientists probing away and making discoveries on all kinds of organisms. To deal with the vastness of tropical biodiversity, a knowledge explosion is needed, but this cannot happen with the constant harping on 'usefulness' as a prerequisite for research.

The other major attribute of modern science is the use of knowledge to create useful technologies. Immediately, people sit up. Yes, this is what we want! But can society have one without the other?

In the private sector, success is measured in earnings within the relatively short time of a few years. Contributing to the knowledge explosion cannot be the business of the private sector. The private sector expects a 'free' ride from public sector R&D and pays back by generating employment and income and by paying taxes. Its own research find-

Table 1. Common Asian attitudes on knowledge, compared with scientific attitudes.

	Common attitude	Scientific attitude
Acquisition of knowledge	Learn from teachers and textbooks. Taught knowledge valued as basis of qualification and advancement	Taught knowledge has temporary shelf life, valued as a launching pad for creating new knowledge
Treatment of useless knowledge	Not worth acquiring or creating; anticipated applications determine what research should be done	All knowledge useful as components of holistic knowledge systems; applications often follow unexpected leads opened by research
Growth of knowledge	Slow, due to secretiveness and reluctance to publish	Exponential, due to publication and global pooling of knowledge
Ownership of knowledge	Compartmentalised; discoverers tending to keep secrets	Global; discoverers settling for public recognition, or legal grant of commercial rights through patents and other forms of intellectual property protection
Quality control	Low, due to lack of competition, lack of pressure to publish, lack of peer review	High, due to competition, pressure to publish, and peer review
Boundaries of knowledge	Defined by culture and politics	Defined by the nature of the topic
Application of knowledge	Researchers themselves expect, and are expected, to develop useful applications from own research	Applications developed by many diverse players in society, through time and space, and drawing upon global knowledge resources

ings are usually commercial secrets, but such secrets are rarely of a type that contributes to fundamental scientific knowledge.

In the public sector, by which I mean the universities and the public research institutes, the business of research should be the generation of a knowledge explosion, and the training of people who are skilled in discovering, publishing, and sharing knowledge. There is no time limit and the benefits should be measured in terms of quantity and quality of the national scientific output, and the scale of private enterprises sustained.

If public sector institutions are ineffective in knowledge generation, the private sector suffers, because it can get little or no real help from the public sector. This is exactly the situation in most Asian countries: public institutions do not put enough effort into public knowledge generation, and do not require their scientists to be part of the global mainstream in science: to read widely, to publish internationally and to be familiar with cutting edge developments.

Money is not the issue. Neither Chi Han nor Loureiro were motivated by money and there is no evidence that either of them benefited financially from their botanical research. We have to conclude that they did it for personal satisfaction. The better scientists always make their own contributions above and beyond what they are paid for. However, Loureiro did more because he was culturally less inhibited. The removal of this cultural inhibition is necessary for the advancement of knowledge. The division of knowledge into useful and useless categories according to preconceived notions can only result in a knowledge system that is full of gaps and inconsistencies.

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