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# STEPAN UPDATE

Newsletter of Science and Technology Policy Network

## Cambodian workshop on STI and science education policy held

The Ministry of Education, Youth and Sports of Cambodia held a workshop on 29-30 March 2010 in Phnom Penh, for the presentation to the Cambodian government of the report and recommendations of a team of consultants engaged by UNESCO Jakarta to conduct an assessment of the country's science, technology and innovation, and science education policy.

The consultancy team consisted of Prof. Tim Turpin of the Centre for University of Western Sydney, who is also the Australian focal point for STEPAN, and Prof. Jose Magpantay of the University of the Philippines.

Participation in the workshop was at a high level, led by H.E. Chea Sieng Hong, Secretary of State for Ministry of Industry, Mines, and Energy (MIME) and H.E. Lok Chum Teav Phoeurng Sackona, Secretary of State for Ministry of Education, Youth and Sports (MoEYS). Senior officials from various Cambodian government agencies and academic institutions were also represented. UNESCO was represented by Mr. Teruo Jinnai, Head of the UNESCO Phnom Penh Office.

The presentation by Tim Turpin highlighted that in today's modern world, innovation is the most important factor in a country's competitiveness. International statistics on publications, R&D expenditure, and a number of researchers were cited to show how far Cambodia has lagged behind other countries, thus emphasizing why Cambodia has to take drastic actions in science and technology.

The presentation further cited the key areas where the country has to make decisive actions. These are (1) establishing a national science and technology policy, (2) producing and engaging highly skilled scientists, engineers, science and mathematics teachers and technicians, (3) developing and enhancing linkages between the academe, public and private sectors, and (4) having a mechanism for monitoring and reviewing the progress within the context of a national innovation system.

The options presented covered two main areas – developing a national science and engineering research capability, and enhancing capacity for science and mathematics education.

The first covers instituting a national funding program for research, enhancing the role of the Royal Academy in S&T matters, establishing a national science and engineering research center, forging closer policy links between professional and technical training systems, improving the coordination between the eleven ministries that supervise the universities and having cross institutional sandwich programs to produce more graduate manpower in S&T.

The second covers recommendations for teacher training, curriculum development, and international exchange programs to improve science and mathematics education.

The presentation by Jose Magpantay argued for a national innovation system (NIS) framework to achieve economic competitiveness and growth. The national innovation system of Cambodia includes the public sectors (National Assembly, Royal Government and the relevant Ministries of Planning, Economy and Finance, Commerce, the 8 Ministries that comprise the National Committee for Science and Technology and the Cambodian Investment Board), the private sectors (SMEs, SEZs, DFIs, Industry organizations), the academe (Universities, technical schools) and the ODA (technical cooperation, country programmable aid). The relationships within each sector and between sectors were then presented to complete the current picture of Cambodia's NIS.

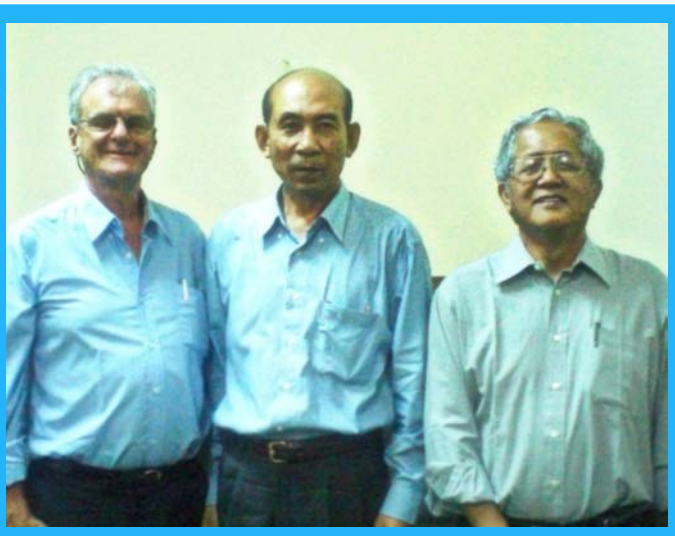
Bearing in mind that the main point in developing the country's NIS is to be aware of the knowledge and technology gaps the country has with other countries and to focus on narrowing those gaps, the options presented were: (1) Cambodia must develop the capability for S&T planning, (2) continuously improve the tertiary education sector, (3) develop key advanced areas in science and technology, (4) focus on how to acquire technology in dealing with DFIs and ODA projects, (5) strengthen the SME sector , (6) establish financial mechanisms for SME's technology upgrade, (7) guarantee the continuity of developing the NIS by establishing a development fund, which may come from the oil and natural gas revenues of the future.

The discussions that followed the presentations cited the current situation in Cambodia – it is difficult to get collaboration among the different ministries and drastic changes will be difficult to achieve. It is better to achieve incremental changes within the purview of each Ministry than to push for major changes that will encompass other Ministries. ###


*Cambodian stakeholders deliberate on the consultants' report and recommendations during a plenary session of the workshop.*

# Science, Technology and Innovation Assessment of Cambodia

*Towards the end of 2009, UNESCO undertook a science, technology and innovation policy study, with emphasis on science education policy, for Cambodia, in response to a request by the country's Ministry of Education, Youth and Sports (MoEYS). A team of two consultants, composed of Prof. Tim Turpin of the Centre for Industry and Innovation Studies(CInIS), University of Western Sydney, Australia, and Prof. Jose Magpantay of the Technology Management Centre of the University of the Philippines, was engaged to carry out the study. This article is an excerpt from their report, specifically the chapter describing the overall situation in STI and science education capacity in Cambodia.*



*The consultants (Tim Turpin, left and Jose Magpantay, right) pose for a photograph after their briefing with Dr. Chan Roath, Director of Department of Scientific Research, MoEYS, in Phnom Penh.*

**Overall Picture of S&T Capacity**

This article presents an overview of the national S&T and STEM capacity in Cambodia. UNESCO statistical data provide some information but they are generally 5-6 years behind the present date. World Bank country statistics also offer relevant data and these are often available in useful international comparison. Where possible this section of the report presents a current overview of capacity and indicates those areas that present pressing and urgent challenges.

As a backdrop it is helpful to locate Cambodia's knowledge based development in a global context. Table 1 below, presents some comparative data based on World Bank knowledge indicators. These data show the immense challenge Cambodia faces in developing its national S&T capacity. Yet the glimmer of hope is the comparatively stronger education capacity, when compared to low income countries generally and two other least developed economies, Nepal and Mozambique. Much of this report and recommendations are directed toward finding ways to use science and technology education policies to provide a stronger base for developing a national innovation system.

**R&D Capacity and R&D Institutions**

Human resources for undertaking R&D are limited. According to 2006 data there were only 223 full time equivalent researchers or 20 per million persons in the population. This compares with 102 per million of the population in Vietnam. Cambodia has the lowest proportion of R&D personnel (per million inhabitants) than all ASEAN countries, with the exception of Lao PDR with 16 per million of the population.

Half of Cambodia's R&D personnel are employed in government (113) the next highest employing sector is private non-profit (47). The business sector employs 35

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*Table 1: Knowledge Indicators for Global Income Groups, Cambodia Nepal and Mozambique*
(Source: World Bank, Knowledge for Development data base (K4D), 2009.)

| Global Income Group and Selected Country | Knowledge Economy Index (KEI) | Knowledge Index (KI) | Economic Incentive | Innovation | Education | ICT |
|---|---|---|---|---|---|---|
| High Income | 8.23 | 8.3 | 8.02 | 9.02 | 7.47 | 8.42 |
| Upper Middle Income | 5.66 | 5.85 | 5.08 | 6.03 | 5.63 | 5.89 |
| Lower Middle Income | 3.78 | 4.04 | 3.01 | 4.96 | 3.32 | 3.85 |
| Low Income | 2.0 | 1.98 | 2.05 | 2.52 | 1.61 | 1.82 |
| **Cambodia** | **1.56** | **1.54** | **1.63** | **2.07** | **1.93** | **0.62** |
| Nepal | 1.74 | 1.62 | 2.11 | 2.27 | 1.79 | 0.8 |
| Mozambique | 1.58 | 1.08 | 3.06 | 1.67 | 0.3 | 1.27 |

and universities 28 R&D personnel. The low proportion in universities no-doubt reflects heavy teaching loads and limited resources for R&D. Our understanding that those employed in the government sector are almost entirely dependent on foreign funding.

The number of technicians engaged in R&D per million inhabitants is 17. The equivalent Thai figure is 160 per million inhabitants .

Human resource capacity for S&T is clearly very limited. A pressing task will be to maximize the potential of this group through policies directed toward cooperation and concentration of resources through government coordination into key development areas.

General expenditure on R&D (GERD) is also limited. GERD as a percentage of GDP is .05. This compares similarly with Indonesia (.06) and Lao PDR (.04), but is well below Vietnam (.19) and Thailand (.25). Over 50% of R&D expenditure is spent in the non-government sector, 25% in the government sector and 12% in the business sector and only 12% in the university sector. In contrast Vietnam has only 11% in the NGO sector and 66% in the government sector. Both the government sector and higher education sectors remain weakly coordinated. This is because various ministries (e.g., agriculture and health) are singularly responsible for directing their government research expenditure and are responsible for finance and research directions in their ministry based universities.

But it is the source of funds that offers the biggest policy challenge. In Cambodia over 70% of R&D funding is financed from either the NGO sector or abroad. By comparison, in Thailand only 2.5% is so funded.

Directing financial resources in Cambodia to R&D thus presents an enormous challenge. Firstly to build the financial capacity to increase R&D but also to develop national priorities for turning the disproportionate investments in the NGO and international funding sectors toward carefully planned national priorities.

## S&T Output

Although the human and financial resources in Cambodia remain limited, there is evidence of growth in scientific output. Publications in international scientific journals have risen sharply since the mid 1990s from almost zero to over 100 per year. In comparative terms, however, the growth is not as vigorous as other neighboring countries such as Vietnam (see Figures 1&2). The important point is that there is growing capacity and the policy challenge is to nurture this development in order to more effectively embed Cambodia, in the global knowledge system. Building a strong cohort of researchers working in key areas of socio-economic development of direct relevance to Cambodia's development strategies is an urgent matter and offers an important policy challenge.

Patents held by Cambodian based institutions are only few with just two registered between 2002 and 2008. In spite of, and perhaps because of, this limited output Cambodia's future economic development will depend on rapidly building a larger workforce of scientists, technicians and engineers. As noted above, the capacity to deliver such resources is limited because of institutionally dispersed higher education responsibilities and the need to concentrate dispersed resources to make them available to a core of the country's scientists, engineers and technicians. A carefully planned program of S&T and STEM policies will be needed to underpin the development of this capacity.

## S&T Institutional Policy Coordination

One of the challenges for developing a coordinated National Innovation System for Cambodia is to coordinate activities across government agencies and potential S&T performing institutions. There are at least eleven ministries with responsibilities, in some way, for agencies that are currently or could potentially be supporting the nation's R&D effort. There is a need to coordinate these activities. This is important for steering not only valuable national S&T output but also for generating a Cambodian scientific community and sharing costly scientific facilities. The Royal Academy of Cambodia, for example, has a number of highly qualified scientific personnel, but access to research funding and infrastructure facilities is limited.

There are currently some useful developments toward achieving S&T coordination. There is a National Committee for Science and Technology (NCOST) that has cross government membership representing the key agencies with relevant S&T responsibilities. However, this Committee appears primarily to coordinate government responses to the ASEAN Committee on Science and Technology (COST). There is clearly potential for this committee to take on a more 'generative' role in Cambodia's S&T effort.

At present responsibilities for Cambodia's higher education institutions are widely spread, although the MoEYS is responsible for overall quality control of the system. Research performance, however, is rather ad hoc and there is not systematic research funding policy or institutional structure in place.

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*Figure 1: Cambodian Social Science and Science Publication, 1990 – 2008* (Source: Science citation index Web of science)

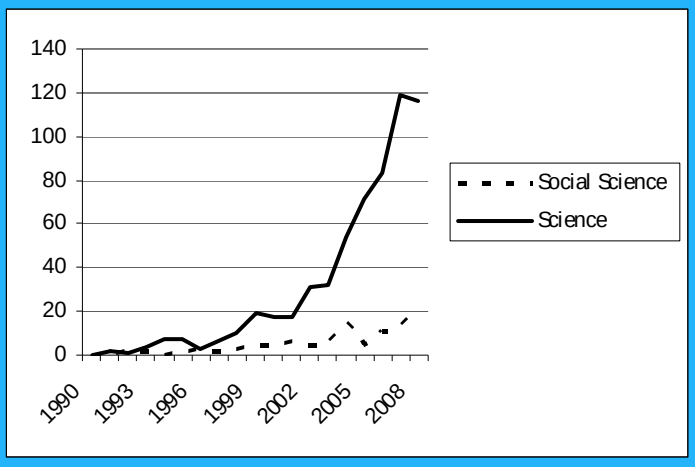
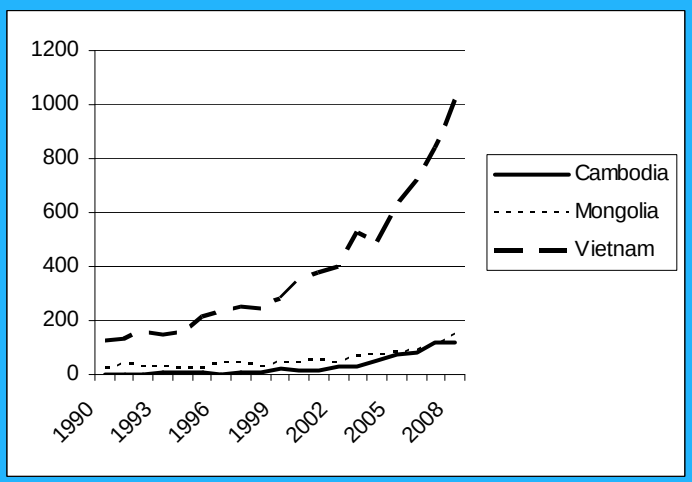



*Figure 2: Cambodia Science Publications compared with Mongolia and Vietnam: 1990 - 2008* (Source: Science citation index Web of science)



# Science, Technology and Innovation Assessment of Cambodia (cont.)

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However, there are currently some new proposals developed by MoEYS to establish a Research Development Policy in the Education Sector. This includes a proposal to establish a National Research Commission for Education (NRCE) and a Research Advisory Board (RAB). There is also a proposal to establish a structural arrangement to formulate research policy and coordinate funding and priority setting processes. These are important developments and there is a clear need to ensure arrangements of this nature are progressed as soon as possible.

**Science, Technology and Mathematics Education**

As noted above, the education system in Cambodia is still undergoing a process of reconstruction. Literacy rates remain low (76% compared to 90% for Vietnam and 94% for Thailand). Gross secondary and tertiary enrollments are also comparatively weak, 42% and 5.4% respectively (compared to 76% and 15.9% for Vietnam and 84% and 44% for Thailand. But more worryingly the quality of math and science education, according to the World bank KAM data also remains low with a regional normalized score of 0.88 compared to 4.66 Vietnam and 6.08 for Thailand.

Secondary education in science and mathematics are an essential starting point for building STEM capacity for a growing higher education sector, both for degree and vocational education. Due to the limited capacity to offer laboratory based experimental learning, there is a corresponding shortage of experienced teachers.

There are four significant policy challenges: (1) to generate a flow of high quality skilled scientists and engineers from the university system; (2) to generate a flow of teachers from the university sector for mathematics and science teaching in secondary schools; (3) to provide a coordinated system of in-service training for mathematics and science teachers; and (4) develop laboratory experimental science education facilities in key geographic locations to enable the sharing of such resources.

At present the national education system has little to offer a growing industry sector except student output. This, of course, is important. However, a higher education system has the potential to provide a national knowledge-hub, essential for the production, transmission and direct transfer of knowledge. At present there appear to be no policies in place that can steer such development. Such development requires coordination of scarce resource, concentration and sharing of resources toward key development priorities. There is no centralized national research facility, but the key national universities like the Royal University of Phnom Penh, the Institute of Technology of Cambodia and the Royal Academy have capacity to undertake limited research and development. Their research infrastructure remains weak and dependent on ad hoc input from NGO and finance from abroad. ###

Join the Science, Technology and Innovation Policy E-forum, and share your ideas and insights on STI policy with other researchers and policy-makers. Respond to comments from other e-forum members or start a discussion thread of STI policy issues particularly those of relevance to the Asia-Pacific region. Visit http://stepan.org/eforum and register!

## STEPAN

The Science and Technology Policy Asian Network (STEPAN) is a high-level official network of people and institutions in the Asia Pacific region involved in research and training for national science and technology and innovation policy development and management. The network develops support programmes to assist the development of S&T management information systems, foster the linking of research with social and economic application, and promote associated human resource development. STEPAN operates under the auspices of UNESCO, which continues to provide substantial support for the network.

Visit STEPAN at http://stepan.org/

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