



Nanotechnology Initiatives/Programs in Iran, Pakistan, Philippines, Sri Lanka and Other Developing Countries in the Asia Pacific Region

Highlights of the United Nation APCTT-ESCAP Consultative Workshop on Promoting Innovation in Nanotechnology and Fostering Its Industrial Application: An Asia – Pacific Perspective

Executive Summary:

1. United Nation APCTT-ESCAP demonstrated an effort to facilitate regional collaborations in nanotechnology innovation and industrial application
2. Sri Lanka, though with limited infrastructure built for R&D and limited funding from the government so far shows its commitment in developing nanotechnology with a unique private public partnership and passionate scientists. The Sri Lanka Institute of Nanotechnology (SLINTEC) was set up in 2008 with 50% funding from Sri Lanka National Science Foundation (NSF) and 5 other industry partners.
3. Iran developed the most comprehensive national nanotechnology initiative since 2005 and made significant leap in nanoscience and technology advancement.
4. Pakistan launched its national and has set up a nanotech center with facilities opened to industry to use and with focused R&D on nanocoating, nanomaterials and nanopowder and industry support.
5. Philippines S&T policy includes Nanotechnology as one of the priority areas. It has completed its nanotechnology road-mapping and has set 8 priority areas including nanomaterials and solar energy devices, drug delivery systems, environmental remediation systems and others. Philippines government established strong education programs to HR training and provides incentives for attracting overseas Philippine scientists and engineers to return home.
6. Neither Bangladesh nor Nepal have established nanotechnology programs or initiatives due to limited infrastructure for R&D, lack of trained human resources and limited international collaboration. However there are research groups conducting research on nanoparticle synthesis and application in polymers and composite materials.
7. The conference provided a very nice platform for all the participating countries to learn from each other the nanotechnology industrial application policy and practices. The UN APCTT-ESCAP is committed to promote nanotechnology among its member countries and will facilitate regional collaborations especially in nanotechnology innovative and industrial application R&D.

I have been writing about Asia nanotechnology since 1999 and covered most of the Asia Pacific

countries. The Asia Nano Forum (ANF, www.asia-anf.org) (which I co-founded and am serving as the Secretary) is now a network of 15 economies, however, it has not covered some of the regional economies especially some of the United Nation members including Bangladesh, Nepal, Pakistan, Philippines, and Sri Lanka.

During Dec. 2-3th, 2009, I was fortunate to have the opportunity to participate at the United Nation (UN) first nanotechnology conference and was invited by the UN Asia and Pacific Center for Transfer of Technology (APCTT-ESCAP) which allowed me to learn about the UN Economic and Social Commission for Asia and the Pacific (ESCAP) nanotechnology initiative and its member economies nanotech policy, programs and activities.

Sri Lanka, a country of about 20M people primarily still an agricultural based developing economy with over 70% of its population living in the rural area. Its GDP per capita is about 2000USD (lower than Vietnam whose GDP per capita is 3340USD). Despite of its recent political instability, its Ministry of Science and Technology and National Science Foundation recognizes the importance of nanotechnology and started to establish its S&T policy to ensure Sri Lanka will not missed the upcoming revolution. I find Colombo a very clean and comfortable city, where I don't see chaos in traffic, hotels ban smoking indoor, people follow the traffic rules, very friendly towards each other and to visitors.

Initiated and supported by the Sri Lanka Ministry of Science and Technology (MOST) led by its Minister Prof. Tissa Vitharana, the first "Consultative Workshop on Promoting Innovation in Nanotechnology and Fostering its Industrial Application: An Asia-Pacific Perspective" was organized by the APCTT-ESCAP, Sri Lanka Ministry of Science and Technology, National Engineering Research and Development Center (NERD Center) and the National Science Foundation (NSF) on Dec 2-3, 2009 in Sri Lanka capital Colombo. The event was inaugurated by Sri Lanka traditional lighting the candles ceremony symbolizing the lighting the darkness of ignorance followed by the opening address given by the Minister Tissa Vitharana who shared his vision of nanotechnology for improving quality of life for Sri Lankans (see photo attached).

The event is an invitation only event with about 50 invited participants from UN Asia and Pacific member countries and one representative from each major R&D institution in Sri Lanka. Sri Lanka NSF launched its Nanotechnology Initiative in 2007 and set up the Sri Lanka Institute of Nanotechnology (SLINTEC) as a private company with LKR 420 million (about USD3.7M) in 2008 with a unique public-private-partnership (PPP) structure where 50% of institute funding comes from 5 private companies including Hayleys, MAS Holdings, Brandix, Loadstar and Dialog. Within a year, the center has now

nicely set up with necessary facilities needed for nanomaterials synthesis, characterization and prototyping. It recruited overseas Sri Lankan scientists and executives with passion, vision and network as well as technical and business capabilities to accelerate the nanotech incubation process in the institute. It also recruited experienced faculty members from local universities to be R&D program managers. It is aggressively seeking for industry collaboration to ensure its R&D efforts stayed focused. It has an impressive advisory board including distinguished scientists such as Prof. Ravi. P. Silva (UK), Prof. A.P. de Silva (UK), Prof. Gehan Amaratunga (UK) and Prof. Kumar Wichremasinghe (USA). The institute is also very active in seeking international cooperation to ensure its international competitiveness. It signed recently a research agreement with Ritsumeikan University (Japan), research group of Prof. Susumu Sugiyama, a well-known MEMS expert in Japan. “We are very fortunate to have a team of passionate and talented scientists and management focusing on application development of nanotechnology and we follow our milestones very seriously. We exploit Sri Lanka rich natural resources such as titanium, graphite and other activated carbon towards nanomaterials application. We aim to deliver sustainable nanotechnology for global competitiveness of Sri Lankan industry and the world will see the label `Made in Sri Lanka` in future high-tech products enabled by nanotechnology”, CEO Mr. Ravi Fernando shared with us during the conference delegation visit at SLTINTEC(see photo attached). The research areas of the institute include Textile & apparel, Solid tires, Fertilizer, Rubber gloves, Activated carbon, Nano materials, and Biosensors. Details of the institute can be found at its website www.susnanotec.lk.

I am most impressed by the Sri Lanka nanotechnology policy is its emphasis on private, public partnership (PPP) and incorporating responsible development and regulatory framework.

Among other countries which are not in our ANF network, Pakistan stands out well in setting up a nanotechnology center by the Pakistan Council of Scientific and Industrial Research (PCSIR), where facilities are for industry to use as well as for conducting R&D that meets industry needs. Its nanotechnology lab facilities are utilized for the development, synthesis and characterization of 12 different nanocomposite coatings used in industries including Orthopedic implants & Surgical, Cutting Tool, Tool & Die and Textiles. Nanotechnology policy in Pakistan is made by its National Commission on Nanoscience and Technology (NCNST). “We place our priority in industry development and support. We have now a fully functional nanotechnology center that focuses on nanocoating, nanomaterials and nanopowder R&D and industry development”, Dr Shehzad Alam, Director General of the PCSIR of the Ministry of Science and Technology, emphasized during his presentation.

Nanotechnology is one of the 8 priority areas (Biotech, Electronics, ICT, Materials Science, Photonics, Space and Nanotech) of the Philippines Council for Advanced Science & Technology Research &



Development (PCASTRD). PCASTRD has developed the roadmap of development of nanotechnology which places 8 priority areas: 1) Nanomaterials and Nanocomposites, 2) Solar Energy Devices, 3) Nano-designed sensors and actuators, 4) Nano-based delivery systems, 5) Nanocomposite films and membranes, 6) Nanosensors, 7) Nanoporous Filters and 8) Nano-based environmental remediation systems. The PCASTRD established various scholarships and fellowships to accelerate the science and technology human resources development in Philippine. The Balik Scientist Program to encourage overseas Filipino scientists and technologists to return to the Philippines and share expertise in order to accelerate the scientific agro-industrial and economic development of the country.

The most rapid rising member country which has the most comprehensive national nanotechnology program is Iran. Iran set up its National Nanotechnology Initiative in 2005 and has spent USD135M during 2004-2008, half of which is funded by the private sector. Its NNI is entering phase II with a 10 year program. Iranian scientists and industries are active engaging international cooperation activities. It has an established education program to train MSc and PhD students, educating the public and policy makers as well as industry and business community. Iran has been actively engaging ISO nanotech standardization activities and was elected as a member of ISO/TC229 to become a representative of the Middle East and North Africa. Its R&D priorities are Energy, Health, Water & Environment, Nanomaterials and Construction. Iran is heading the ANF Energy and Water Working Group. Details about Iran nanotechnology can be found at its portal site www.nano.ir. Iran Nano Business Network (INBN) was set up in 2007 connecting 110 nanotech companies. Infrastructure network was set up in 2004 covering 42 advanced laboratories national wide. In terms of number of ISI publication, Iran has jumped from rank 42 in 2004 to rank 19 in 2008. The embargo on Iran has motivated Iran industry to develop its own technology and products including STM, Water Purification System, Air Filters, Industry Scale Quantity CNT and others.

Neither Bangladesh nor Nepal have established nanotechnology programs or initiatives due to limited infrastructure for R&D, lack of trained human resources and limited international collaboration. However there are research efforts ongoing in the areas of nanoparticles (Ag, Oxidies) synthesis, functionalisation in polymers and composite materials. Both countries expect to have nanotechnology incorporated in its existing S&T policy in the near future.

Nanotechnology development update in the rest of the Asia Pacific countries is included in my recent book *Emerging Nanotechnology Power: Nanotechnology R&D and Business Trends in the Asia Pacific Rim* (<http://www.worldscibooks.com/nanosci/7224.html>).

The UN APCTT-ESCAP Nanotech workshop, held in Colombo, in collaboration with the Sri Lanka NSF

and NERD Center was participated by UN Asia Pacific regional member countries including Bangladesh, China, Korea, India, Indonesia, Iran, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka and Thailand. Dr Peter Mogyrosi (Director of Laser Consult KFT, Consultant to APCTT) and myself are two invited experts to provide overviews on Nanotechnology global R&D and commercialization. I also represent the Asia Nano Forum to invite the non ANF member economies to join our network and invite the opportunity to work with APCTT-ESCAP. There was not concrete conclusion at the end of the workshop, however Dr Jeong Hyop Lee summarized different nanotech commercialization models presented by the member countries which include 1) Indonesia`s green and international cooperation and global value chain strategy, 2) Pakistan`s industry outreach and extension strategy and Sri Lanka`s private public partnership strategy. Iran representatives suggested to conduct nanotechnology regional road-mapping and will seek funding from Iranian government to execute this initiative. Suggestion was also raised on conducting joint R&D project which will require expert and funding support.

“We should work in partnership with existing networks to leverage what has been accomplished so that developing countries in the Asia-Pacific region can apply nanotechnology innovatively to improve the quality of life of its citizens while enabling local industries and businesses to be able to compete better in today's global business setting”, head of APCTT-ESCAP Dr K. Ramanathan concluded the event.



Minister of Science and Technology of Sri Lanka gave the opening speech



Delegation visit to SLINTEC, the Nanotech institute in Sri Lanka, received by its CEO and his team of management and scientists