

# **Societal Impact of Nanotechnology in the Asia Pacific Region**

***-Highlights of the Asia Nano Forum (ANF) Special Workshop Held on Nov. 26<sup>th</sup> 2004 Beijing***

With increasing awareness of societal implication of Nanotechnology and strong movement in addressing the issue in the USA and EU especially in the past year, the Asia economies have been inspired to raise this issue at the public discussions. Since August 2004, Japan National Institute of Advanced Industrial Science and Technology (AIST) initiated the monthly Nano & Society Workshop at its Tokyo headquarter office and brought gathering policy makers from various funding agencies, physical scientists, social scientists, industrialists and business community to discuss various issues related societal implications from different perspectives. To address this issue in Asia Pacific region, AIST and the China National Center for Nano Science and Technology (NCNST) co-organized first workshop on Nanotechnology Societal Impact in the Asia Pacific Region. This event is regarded as a special workshop of the Asia Nano Forum (ANF).

Asia Nano Forum (ANF) is a network organization founded in May 2004 at its kick-off meeting `Asia Nano Forum Summit (ANFoS2004) held on May 10-11th in Phuket, Thailand where influential leading scientists, R & D managers as well as policy makers gathered together to exchange views on the status of nanotech R & D in each Asia Pacific economies. ANF is supported by 13 economies in the Asia Pacific region. They include Australia, China, Hong Kong, India, Indonesia, Korea, Japan, Malaysia, New Zealand, Singapore, Taiwan, Thailand, and Vietnam. The ANF network is coordinated by government organization, leading R & D organization or a national nanotech coordination office in each participating economies. They include the Australian CSIRO, Chinese Academy of Sciences (CAS), Hong Kong University of Science and Technology (HKUST), Department of Science and Technology (DST) of India, Mochtar Riady Centre for Nanotechnology and Bioengineering (MRCNB) of Indonesia, Japan National Institute of Advanced Science and Technology (AIST), Korean Nanotechnology Researchers Society (KNoTRS), Universiti Teknologi Malaysia, MacDiarmid Institute for Advanced Materials and Nanotechnology, National University of Singapore (NUS), Taiwan Office of National Science and Technology Program for Nanoscience and Nanotechnology, National Nanotechnology Center (NANOTEC) of Thailand, and Vietnam Academy of Science and Technology (VAST).

The event brought together 13 member economies in the Asia Pacific region including Australia, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Singapore, Taiwan, Thailand and Vietnam to Beijing for exchanging views on Societal Impact of Nanotechnology the first time.

During the event, each subcommittee member/representative gave a 15-minute briefing from his/her region perspective of the impact of government policy, research programs, research findings and public concern on environment, energy, local industries, healthcare, benefits and risks.

There were over 100 participants attended the first Asia Nano Forum (ANF) Workshop addressing the Societal Impact of Nanotechnology, among them about 40 were invited ANF network guests.

Highlights of presentations given at the workshop:

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1. Australia (Terry Turney, Director of CSIRO Nanotechnology Center) - awareness raising program such as NanoHouse Initiative, Water (nanostructure and biomimetic membrane for water purification) and Energy (photovoltaics using nanomaterials), annual investment is about USD90, , Nanotech is Not yet a public issue, recommend national coordinated nanotechnology initiative to ensure responsible development of nanotechnologies by the PMSEIC Working Group on Nanotechnology
2. China (Celi Gao, Deputy Director, Office of Scientific R & D, TsingHua University) - enhance basic and applied research to foster long term creativity and progress in nanoscience and technology, apply nanomaterials technology to help traditional industries, create new industry applications by developing nanobiology and nanodevices. China is strong in nanoscience research: Search of the Science Citation Index for the first eight months of 2004, using a comprehensive and precise 92-term query for the highly critical field of nanotechnology, China hit 3621 in number of records of research papers. The national center for nanoscience and technology is designed to provide information and education to the public, provide recommendation to the government policy making, establish alliance between research institution and industry, provide education and training to the youth as well as a window for international collaborations. China plans to establish industry standard for nanotechnology using top down approach governed by the State Standardization Department coordinated by the NCNST. Photocatalyst application for water treatment and interior applications. Lubrication composites and nanocomposites applications.
3. Hong Kong (C.T. Chan, Director of Institute of NanoMaterials and Nanotechnology, The Hong Kong University of Science and Technology) - public image of nano could give health benefits, offering water/oil/dirt repelling apparel, public know about nano catalyst for air cleaning. Public think nano is magic and high-tech. Nanotech center has been trying to increase public awareness by giving seminars. Use media such as radio TV, museums, library to educate the public. Institute of NanoMaterials and NanoTechnology (INMT) is forming Industry Consortium for developing nanotech products and manufacturing processes in order to create strong impact of nanotech in society.
4. India (R.C. Srivastava, Advisor of Science & Engineering Research Council, Department of Science and Technology) - Manpower development is top priority; Energy, drinking water and health care are of major concern; powder production, CNT production for reinforced composites and ceramics; Nanopowder for water and air purification; USD22M for 2002-2007 proposed.
5. Indonesia (Syahril, Group Leader of Metal Research of Research and Development Center for Materials Science and Technology) - apply nanotechnology and bioengineering in solving health problems (i.e. tropical diseases or cancer), ensuring food availability, preserving natural resources, seeking alternative energy, and complementing metal processing, cement, ceramic, herb, or cosmetic industries; foster nano and bio industry in Indonesia and train young scientists and engineers; National priority: Food and Energy
6. Japan (H. Yokoyama, Director of Nanotechnology Research Institute) - Infrastructure and Human Resource development is key to creating impact of nanotechnology. The Japanese government sponsored Nanotechnology Support Program, particularly the NanoProcessing Partnership Program (NPPP) managed by AIST led by Dr H. Yokoyama, has demonstrated its beneficial impact in industry, academia and public R & D institutions through various training programs including tutorials, microfab school, nanoprocessing school and electron beam training.
7. Korea (Jeong-Woo Choi, Professor of Department of Chemical and Biomolecular Engineering, Sogang University) - Nanotechnology policy in Korea takes into account social concern and focus on application field (such as chemical industry, health, medicine, electronics, environment, bioprocess energy) and technology products in the field of

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nanodevice, nanobiotechnology, nanomaterials and nanomechanics. There are a number of associations established for better coordinate nanotech R & D and enhance public awareness in nanotech (Nanotech researchers association, nanotech industry association, NanoKorea200X Symposium and Exhibition etc), Research findings are assessed by industrial impact and improve QOL. NGO to conduct environmental evaluation and takes care of public concern in terms of health and risk. Korean Public feel nanotech will bring benefits but at the same time are concern about uncertain risk nanotech may bring. Currently the public understanding of nanotech mainly comes from contact with products and information from Mass media. NGO and government are beginning to conduct environment effect analysis and risk analysis studies.

8. Malaysia (Halimatun Hamdan, Ibnu Sina Institute for Fundamental Science Studies, Universiti Teknologi Malaysia)- government provides support for policy guidelines, HR development, infrastructure and funding for R & D. Strategic Research Program (SR) stresses on future competitive socio-economic environment and new breakthroughs. Malaysia is strong in catalyst (Zeolite and Aerogel), hybrid catalyst. R & D programs focusing in basic R & D and HR development. The newly launched Scientific Advancement Grant (SAGA) with total of RM20M for one year focusing in physics, chemistry and medicine & physiology.
9. New Zealand (Andreas Markwitz, The Institute of Geological and Nuclear Science Ltd) – strong in nanostructure synthesis using self-assembly and top-down lithography approach.
10. Singapore (LIM Chwee Teck, NUSNNI) – Government and university are ramping up power for Manpower training by offering attractive scholarships and Graduate Program in Nanoengineering and the Young Investigator Club. Singapore government attracts world experts to Singapore through the Short Term Visit Program and Visiting Investigator Program to share their knowledge and help research programs. Singapore focuses on applied research in biotechnology & medicine, Information & Communication Technology, and Engineering. Singapore spent over 40% R & D effort in magnetics (to support its hard disk drive business), 30% on Metrology, 12 % on Electronics, 10% on Optoelectronics & Optics, 5% on Medical, 2% on catalyst and the rest on sensors.
11. Taiwan (T.K. LEE, Co-Executive Director, Institute of Physics, Academia Sinica) – Industrialization technologies the Taiwanese government is focusing on are Electronics, Display, Data Storage, Photonics, Electronic Packaging, Biomedicine, Traditional Industry upgrade/transformation, Energy conversion & storage. Government allocated 20 resources on traditional industry application, 60% on strategic industry applications and 20 % on Frontier research. Government initiated various approaches to accelerate industrialization of nanotech such as Nanotech Express (hold workshops to simulate industrial interest and participation around the island), Industry Early Participation Program, Open Lab/Incubator and Nano Emblem Committee (focus on consumer products). The government developed K-12 Project and Regional Nanotechnology Personnel Development Center Project for the Nanotechnology Talent Bank Establishment and Support program. Various nanotech teaching materials and programs are available at school, university and general public level.
12. Thailand (Nick Pornsin-Sirirak, Assistant Director, NANOTEC) – Nanotech impact sectors are expected to be in Agriculture & Food, Automobile Parts, Electronics, Petrochemical/Chemical/Textile, OTOP, Health & Medical and Energy & Environment. Government puts focus on HR, Infrastructure, Public Awareness and R & D. The R & D areas of focus are Nano-biotechnology, Nano-Electronics, and Nanomaterials. Safety & Ethics, Public understanding and awareness are incorporated in the National Nanotechnology Policy. NANOTEC has been actively promoting public awareness of nanotechnology the past year through various national events and seminars and mass media communications. Formed clusters with industries
13. Vietnam (Prof. Phan Hong Khoi, Institute of Materials Science, VAST) – microelectronics, biotechnology, environment protection, gas and petroleum exploration and energy

conservation are the areas of application nanotechnology is expected to impact. Ministry of Science and Technology launched the Nanoscience and nanotechnology infrastructure building program (2004-2006). Nanomaterials such as Nano-catalyst (for water, air purification and surface coating), Nano-composites (for reinforcement materials and electronic devices) and MEMS based nanostructured magnetic, semiconductors and photonics materials are expected to be applied in industry in the near future in Vietnam.

The following table summarizes the societal impact of nanotechnology in terms of public policy, current industry impact, education effort human resource development, public awareness on the benefits and risks of nanotechnology. We classify each category into 3 levels, namely, low, medium and high.

Economy	Government Policy Awareness	Government Policy Support	Industry Impact	Education Program	Public Awareness on Benefits	Public Concern on Risk
Australia	medium	medium	low	high	high	low
China	high	high	low	low	high	low
Hong Kong	high	high	low	low	medium	low
India	high	medium	low	low	medium	low
Indonesia	low	low	low	low	medium	low
Japan	high	high	high	medium	high	medium
Korea	high	high	medium	medium	high	medium
Malaysia	medium	medium	low	low	medium	low
New Zealand	medium	medium	low	low	medium	low
Singapore	high	high	low	high	medium	low
Taiwan	high	high	medium	high	high	medium
Thailand	high	high	low	medium	medium	low
Vietnam	high	medium	low	medium	medium	low

Figure 1

We noticed that the awareness of risk is low in general in Asia Pacific region and there is much hope for benefits nanotech may bring. Education programs have shown to be very successful in Australia, Singapore and Taiwan. General Asian governments are highly aware of the importance of nanotechnology and has placed nanotech as a priority, however the level of actually funding support varies from country to country.

The ANF subcommittee meeting was also held on the same day and defined the first time clearly the Asia Nano Forum Mission, that is

***To promote the research and development and industrialization in nanotechnology that educationally, socially, environmentally and economically benefit each economy by fostering the international network and collaboration***

The ANF Objectives were outline as the following:

- 1. To promote human resource development by exchanging students, researchers and experts***
- 2. To promote sharing information, resources, and experiences, i.e., R&D projects, basic infrastructure, etc. of each economy through the ANF network***
- 3. To enhance public awareness and education***



ANF Workshop on Societal Impact of Nanotechnology in the Asia Pacific Region on Nov. 26<sup>th</sup> 2004.



ANF Workshop Dinner on Nov. 26<sup>th</sup> 2004.



Group Photo of ANF Workshop on Nov. 2004.

We include here the welcome messages for the ANF workshop from the Vice-President of AIST, Dr Kazunobu Tanaka and VP of the Chinese Academy of Sciences (CAS), Dr Chun-li Bai:

### *Welcome Message From China*

On behalf of the National Center for Nanoscience and Technology of China, one of the network organizations of the Asia Nano Forum (ANF) and the co-organizer of the ANF Special Workshop on Nanotechnology Societal Impact in the Asia Pacific Region 2004 (ANFNSI2004), I would like to sincerely welcome all the participants of this special workshop that follows the theme established in the successful Asia Nanotech Forum Summit (ANFoS2004) held May 10-11, 2004 in Phuket, Thailand.

The fast evolvement of nanoscience and technology has generated global interests in both developed and developing economies. The academic community has been called upon to join the effort of public agencies to provide genuine assessment on the social impact of the emerging technologies. This will provide guidance for both academia and industries to further stimulate their endeavours in this important area. The focus of the workshop is no doubt important and beneficial to general public of Asia economies and beyond. We appreciate the effort of the Asia Nano Forum (ANF) to bring together 13 economies in the Asia Pacific region including Australia, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Singapore, Taiwan, Thailand and Vietnam the first time in Beijing for exchanging views on Societal Impact of Nanotechnology. We believe such an event will not only help the participants and particularly the audience from China to learn about the global perspective of nanotechnology and its impact in society, but also help strengthening the nanotechnology network and relationships across the Asia Pacific Rim.

I look forward to the success of the workshop and fruitful collaborations among the participants.

With best wishes I remain,

**BAI Chunli**  
**Vice President**  
**The Chinese Academy of Sciences**

**and**

**Director**  
**National Center for Nanoscience and Technology, China**

## *Welcome Message From Japan*

Nanotechnology as well as nanoscience is now a key concept that encourages interdisciplinary interaction among different R&D fields and also various sorts of collaboration among different countries. It clearly has the long-term potential to bring revolutionary changes in society in a global scale. As has been reported by government organizations the worldwide nanotechnology R&D investment has increased dramatically for the past five years, in particular, in Asian countries.

In order to enhance communication and networking between scientists, R&D managers and policy makers among Asian countries the Asia Nano Forum (ANF) was founded under the agreement among 12 economies in May, 2004, at the first Asia Nano Forum Summit 2004 (ANFoS2004) held in Phuket, Thailand. Our collaboration should include (a) standardization of concepts and measurements, (b) social, environmental and health issues, and (c) education and human resource development.

This ANF special workshop on “Nanotechnology Societal Impact in the Asia Pacific Region” (ANFNSI2004) is, to my knowledge, the first international workshop on the issue of Nanotechnology and Society in Asia. Needless to say, societal impact should always be evaluated through a balanced study between benefits and risks, which enables us to make a healthy contribution to human society. We hope this meeting will initiate a new movement for advancing sustainable science and technology development through nanotechnology.

As a co-organizer of ANFoS 2004 as well as ANFNSI2004, AIST is pleased to pledge our continuous support to the Asia Nano Forum, and personally, I wish all of you a great success with this workshop.

**Kazunobu TANAKA**  
**Vice President**  
**National Institute of Advanced Industrial Science and Technology (AIST), Japan**