



A Decade of Foresight

Technology Foresight in Asia - Pacific

1998 - 2008



A Decade of Foresight : Technology Foresight in Asia - Pacific 1998 - 2008

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and
Nares Damrongchai



APEC Center for Technology Foresight
National Science and Technology Development Agency

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Congratulatory Messages

Hindsight on Foresight : Ten years of APEC Center for Technology Foresight



The APEC Center for Technology Foresight (CTF) was established ten years ago, in 1998, following the initiative of the Thai Delegation to the APEC Industrial Science and Technology Working Group, in order to do foresight studies of APEC-wide issues concerning technology, and to help APEC member economies individually in their own foresighting.

The main rationale for its establishment was that technology and knowledge were becoming the decisive factors in trade and development, communication and in general well-being of our societies. The APEC economies, accounting for about half of world trade and a sizeable portion of its population, comprising both the developed and developing countries at various stages, had to prepare for these changes. The knowledge-based economy, fueled by technology and innovation, was seeing the rise of flexible production and services in place of mass production as in the old economy that we are familiar with. Production and services were being integrated globally, within and beyond APEC. Foresighting of new or existing technologies should help crucially in integrated planning for future development.

The establishment of APEC CTF saw the first undertaking of foresighting on a regional basis. Through the work of international teams the Center has accomplished various studies including problems of the future concerning Water Supply and Management, Sustainable Transport, Megacities, Technology for Learning and Culture, Nanotechnology, DNA Analysis, and Converging Technologies for Emerging Infectious Diseases.

As the APEC economies comprise both advanced and developing economies, the CTF not only concentrated on studies and research on technology foresight, but also on training of personnel involved in science and technology policy, and in development planning in general.

Over the years the CTF also became the catalyst for foresighting of social and economic development in general. For example the National Economic and Social Development Board (NESDB) of Thailand recently held a nation-wide exercise in social foresighting, in order to plan for possible future scenarios appropriately.

Five years ago, during the APEC CEO Summit in Bangkok, I proposed that future work of APEC CTF be broadened to embrace important economic and social issues, and should be focused on efforts to answer the questions

- What will be the future status of knowledge and technology in the APEC economies?
- What impact will it have on the economic and social status of the APEC economies?

I believe that these questions are still relevant today, ten years after the establishment of the APEC CTF.

Yongyuth Yuthavong
Founder of APEC CTF and
Former Science and Technology Minister of Thailand

9 November 2008

Be Bold, Be Innovative



On the occasion of the 10th anniversary of the International Advisory Board of the APEC Center for Technology Foresight, it is a real pleasure to send greetings to my colleagues and friends at the CTF and to offer my congratulations and best wishes for continuing success.

As you know I have been involved with the APEC CTF as a Member of the IAB for most of the ten years since the CTF was established and served as Chair of the Board for an extended period of time. Looking back over that period the foresight activities of the CTF have expanded considerably, much experience on "Foresighting" has been gained and the CTF itself has grown in stature and reputation in Thailand, Asia and around the world. The Center has attracted financial support and approval from APEC and its Working Groups on numerous occasions, from NSTDA on a continuing basis and from other countries including Canada.

One of the most notable impacts of the CTF has been in communicating the value of foresighting and roadmapping through workshops, seminars, conferences and by describing the tools and techniques which can be employed for futures oriented policy making and management. In Thailand particularly but also elsewhere in APEC many organizations including government departments and agencies, universities and the private sector have learnt about foresight and put it to use in their own strategic planning.

While it is not my intent to document all of the achievements of the CTF I would be remiss if I did not mention a few of the seminal projects undertaken with the approval of the IAB. These would include APEC wide studies such as: Water Supply and Management; Nanotechnology; Transportation and Megacities; DNA Analysis; Future Fuel Technologies. Some of these e.g. Future Fuels were very timely given subsequent developments.

In summary the vision of creating an APEC Center for Technology Foresight was bold and innovative. The directors, advisors, and staff of the CTF can be very proud of what has been accomplished over the last ten years. Similarly the IAB should be complimented for the sound advice and direction it has provided. And of course National Science and Technology Development Agency (NSTDA) has been instrumental in providing a home, resources and people to enable the APEC CTF to succeed.

So happy birthday and good luck in the years ahead.

Arthur Carty
Former Chair of the International Advisory Board
APEC Center for Technology Foresight

16 November 2008

Foresight is Needed More Than Ever



I am pleased to have this opportunity to congratulate the APEC Center for Technology Foresight on 10 years of achievement in developing and diffusing the concepts of foresight in the Asia-Pacific region. The development of the global knowledge economy has meant that economies are linked more closely than ever before and, as events in the past decade have shown, adverse changes in one economy can rapidly affect others around the world. Such changes can be social, economic, political, technological and environmental in origin. Foresight is a process which can assist in anticipating and managing such changes. It is a systematic and participatory approach to developing strategies and policies for the medium to long term future.

There is continuing debate over the various concepts of foresight, forecasting, roadmapping and assessment but it is now recognised that they all can be described by the general title of *future-oriented technology analysis*. The Center has gradually adapted its approach over the past decade as it has tackled a variety of topics seen to be of importance to the APEC region. The projects have become more complex and have increasingly involved a wide range of experts from different backgrounds as the need for convergence of technologies and knowledge systems in pursuit of a common goal has emerged. This is particularly true of the last two studies on Future Fuels and on Emerging Infectious Diseases.

A significant feature of the Center's activities is that it pioneered the concept of multi-economy foresight. Until the start of the Center all foresight studies were nationally based and it was felt that multi-economy studies were potentially very interesting but too difficult. Once the Center had demonstrated that such studies were possible and very useful, others such as the European Futures Studies followed suit.

Apart from the project reports themselves and their input to the policy thinking of APEC economies on matters related to industrial science and technology, the Center has played a significant role in networking experts in the region. Another important role has been the training through structured courses of a new generation of strategic thinkers.

I wish to acknowledge the continuing support of the Royal Thai Government through the National Science and Technology Development Agency (NSTDA) over the decade. This support has been critical to maintaining the high profile of the Center in the region and has provided a strong basis for securing additional support from APEC funds. I believe that the existence of the Center has also contributed to strategic thinking in Thailand.

I am proud to have been associated with the start-up of the Center as its Co-Director for two years, then as Executive Advisor and now as Chair of its International Advisory Board. The need for its existence is now more pressing than ever before and I wish it every success for the next decade.

Greg Tegart
Chair of the International Advisory Board
APEC Center for Technology Foresight

15 November 2008

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A Decade of Foresight : Technology Foresight in Asia - Pacific 1998 - 2008

Part One : A Brief History of APEC Center for Technology Foresight

- Inauguration

Professor Yongyuth Yuthavong, the then President of the National Science and Technology Development Agency (NSTDA), proposed to the first Asia - Pacific Economic Cooperation (APEC) Minister's Conference on Regional Science and Technology Co-operation in Beijing in October 1995 that an APEC Center for Technology Foresight should be established to provide a focus for technology foresight and stimulate such studies on a multi-economy basis. The proposal received wide support and a feasibility study was subsequently approved and conducted during 1996 - 1997. A team of international consultants worked out details with the Thai working group regarding the possibility of establishing the APEC Center for Technology Foresight in Thailand including its operational framework and the work program. A survey of opinions on possible topics for foresight studies in the APEC region was conducted. As the final phase of the feasibility study, the *APEC Symposium on Technology Foresight* was held in Chiang Mai, Thailand during 10 - 13 June 1997.

The Symposium was attended by 32 international delegates from 11 economies, 78 Thai delegates, 2 observers from Russia and Peru. As for non-APEC attendance, there were a key note speaker from the Netherlands and 2 unofficial representations from UK and United Nations Industrial Development Organization (UNIDO). Apart from key note speeches, presentations from member economies, and report of the feasibility study, participants held three separate group discussions on possible topics for regional cooperation, an open discussion on other topics and a special session were conducted on mechanism for future cooperation which covered policy and management, finance, collaborative research/training, research dissemination, and information sharing.

The success of the Symposium lent substantial weight towards the approval at the 13th Industrial Science and Technology Working Group (ISTWG) in September 1997 for the creation of the APEC Center for Technology Foresight (CTF) in Thailand.

The Center was launched on 3 February 1998 followed by a public seminar and a three-day workshop on technology foresight. It also received official approval from the Thai Cabinet as a special unit under NSTDA. Professor Greg Tegart from Australia served as the first Executive Director with Dr. Chatri Sripaipan of NSTDA as the Co-Director. An International Advisory Board (IAB) to provide guidance to the Center was appointed on the basis of their expertise on foresight, or science and technology policy and planning more generally. There was also a Steering Committee (SC) to oversee the operation and management of the Center. Some members were appointed on the basis of position and others on the basis of expertise.

- The Early Period

In the first year of operation, the Center has focused on creating awareness of the Center and its capabilities through four activities: the creation of a web site to promote accessibility, the conduct of training workshops, public lectures and visits, and a multi-economy foresight study. The first of such APEC-wide foresight project was on the topic of *Water Supply and Management*. The website provides information about the Center and its activities, and about foresight elsewhere in APEC. It also offered links to relevant web sites around the world, as well as to the APEC ISTWG site. All materials of the Center (books, foresight project reports, conference papers, etc.) are open to the public and downloadable from the website free of charge. In order to facilitate more interactions among foresight practitioners, an APEC Technology Foresight Network was developed with technical support from the National Research Council of Canada to connect foresight experts, improve the flow the ideas and information, and help to build up the Center's knowledge of foresight in APEC and around the world.

The second year saw the concept of a virtual center gain strength with two Experts Meetings being held outside Thailand - *Technology for Learning and Culture* in Vancouver, Canada, and *Sustainable Transport* in Melbourne, Australia. The Center was also honored to co-organize the *International Conference on Technology Foresight* organized by National Institute of Science and Technology Policy (NISTEP) in Japan in 2000.

To disseminate the knowledge on foresight widely, the Centers has steadily lengthened its list of publications. Each foresight study ended with two publications: a short policy-oriented report intended for policy makers, and a full report. A number of papers were written and presented in various international conferences as post-foresight activities.

The Center frequently organized public lectures on foresight by inviting prominent experts whenever such opportunity occurs, usually when such expert come passing by the region. Apart from single economy foresight training and workshops in Malaysia and Vietnam, international training program was not a regular activity until Prof. Ron Johnston proposed a training course called: *Tools to Manage the Future: A Portfolio Approach* which ran for the first time in 2002 with great success. The course was repeated annually five times.

Since the Center made a commitment to ISTWG to have a review within three years, in July 2000 Professor Lan Xue of the Development Research Academy for the 21st Century, Tsinghua University, Beijing, China, and Dr Paul Gandar of the Ministry of Research, Science and Technology, Wellington, New Zealand, were engaged to carry out the evaluation. The review was systematic and comprehensive. Starting from a submission prepared by Prof. Greg Tegart, the evaluators set up a framework for analysis and conducted a series of interviews with the Center's staff, Steering Committee members, Thai members of the International Advisory Board, NSTDA executives, the Thai ISTWG contacts and participants in the Center's activities. The evaluation report recommended that the Center needed to develop a growth strategy, secure stronger commitment and support from APEC, develop and implement a fund raising strategy, and appoint an Executive Director and administrative assistant.

The evaluation report (more details in Part Two) marked a turning point for the Center and ushered it into the second phase of development. The report was discussed thoroughly by a combined meeting of the International Advisory Board and the Steering Committee in December 2000 and the scope and purpose of the Center were revised. NSTDA was convinced of the value of the Center and committed to increase the number of staff to six. Dr. Witaya Jeradechakul, an Associate Professor from Srinakharinwirot University in Bangkok, with a background in language, education, and management science was recruited to be the Center's first full-time Executive Director, starting in January 2002.

- The Recent Years

Before the word *nanotechnology* became widely recognized in the general public, the Center proposed and conducted an APEC-wide foresight project on *Nanotechnology* during 2001 - 2002. The report of the project turned out to be the most popular download from the Center's web site, probably also due to the awareness in this new technology area. In 2003 another APEC-wide project was conducted on *DNA Analysis for Human Health in the Post-Genomic Era*, following high interest in the success and anticipated risks and benefits from the Human Genome Project.

The Center ventured to conduct an even larger-scale project on *Foresighting Future Fuel Technology* during 2004 - 2005, a project that run for 2 full year and employed multiple foresight methods such as online surveys, scenarios, and technology roadmapping. Future Fuels become a major exercise and importantly it was very timely as it coincided with the global high rise in oil price.

Thailand and Japan jointly proposed and conducted an APEC-wide project on *Roadmapping Converging Technologies to Combat Emerging Infectious Diseases (EIDs)* starting from 2006. The project continued for more than 2 years and incorporated a very broad range of technologies into one application: to cope with the potential risk of EID outbreaks. The project connected with the UK Foresight project on similar topic that was announced in 2006 and an expert from UK was invited to share the European experience at the Final Symposium of the project in 2007. Apart from APEC-wide foresight projects, the Center often provide consultancy

services to clients upon request. It assisted national or organizational foresight projects by providing advice to project designs and facilitation in workshops, such as foresight projects in Malaysia and Vietnam.

In 2003, the Center began to explore new opportunity of regional foresight in a project called the *ASEAN Technology Foresight and Scan*. It became a major project that continued for almost 3 years and resulted in lessons learned both for the Center and participating ASEAN members. Higher recognition of the role of the Center was gained by the success of this project (more details in Part Two).

The Center co-hosted an APEC seminar on *Emerging Technologies* with the US Naval Research in Bangkok in 2005, which was held back-to-back with an International Conference on same topic. It was an example of a collaborative foresight project that resulted in wide public awareness in foresight and emerging technologies. Thailand decided to continue exploring this issue throughout 2006, and conducted a public congress led by Ministry of Science and Technology in 2007, whose result developed into Thailand's other nation-wide project on *Emerging Challenging Issues* supported by the National Economic and Social Advisory Council during 2007 - 2008. The whole experience was shared and discussed at NISTEP's 20th Anniversary Symposium in Tokyo in November 2008 by Professor Yongyuth Yuthavong, the Founder of CTF.

The idea of conducting a close-group seminar back-to-back with a larger public-oriented conference was seen as an effective and sound use of resource and opportunity. Therefore in 2007 the Center organized an event called *The First Workshop and International Conference on City Foresight in Asia - Pacific* in Chiang Mai, right after the completion of a city foresight project in Lamphun, a small city in northern Thailand. The Chiang Mai event was held in collaboration with Tamkang University in Chinese Taipei, Public Policy Development Office in Thailand, Chiang Mai University, and many other collaborators.

Training courses continues regularly with Professor Ron Johnston's : *Tools to Manage the Future: A Portfolio Approach*, Professor Sohail Inayatullah's *Creating the Futures with Difference*, and *Technology Roadmapping* courses by Mr. Geoffrey Nimmo from Canada, Dr. Nathasit Gerd Sri and Dr. Nares Damrongchai in Thailand.

The Center constantly reported its activities at side-meetings at APEC ISTWG biannual meetings, and continues to receive funding support from APEC and commitment by NSTDA. By 2008 the Center expanded into a semi-virtual organization of 9 permanent staff (including a full-time Executive Director) and ever-expanding expert network in foresight, science, technology, economics, and social studies.

Details of the Center's governance and activities could be found in the annual reports published at the end of each year.

- Overview of Activity and Consistency with Scope and Purpose

Table 1 summarizes the experience of the APEC Center for Technology Foresight by enlisting all types of projects conducted by the Center in chronological order and mapped according to types of activity into four different categories: APEC-wide and multi-economy, single-economy research and consultancy, and training. This gives an overview that could be useful in considering the balancing of the Center's activities and provide a factual basis for the consistency-check with the Center's scope and purpose.

Table 1 Mapping of CTF's Past Activities

Type / Year	APEC-wide and Multi-economy Projects	Single - economy Research and Consultancy	Training
1998	<ul style="list-style-type: none"> • Water Supply and Management • Digital Economy Video Conference 	<ul style="list-style-type: none"> • Water Supply and Management • Digital Economy Video Conference 	<ul style="list-style-type: none"> ▫ Using Technology Foresight Workshop
1999	<ul style="list-style-type: none"> • Technology for Learning and Culture • Sustainable Transport for APEC Megacities 	<ul style="list-style-type: none"> • Technology Foresight for Agricultural Development • Science and Technology for Development in 2020 • The Construction Industry Development Board of Malaysia 	<ul style="list-style-type: none"> ▫ Foresighting to Create a Learning Organization Workshop
2000	<ul style="list-style-type: none"> • Healthy futures for APEC Megacities • The International Conference on Technology Foresight, NISTEP, Japan 	<ul style="list-style-type: none"> • IT for Education • Workshop on Food Processing Industry, Vietnam 	<ul style="list-style-type: none"> ▫ Training Workshop for MOSTE, Malaysia ▫ Workshop on Technology Roadmapping
2001	<ul style="list-style-type: none"> • Nanotechnology: the Technology of the 21st Century • Technology Foresight Symposium, Hanoi, Vietnam • APEC Technology Foresight Network 		

Type / Year	APEC-wide and Multi-economy Projects	Single-economy Research and Consultancy	Training
2002	<ul style="list-style-type: none"> • 4th APEC R&D Leaders' Forum • Nanotechnology for the ASEAN Region 	<ul style="list-style-type: none"> • IT for SMEs • Healthy futures for Thai Cities • Consultancy for Technology Promotion Association (Thailand-Japan) • Workshop on Food Processing (Tea Industry), Vietnam 	<ul style="list-style-type: none"> • Workshop on Tools for Managing the Future : A Portfolio Approach • Pre-national Technology Foresight Seminar, MOSTE, Malaysia
2003	<ul style="list-style-type: none"> • DNA Analysis for Human Health in the Post Genomic Era • The Second International Conference on Technology Foresight, NISTEP, Japan • ASEAN Technology Foresight and Scan Project 	<ul style="list-style-type: none"> • Consultancy for The Malaysian Ministry of Health • Consultancy for Thailand's Health System Research Institute • Scenarios for the National Biotechnology Policy Framework • Foresight and Strategic Planning Workshop for Thailand Electrical and Electronics Institute 	<ul style="list-style-type: none"> • The second workshop on Tools for Managing the Future : A Portfolio Approach • Workshop on Technology Roadmapping : A Strategy for Success
2004	<ul style="list-style-type: none"> • Foresighting Future Fuel Technology • ASEAN Technology Foresight and Scan Project (cont.) 	<ul style="list-style-type: none"> • Consultancy for Thailand's Health System Research Institute (cont.) • Consultancy for Kasetsart University 	<ul style="list-style-type: none"> • The third workshop on Tools for Managing the Future : A Portfolio Approach • Workshops on Higher Education Planning
2005	<ul style="list-style-type: none"> • Foresighting Future Fuel Technology (cont.) • ASEAN Technology Foresight and Scan Project (cont.) • Emerging Technologies Workshop and International Conference 	<ul style="list-style-type: none"> • Consultancy for Kasetsart University (cont.) 	<ul style="list-style-type: none"> • The fourth workshop on Tools for Managing the Future : A Portfolio Approach • Workshop on Creating Future with a Difference
2006	<ul style="list-style-type: none"> • Roadmapping Converging Technology to Combat Emerging Infectious Diseases 	<ul style="list-style-type: none"> • Foresight Aging Society in Thailand 	<ul style="list-style-type: none"> • Strategic Foresight in Modern Management Workshop • Second workshop on Creating Future with a Difference • Technology Roadmap Trainings

Type / Year	APEC-wide and Multi-economy Projects	Single-economy Research and Consultancy	Training
2007	<ul style="list-style-type: none"> ▫ Roadmapping Converging Technology to Combat Emerging Infectious Diseases (cont.) ▫ The 1st International Conference on City Foresight in Asia-Pacific 	<ul style="list-style-type: none"> ▫ Lamphun City Foresight 2027 ▫ From Aging Society to Mature Society ▫ Thailand Emerging Issues ▫ National Health Insurance Foresight ▫ Sectoral technology roadmaps 	<ul style="list-style-type: none"> ▫ Technology Roadmap Trainings ▫ Technology Foresight for Oil and Petrochemical Industry Managers in Asia
2008	<ul style="list-style-type: none"> ▫ Roadmapping Converging Technology to Combat Emerging Infectious Diseases (cont.) ▫ Futures of Low Carbon Society: Climate Change and Strategies for Economies in APEC Beyond 2050 	<ul style="list-style-type: none"> ▫ National Health Insurance Foresight (cont.) ▫ Thailand Emerging Issues (cont.) ▫ CDG scenario ▫ Consultancy for Technology Promotion Association (Thailand-Japan) ▫ Kasetsart University, Faculty of Agro-Industry ▫ Sectoral technology roadmaps 	<ul style="list-style-type: none"> ▫ Technology Roadmap Training Workshops ▫ Foresight Training for OIC Countries, Pakistan ▫ Patent Mapping Workshops

According to Table 1, it is possible to see the (un) change in emphasis of CTF's activities throughout the ten years. It could be said that the Center remains committed to the activity goals set forth since its beginning. To understand the rationale behind these activities, it worth to re-visit the Scope and Purpose of the Center which has been revised by the Center's IAB in 2000. The objectives, core competencies, and scale of operation were outlined as follows:

- **Objective:** To develop and diffuse foresight capability across APEC through multi-economy studies, training, consultancy and related activities.
- **Core Competencies of the Center:**
 - Capability to coordinate and facilitate multi-economy foresight studies (with embedded training);
 - Expertise in training and consultancy services;
 - Expertise in foresight methodologies and practice;

- **Core Competencies of the Center:**
 - Capability to coordinate and facilitate multi-economy foresight studies (with embedded training);
 - Expertise in training and consultancy services;
 - Expertise in foresight methodologies and practice;

Underpinned by:

- Ability to work effectively across a range of cultures and types of organizations;
- Ability to understand and communicate basic science and technology and its implications for socioeconomic development.

- **Scale of Operation:** The APEC Center for Technology Foresight operates as a semi-virtual center. From a solid base in its host economy - Thailand - the Center aims to serve and involve all the members of APEC through partnerships and networking.

These objectives, core competencies, and scale of operation has been considered and reviewed annually at the IAB meetings, and eventually remained mostly unchanged throughout the first decade of the Center.

Part Two: Orientation for the Next Decade

This part will start from examining the meanings of important milestones, or a non-linear version of the Center's history, defining success, and conclude with a little vision of the future. We will first look at the past review and evaluation.

- The First Review by External Experts in 2000

A commitment to evaluate CTF in three years was made at the time the Center was set up. A systematic and comprehensive review of the Center was carried out in July 2000 by Professor Lan Xue of the Development Research Academy for the 21st Century, Tsinghua University, Beijing, China, and Dr Paul Gandar of the Ministry of Research, Science and Technology, Wellington, New Zealand.

The purpose of this review was internal, focusing on objectives, client relationships, governance arrangements, operational capacity and funding arrangements. The main findings were that CTF has:

- built a sound basis for its operations in Thailand and has begun to develop clients and networks in other economies;
- established a capacity to carry out foresight projects using a range of methodologies and pioneered development of multi-economy foresight methodologies;
- completed four major projects and a larger number of minor projects;
- contributed to development of foresight capacities in Thailand and is building awareness in developing economies; and,
- gained base funding from the Royal Thai, project funding from APEC and support in kind from organizations in a number of APEC economies.

Overall, the reviewers were impressed at the level of CTF's achievement and the quality of its work. They mentioned that dedication and commitment of CTF staff was particularly noteworthy.

The main factors limiting CTF's future development, according to the reviewers, were its levels of staffing and finances relative the size of its mission and the opportunities for its work within APEC.

The reviewers eventually provided some recommendations for the Center to develop a growth strategy, secure stronger commitment and support from APEC, develop and implement a fund raising strategy, and appoint an Executive Director and administrative assistant.

It could be said that this review gave the Center the first opportunity to do a comprehensive self-check and re-think its strategy. Some particular items of the recommendations were implemented afterwards, leading to further growth of the Center in the following years.

- Lessons Learned Through Projects

APEC-wide projects are the activity that the Center put most of its resource in, and probably learned most from. The Center learned from the first project on *Water Supply and Management* that to be successful it needs institutional supports to host the meeting, to write issues paper, to supply experts, and to attract participants. Therefore, from the second project on Technology for Learning and Culture onwards, it actively seeks support from strategic partners in every project.

One might ask how the Center select the topic. It can be said that all the technology foresight research topics in the early period came from the opinion survey and the Chiang Mai Symposium in 1997. They were: *Water Supply and Management*, *Technology for Learning and Culture*, *Megacities*, and *Sustainable Transport*.

Later the Center has developed a number of criteria to select topics for multi-economy foresight study:

- The issue must be of concern to most economies, with at least 4 agreeing to participate in the study;
- The issue must transcend national boundaries, so that it can go beyond anything that might be achieved by a national or bi-lateral study;
- There must be potential for sharing the results with all the APEC members;
- The issue is likely to be of general, public/benefit and not one that is likely to be dealt with by the private; and finally
- The issue will have important technological components but not necessarily "high-tech" ones.

In 2001, however, there was an emerging issue of *Nanotechnology* and the IAB saw the opportunity of doing a foresight exercise on this high-potential looming topic. Since obtaining support from the APEC Central Fund usually needs planning a year ahead, to ensure the timeliness of the study, the IAB decided to conduct the project with self-funding from member economies and the support of the National Research Council of Canada in hosting the Experts Meeting in Ottawa in November 2001.

Other subsequent topics like *DNA Analysis for Human Health*, *Future Fuel Technology*, *Emerging Infectious Diseases*, and the present *Low Carbon Society* were selected in consultation with the IAB and the focal points of member economies in ISTWG, but the criteria remain the same .

With regard to methodology, in the beginning a foresight project usually started with writing of a position paper on possible future issues. Both scenario planning and Delphi were used in the first two projects. Then the Center found that it was rather difficult to obtain substantial response from member economies on Delphi questionnaire by mail or email. Therefore, Delphi was abandoned in the next two projects, and instead a number of other approaches were introduced. For example, in the *Megacities* project, a scoping meeting with a number of experts was held to define the clear scope of the foresight study. Then in the *DNA Analysis* project, in addition to the scoping meeting, a questionnaire survey was added to obtain some prior information before the scenario exercise. While in the *Sustainable Transport* project, the author added substantial inputs from his research into the report after the scenario planning exercise.

In the later years there was a surge of demand for technology roadmapping from member economies. Technology roadmapping was then used frequently in combination with scenario planning since the project on *Future Fuel*. With the communication technology transforming the internet by the more interactive, society-oriented Web 2.0, Delphi is being used again in form of web-based Real-Time Delphi. The current project on *Low Carbon Society* is making the most out of this new development.

- The Foresight Network Created by the Center

The Center has created a vast network of foresight experts and practitioners during its decade of existence, usually through foresight projects and training. Besides, the Center realized that regional and institutional connections were most important for the mission of the Center to be successful. Here are some example of the foresight network created by the Center:

- Europe, through IPTS and EFMN

Professor Greg Tegart, the first Executive Director of the Center started to visit the Institute for Prospective Technological Studies (IPTS) in Seville, Spain since 1998 and he managed to continue the visit almost every year during his yearly holidays in France. In 2004, when IPTS organized the first International Foresight Conference, the Center was represented by Prof. Ron Johnston, our IAB member and Ms. Tamsin Jewell, Researcher. The success of the first conference led to decision to organize biennial seminars and Prof. Ron Johnston was asked to organize the Second Conference in 2006 and the Third Conference in 2008. In 2006, Dr. Nares Damrongchai, the Center's Executive Director and Dr. Chatri Sripaipan, NSTDA's Senior Advisor, presented papers at the Conference and used the opportunity to connect with foresight experts and practitioners (mainly European). Dr. Nares Damrongchai did the same in 2008, having also submitted two papers to *Foresight Brief* of the European Foresight Monitoring Network (EFMN), one published in its database and another in the pipeline.

- Japan, through NISTEP

Mr. Terutaka Kuwahara, then Director of Technology Forecast Research Team at the National Institute of Science and Technology Policy (NISTEP) participated as a resource person in the feasibility study for the establishment of the Center and later served as an International Advisory Board member. The Center was honored when NISTEP organized the First International Conference on Technology Foresight in 2000 and invited the Center to be a Co-organizer. Dr. Nares Damrongchai, who would become the Executive Director spent three months at NISTEP in 2002 as Visiting Research Fellow to study foresight methods. The CTF-NISTEP connection continued when in 2006 Thailand and Japan co-proposed a project on *Emerging Infectious Diseases*, where a scenario planning workshop was held in Thailand and a technology roadmapping workshop was held in Japan with the strong support and contribution from NISTEP. Many

experts from NISTEP provided the Center with indispensable contribution, to which the Center was very grateful.

- APEC, through ISTWG

The APEC Center for Technology Foresight was established as a project of the APEC Industrial Science and Technology Working Group (ISTWG), and its mandate to promote foresight across the APEC region was derived from this group. The Center therefore regards it essential to participate fully in the biannual ISTWG meetings, and to hold a side-meeting at ISTWG meeting. The purpose of the participation in ISTWG meetings are to create more opportunity to interact with focal points of member economies and to inform them regarding the progress of ongoing project(s) and to obtain ideas and support to the next project. As a result, the Center could be said to be one of the most active projects of the ISTWG. Funding support from the APEC Central Fund through the ISTWG forum could be said as one key measure of success, but what has been most valuable was the human resources in APEC network, without which access would have been difficult.

- ASEAN

APEC-wide foresight projects are usually the flagships of APEC CTF. After some accomplishments in running these regional foresight projects, the Center was ready to try out another type of regional foresight exercise. It turned out that the Association of Southeast Asian Nations (ASEAN) countries neighboring to Thailand, the home of the Center, were the ones lying in wait to receive most benefits from foresight. The ASEAN members are mostly developing countries in a more homogeneous setting in terms of level of economic development, comparing with APEC.

The *ASEAN Technology Foresight and Scan* project was supported by ASEAN Sub-Committee on S&T Infrastructure & Resource Development (SCIRD), and was carried out between July 2003-2005. Since foresight was very new to most ASEAN members especially the Indochina countries, the ASEAN foresight project was designed to be supportive to those countries. The project consisted of many components: a Design and Methodology Workshop to develop awareness and to solicit support from senior ASEAN delegates, a training workshop on foresight to build up country teams of foresight facilitators; consultation for in-country foresight projects; an exchange mechanism via bi-monthly electronic newsletters, and a final face-to-face workshop. Workshops were conducted by

leading foresight experts such as Dr. Chatri Sripaipan, Professor Ron Johnston, and the late-Professor Akio Kameoka.

The project resulted in completed 8 national foresight projects conducted by Brunei Darussalam, Myanmar, Indonesia, Laos, Malaysia, the Philippines, Thailand and Vietnam. Many project leaders of these countries are still in contact with the Center at present.

- How Much Success was CTF's Success?

At *project* level, each project that the Center has conducted has its own success depending on the judging criteria. Below are some examples to begin with.

In terms of timing, the *Nanotechnology* project was probably the most appropriate. Despite being self-funded, the scenario planning meeting in Ottawa hosted by the National Research Council of Canada was well attended by experts from developed economies (although few experts from developing economies could attend, regretfully). The report contained a number of "state-of-the-art" presentations from experts and the National Science Council of Chinese Taipei purchased a few hundred copies for distribution in the economy. One year after the CTF meeting, the world was flooded with international conferences on nanotechnology. This project also contributed to the decision of the Thai government to establish the National Nanotechnology Center in 2003 and content of the report was used in its first Framework Plan. The Center received a request for permission to use part of the *Nanotechnology* report in a textbook *Introduction to Nanoscience*, written by Dr. Louis Hornyak of NanoThread, Inc. The book was published in May 2008.

Future Fuel was also timely and became the first project whose report made its way to reach the hand of the Thai Prime Minister in 2005. The Center was also requested for publication articles from the project and oral presentations at PTT Public Company Limited, Thailand's major oil company, and Thai decision-making bodies such as the Energy Commission of the Parliament. The project also inspired other research projects such as the *Biodiesel Specification Standardization*, later proposed to the APEC Energy Working Group (EWG) and conducted in 2007.

The ASEAN Technology Foresight and Scan was a unique project where failure led to success. Initially the project was designed for all participating countries, after completion of the training workshops, to conduct their in-country foresight projects around a common topic that was to be selected by all members and therefore lessons learned could be compared. That did not happen, however, due to the lack of some central financial support for each in-country project. Therefore member countries instead chose to conduct their in-country projects on their own topics that differ from one another. It could be observed that this was a major difference from the tradition of APEC-wide foresight projects which are usually conducted on a single topic.

The initial shortcoming, the failure to find a common topic due to the lack of financial support to in-country foresight projects, led to the members seeking sectors that were most relevant and ready to try foresight. Eventually the project turned out to be successful in drawing many developing countries to set their own priority, explore and invest in foresight using their own budget, with support in training and consultation from the Center. The completion of in-country projects meant clear and tangible interest and commitment from the participating members in employing foresight to develop their domestic industries.

In hindsight, the project was a showcase for the Center's capacity in providing technical and consultancy support to a wide range of different national clients, which are the core competencies of the Center.

- The Feedbacks

Measuring success should not be done only at project level. The feedbacks, or lack of feedbacks, could be another indicator showing how the Center was viewed by others, and therefore should be one important component in identifying success.

To continue using the example of the ASEAN project, a few years after the completion, the Center received some feedbacks from the project's participating members. Below are some examples.

Malaysia reported that it has applied the technology foresight methodologies effectively in the development of their Electricity Technology Roadmap (2005 - 2030), called the TRM1 document. This is now (as of November 2008) a policy document which is widely used as reference for our short term operational plans.

Malaysia also went a little further, to identify 6 strategic technologies from the TRM1 document and developed detailed action plan strategies (2005 - 2010). The project leader reported to CTF that the methodologies taught during the foresight training workshops have indeed been very useful, and they have applied foresight to many strategic planning processes, and that in Malaysia there is certainly demand for technology foresight in many areas.

The Philippines, whose in-country report was on Human Resource Capability Towards the Creation of Technology Champions in Key Industries: Electronics, also reported favorably regarding the impact of the ASEAN project. Its in-country foresight project was supported by the government, academic institutions, and the electronic industry associations.

In February 2006, less than a year after completion of the ASEAN project, the Philippines conducted technology foresight training of 25-30 governmental personnels at PCARRD, Los Banos Laguna. The team applied foresight to PCARRD's Strategic Assessment of Research and Development Consortium, including 12 regions.

The Philippines continued to build capacity in foresight through its Research Education and Development Training Institute. In August 2007 the Institute host seminars on Building Comparative Advantage through Science, Technology, and Innovation: Agenda for Philippine Higher Education and Other Stakeholders, and a seminar on Technology Foresight for IT Personnel and Administrators.

Some participating members in the ASEAN project tried to engage expert groups, who were later expected to be the people who implement the strategy, as part of the foresight process outcome. Others reported that there are gaps and needs to enhance both the awareness and practice capacity for using foresight methods in their respective countries.

For most members, it was reported that the key barriers have always been to develop a strategy which is executable and have a strong "buy-in" by key leaders.

There were also, of course, feedbacks from past APEC-wide foresight project participants. When CTF sent a short evaluation form to the alumni of 4 past projects during 1998-2000, responses were positive (although it could be assumed that those with negative attitudes did not bother to reply).

- The Converts

In some cases, the Center could successfully 'convert' people who otherwise would have ignored foresight to become 'believers' in foresight. This could be seen throughout the decade of the Center's activity. For example, here is one case among the converts who responded to the short evaluation:

"I am now a follower of the foresight technique. When we were at the workshop I thought that we were creating science fiction with our four overviews of the water problem. A few months later I started realizing that our collective imagination was very realistic. Now I think that when you want to plan for the future, the opinion of the experts to foresight many aspects of our civilization is unavoidable." --- Dr. Oscar Monroy, Mexico.

Here is another quote from a participant at the Tokyo Roadmapping workshop in 2007:

"I did not quite believe in foresight until I became involved actively (in CTF's training workshop, DNA and EID foresight projects). I now realize that foresight is a very useful tool for planning the future. Actually I can tell from my personal experience that foresight is useful in planning my daily life." --- Dr. Sirirug Songsivilai, Thailand.

- The Returning Customers

During the 5 consecutive training workshops led by Professor Ron Johnston, held from 2002 to 2006, there has been a number of participants to the workshop who returned to attend the workshop again the next year. They were in most cases from governmental organizations. Some of these returning participants attend by themselves multiple times, some of them recommended their successors or representatives to attend. Some were experts who, after finishing the training, continues to conduct or became active in their foresight projects.

The Center was recently invited to conduct a *Training Course on Foresight for Organization of the Islamic Conference (OIC) Members* at OIC Standing Committee on Scientific and Technological Cooperation (COMSTECH) in Islamabad, Pakistan, in 2008. More than 40 participants from OIC countries attended the training to build key conceptual understandnig about the objectives and methods of technology foresight with some case studies and hands-on assignments. Later that year, the Center received an invitation from COMSTECH to make another visit and conduct a 2-week foresight course in 2009.

Technology Promotion Association (Thai-Japan), a non governmental organization, requested the assistance from the Center for their strategic decision and planning in 2002. The result of the exercise led to major decisions in the organizations which shaped its direction for the next 5 years. TPA has apparently acquired some skills in foresight, hence in 2008 when it returned to the Center for consultation in its foresight update exercise, it already conducted a

SWOT analysis, completed with a set of future scenarios. The Center only further facilitated the extraction of key issues from the scenarios and led the discussion to conclude TPA's vision, mission, and strategic positioning based on the scenarios.

CTF conducted foresight for Kasetsert University (KU) to look into the future of the University for the next 20 years during 2004 - 2005; a major project in itself, covering all aspects of the university. In 2008, Faculty of Agro-Industry of KU returned to the Center for further consultancy in foresight. Four scenarios were generated specifically for the Faculty to formulate strategies in coping with the anticipated change in the next 10 years.

Health System Research Institute (HSRI) conducted 4 foresight projects with the assistance of the Center during 2003 - 2004. Later on, the relationship developed into some other distinctive projects such as Foresighting Aging Society / Mature Society by the Institute for Policy Research and Development Foundation, and National Health Insurance Foresight by Health Insurance System Research Office (HISRO). All these organizations are related to HSRI and CTF provided consultancy to all of them.

A number of private companies / public organizations who attended training workshops by the Center such as Siam Cement Group (SCG) and Electricity Generation Authority of Thailand (EGAT) are notable returning customers in the Center's technology road-mapping trainings.

PTT, Thailand's major oil company who participated in the APEC-wide project on future fuels during 2005 - 2006 requested for the Center's assistance in organizing a training workshop for the oil and petrochemical industry in 2007.

- The Supporters

As far as supporters are concerned, NSTDA has long been both supporter and major customer of the Center. Many research laboratories, research programs, and the Cluster and Program Management Office (CPMO) have been and continues to be returning customers of the Center.

The APEC Industrial Science and Technology Working Group (ISTWG) have been a strong supporter of the projects proposed by the Center. The last 3 projects proposed to ISTWG received very high support at the forum (either ranking #1 or #2) and not less than 10 co-sponsoring economy for each. Particularly the project "*Research on Futures of Low Carbon Society: Climate Change and Strategies for Economies in APEC Beyond 2050*" has undergone the Quality Assessment Framework (QAF), a detailed assessment of proposal quality by the forum, and received the highest point among the proposed projects in 2008.

To name names, the Center has been grateful to quite a number of people: Prof. Yongyuth Yuthavong who founded the Center, Prof. Pairash Thajchayaong and Dr. Sakarindr Bhumiratana for their strong support, Prof. Greg Tegart who showed the Center how to run an international center, Prof. Ron Johnston who taught the staff about foresight, scenario planning and many more, Dr. Arthur Carty who gave support with the resources of the National Research Council of Canada, Mr. Terutaka Kuwahara who helped with the long experience and resources of NISTEP, and Dr. Richard Silberglitt who gave tireless advice. Of course, there are too many other names that it would be impossible to mention all here.

Apart from strong personal and institutional support, one might wonder what the Center's key success factors are. Carefully considered, it could be said that our most important key success factors are our opportunity to use the prestige of APEC to leverage resources (most of the time in the form of in-kind contribution) from member economies. The Center has tried its best to involve relevant experts and institutions in each project. To keep member economies informed about the latest development of the Center, the Executive Director of CTF not only attends every ISTWG meeting but also holds side-meetings to report the progress of ongoing project(s) and to solicit the views and support of Focal Points from

member economies on the formulation of the next project. Usually many APEC member economies (often more than 10) provide co-sponsorship to CTF's proposed projects, and some members contribute papers and/or send experts to attend the Center's activities at their own expenses.

- The Future: No Impact, No Success

Creating impact is without doubt the utmost desire of foresight institutions (and in fact all kinds of institutions), but the impact of foresight is particularly difficult to measure unless well-defined.

When considering what the Center has achieved collectively, it was said, half-jokingly, that 'one thing is that now we do not have to explain the meaning of *foresight* every time we meet a new person'. This joke contains a grain of truth, though.

From the first year onwards, there has been a steady stream of requests for training and planning with foresight from organizations in Thailand, member economies and non-member economies. They represent a wide spectrum from governmental organizations, state enterprises, and non-profit organization to private companies. The level of interest shows that the Center is successful in attracting new clients to a level that is beyond its capacity to service them. While (almost) no request has been turned away, they are taken care of differently, for example, by training the staff of the requesting organization to handle a large part of the project or to refer the job to another consultant.

But creating awareness is only the first step, if at all, in creating impact. The Center's experience showed that organizations which take foresight seriously did benefit from it in resolving a number of strategic issues. However, apart from these anecdotal and organizational-level impact, the Center will need to consider its foothold in APEC region and make its impact felt at a higher level. To be felt, one has to be outstanding.

Therefore, the future success (or rather survival) of CTF might depend on whether it could find meaning and fully create a unique value out of what is called *regional technology foresight capability and network*.

As globalization rolled out, economies, including nation states, are in extremely dependent circumstances in S&T as in trade and political affairs. Even the most powerful economies or nations find it hard to attain leadership in all fields of S&T. It is here that regional technology foresight could come into play in making collective informed (though constrained) choices i.e. understanding what one's room for maneuver is, what trade-offs may be required, and who to look for as collaborators or partners.

Especially for less developed economies, technology foresight could help creating the awareness that even if one cannot occupy the technology frontier in many areas, there are opportunities to be active e.g. in specific application areas, in particular niches, in collaborations, in using research to enhance one's 'absorption capacity', making excellent use of knowledge generated elsewhere.

The most difficult challenge that awaits the Center in its future course might be the question of how to best shape foresight to fit with local context in a region as diverse as APEC, and how to put its findings into actionable recommendations.

In responding to the challenges, the authors would like to propose the following agenda as a starting point in guiding the Center's direction into the next decade and beyond.

1. Increase international profile and recognition, particularly seeking channels to make its findings to be more recognized not only in the APEC but globally.
2. Monitoring foresight project impacts of past and current projects, while connects with the international foresight community to exchange its capacity building in impact assessment.

3. Explore and build capacity in Horizontal Scanning in order to provide insights on technology and technology-related trends for the region. This is perhaps the area that has highest growth of demand in APEC.
4. Play a prominent role in bringing the foresight skills to benefit the most needing (developing) economies in the region. This could include the ASEAN region as the project conducted earlier by the Center.

"Organizations exist to enable ordinary people to do extraordinary things", said the late Ted Levitt, an American economist who coined the term *globalization*. A decade is a good time for an organization to reflect on its successes and failures, lessons learned, and make some re-orientation, if needed, to ensure it continues to create values that justify its existence.

As for the APEC Center for Technology Foresight, we are now getting ready for the journey into the next decade.

Beyond the Frontiers of Technology and Knowledge : Implications for APEC

Submitted to APEC CEO Summit, Bangkok, Thailand
21 October 2003

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Excellencies, ladies and gentlemen

We have heard excellent presentations on the advances of knowledge and technology which will affect the APEC economies as well as those in the world at large with ever greater impact. We can see that technology and knowledge will, much more so than before, be the decisive factors in trade and development, communication and in general well-being of our societies. The APEC economies, accounting for about half of world trade and a sizeable portion of its population, comprising both the developed and developing countries at various stages, need to prepare for these changes. How it fares will very much indicate how the world at large will be able to meet the new challenges.

The knowledge-based economy, fueled by technology and innovation of the types that we saw from the earlier presentations, will see the rise of flexible production and services in place of mass production as in the old economy that we are familiar with. Production and services will be integrated globally, within and beyond APEC. The presence of skill and brain manpower, and the infrastructure which can serve with speed to market, will dictate the site of production and services. Firms in various economies, both in APEC and outside, which link together appropriately to take advantage of the new scenarios will win, and those which cannot will lose. It is a win-win situation for some, but not for all.

Excellencies, ladies and gentlemen, I would like to draw your attention to two frontiers for APEC

First, the frontier of knowledge and technology for mankind. The developed economies of APEC are among the most advanced on this frontier, as we saw earlier. The benefits of the new technologies will befall these countries and their partners. Hopefully, the less advanced APEC economies will also reap some benefits from partnering with the more advanced ones.

Second, the frontier limited by the status of development. The developing economies of APEC are beset with various problems, both distracting and hindering them from optimal use of the new knowledge and technology available to mankind. They need to solve the urgent problems of underdevelopment even as they try to face the new challenges from knowledge and technology from the first frontier. They are therefore handicapped in dealing with these new challenges.

APEC objectives in free trade and investment reflects the double difficulties for the developing nations. Hence it was agreed that free trade and investment in APEC should be realized by 2010 for developed economies, and by 2020 for less developed economies. The main problems include current trade practices, anti-globalization trend, diverse geographic locations of the APEC economies, diverse economic and social conditions, and diverse statuses of science, technology and knowledge essential for the knowledge-based globally integrated economy.

As the revolution in technologies gathers pace, giving rise to new areas and merging of several areas, the gap between the technology-rich and technology-deprived economies widens. This has deep implications in that instead of an all-win situation, a large part of APEC, as also the world outside, feel that they are losing. Hence the increase in anti-globalization trend is felt in APEC as elsewhere. Yet, there is a fear of the developing countries lest they should miss the "technology train" leaving the platform. They want to join the technology club, and yet are torn by the negative consequences of uneven development.

May I draw your attention to a bit of history?

In surveying the frontiers for APEC, it is appropriate to consider related frontiers in the past. In 1944, on request from President Roosevelt to develop and disseminate scientific knowledge for the US, Vannevar Bush, Director of the Office of Scientific Research and Development, wrote a report entitled, *Science: the Endless Frontier*, which laid the foundation for the National Science Foundation. It put much emphasis on exploring the frontier of science, with the conviction that benefits to society will follow eventually, as seen in the past.

The lessons of the past sixty years teach us that the pursuit of science, the endless frontier, certainly gave various benefits, such as those we see from genomic technology which was derived from discovery of DNA structure by Watson and Crick in 1953. However, it became increasingly clear that science-guided development is not, and should not be, the whole picture. Rather, we need to start from the demand of the society for science and technology. This led the leaders in Europe, for example, to issue a new call, *Society: the Endless Frontier*. This call puts science and technology to service of the society, including help in tackling the challenges of unemployment and ageing. Research and innovation policies were set up, integrating societal objectives with governmental support of innovation systems.

The endless frontier therefore seems to change with place and time.

Back to APEC's present frontiers,

As for the first frontier, that of knowledge and technology, while we should marvel at the new technologies advancing relentlessly in the developed economies of APEC, we should note also that the gap between the developed and developing economies is widening. The big question, therefore, is:

HOW DO WE REDUCE THE GAP?

The question is very much related to the second one arising from consideration of the second frontier for APEC: the frontier imposed by limited status of social and economic development. The developing economies of APEC have limited prospects, due in part to lack of knowledge and technology. They have many "firefighting" problems, distracting and preventing them from effectively joining the knowledge-based economies. Poverty, lack of access to education, poor nutrition, infectious diseases including AIDS, malaria and TB - these are only some of the problems facing these second-tier countries. How can they rise up to the challenges of the knowledge-based economy when the basic necessities for life are not being met? We therefore should ask:

WHAT CAN APEC AS A GROUP DO TO ALLEVIATE THE DIFFICULTIES FACED BY THE DEVELOPING ECONOMIES?

What then are the solutions?

While there is time for me to raise these questions, there is unfortunately no time even to begin to answer them satisfactorily. Suffice it to say that I think the answers lie partly in further technical advances that we can make, which can go a long way in solving our problems of imbalanced development, for example, in making communication and education accessible to all strata of our societies, or in furthering the health of all members of our societies. However, we should try to solve our problems at their roots through our hearts and souls with compassion. We should study the problems not only from a mechanical standpoint through analysis of individual components, but also from a holistic viewpoint, understanding the true causes and struggling for the solutions at their roots. The APEC region encompasses the cultures, philosophies and ethical principles of both West and East, which place emphasis on different approaches. Let us try to combine the approaches in order to solve our problems together.

But what about the future?

Before I finish, let me talk about the times of the future. You have already seen that technology advances so quickly that there is no time to respond appropriately, if you are not somewhat prepared in advance. Now, while one can certainly not predict the advances of technologies accurately, due to uncertain and unforeseen aspects inherent in science and technology, you can anticipate something on a macroscale. Over the past decade or so, many countries, including the UK, Australia and Japan have been paying more attention to foresighting in technology and broad aspects of the society. In contrast to forecasting, foresighting is not extrapolation of the present technology trends to the future, but looking at the future societies in all its broad aspects including technology. It is therefore long-range indicative planning, helping us to see possible futures a little more clearly, and to prepare more appropriately for such futures. The APEC Center for Technology Foresight was set up at the initiative of Thailand in the Industrial Science and Technology Working Group of APEC in 1998, to do foresight studies of APEC-wide issues concerning technology, and to help APEC member economies in their country-wide foresighting. It was the first undertaking of foresighting on a regional basis, and through the work of international teams the Center has accomplished various studies including problems of the future concerning water supply and management, sustainable transport, megacities, technology for learning and culture, nanotechnology and DNA technology.

Having raised the problems concerning the two frontiers of APEC, I would like to propose that foresighting should be done on these frontiers, including efforts to answer the questions

- What will be the future status of knowledge and technology in the APEC economies?
- What impact will it have on the economic and social status of the APEC economies?
- **HOW DO WE PREPARE TO ADVANCE ON THE TWO FRONTIERS?**

Excellencies, ladies and gentlemen,

We have been talking about two frontiers of APEC, and about science and society as the endless frontiers. In conclusion, I think you will agree with me that these frontiers point to perhaps the truly endless frontier:

HUMANITY: THE ENDLESS FRONTIER

Humanity is the frontier which lies beyond the frontiers of knowledge and technology, and social and economic development. It consists of various levels: the individual, the people, the nations, and the world. Together, APEC can demonstrate that it cares not only for trade and investment, but for all the values of humanity resulting from co-operation on the basis of individual strengths. I therefore pose the last question to you:

CAN APEC HELP TO BRING ABOUT A MORE HUMAN WORLD?

Thank you very much.

APEC Center for Technology Foresight Photo Archive



1998 : The Launch of APEC CTF



1998 : The Launch of APEC CTF



1998 : Digital Economy Video Conference



1998 : Foresighting to Create a learning Organization : Workshop



2000 : Foresighting Future for APEC CTF



2000 : Foresighting Future for APEC CTF



2000 : Healthy Futures for APEC Megacities



2000 : Healthy Futures for APEC Megacities



2002 : DNA Analysis for Human Health in the Post - Genomic Era



2003 : Tools for Managing the Future : A Portfolio Approach



2002 : 4th APEC R&D Leaders' Forum



2002 : Nanotechnology for the ASEAN Region



2003 : 2nd International Conference on Technology Foresight, Tokyo



2003 : 2nd International Conference on Technology Foresight, Tokyo



2002 : Nanotechnology for the ASEAN Region



2003 : 2nd International Conference on Technology Foresight, Tokyo



2003: Technology Roadmapping Training Workshop : A Strategy for Success



2002 : Tools for Managing the Future : A Portfolio Approach



2002 : APEC Technology Foresight Network



2003: Technology Roadmapping Training Workshop : A Strategy for Success



2003: Technology Roadmapping Training Workshop : A Strategy for Success



2004 : Future Fuel Technology Scenario Krabi



2004 : Future Fuel Technology Scenario Krabi



2003 : DNA Analysis Scenario Workshop



2003 : DNA Analysis Scenario Workshop



2004 : Tools for Managing the Future : A Portfolio Approach



2003 : DNA Analysis Scenario Workshop



2004 : Future Fuel Technology Scenario, Krabi



2004 : Tools for Managing the Future : A Portfolio Approach



2004 : Tools for Managing the Future : A Portfolio Approach



2005 : Future Fuel Technology Roadmapping Workshop, Vancouver



2005 : Future Fuel Technology Roadmapping Workshop, Vancouver



2005 : Tools for Managing the Future : A Portfolio Approach



2005 : Tools for Managing the Future : A Portfolio Approach



2005 : ASEAN Technology Foresight & Scan Workshop



2005 : Tools for Managing the Future : A Portfolio Approach



2006 : Strategic Foresight in Modern Management



2005 : ASEAN Technology Foresight & Scan Workshop



2005 : ASEAN Technology Foresight & Scan Workshop



2006 : Strategic Foresight in Modern Management



2006 : Strategic Foresight in Modern Management



2006 : Comprehensive Training on Technology Roadmapping



2006 : Comprehensive Training on Technology Roadmapping



2007 : Emerging Infections Diseases Roadmapping Workshop, Tokyo



2007 : Emerging Infections Diseases Scenario Workshop, Khao Lak



2007 : Emerging Infections Diseases Roadmapping Workshop, Tokyo



2007 : Emerging Infections Diseases Roadmapping Workshop, Taipei



2007 : Emerging Infections Diseases Roadmapping Workshop, Tokyo



2007 : Emerging Infections Diseases Roadmapping Workshop, Tokyo



2007 : Emerging Infections Diseases Final Symposium



2007 : Emerging Infections Diseases Final Symposium



2007 : City Foresight Conference, Lamphun



2007 : City Foresight Junior Futurists Workshop, Chiang Mai



2008 : Health Insurance Foresight Scenario Workshop, Pattaya



2008 : Health Insurance Foresight Real-Time Delphi Kick-Off



2007 : City Foresight Conference, Chiang Mai



2007 : City Foresight Workshop, Chiang Mai



2008 : CDG Company Scenario



2008 : CDG Company Scenario



2007 : Kasetsart University Foresight, Pattaya



2007 : Kasetsart University Foresight, Pattaya



2008 : Strategic Roadmap for Furniture Industry



2008 : Low Carbon Society, Hong Kong, China



2008 : Low Carbon Society, Hong Kong, China



2008 : Low Carbon Society



2008 : Low Carbon Society



2008 : Low Carbon Society



Apec CTF staff, April 2008

