

Multi-Economy Foresight Activities of the APEC Center for Technology Foresight

Witaya Jeradechakul*, Chatri Sripaipan, and Tamsin Jewell*****

*Executive Director, APEC Center for Technology Foresight

**Vice-President of National Science and Technology Development Agency

***Policy Researcher, APEC Center for Technology Foresight
Bangkok, Thailand.

ABSTRACT:

Foresight has been recognized as an important tool for S&T planning and policy. The foresight methods themselves are also applied in different contexts and situations, depending on the objectives and application. This paper discusses 5 multi-economy projects completed during 1998-2002 by the APEC CTF. The first section provides a short description of the Center's 5 multi-economy projects as related to APEC's central structure and its working groups. The second section touches on the formation of the Center's multi-economy projects in the pre foresight stage covering choosing the topics, framing the study scope, and engaging the sponsors and resources. The third section moves to discuss the main foresight stage covering, specifically, the five multi-economy projects in terms of their use of scenario and Delphi in addition to some observational points regarding both methods. The fourth section presents the post foresight phase discussing the outcome dissemination and impact with specific examples. A short discussion on the outcomes of the multi-economy projects as well as the Center's possible direction are presented to conclude the paper.

INTRODUCTION:

APEC (Asia-Pacific Economic Cooperation) was established in 1989 in response to the growing interdependence among Asia-Pacific economies with its primary goal to promote and facilitate economic growth, cooperation, trade and investment in the APEC region. APEC's 21 member economies, despite its enormous diversity in terms of political systems, governance, physical environments, languages, cultures, and levels of science and technological development, contribute to a combined GDP of 19 trillion US dollars accounting for 47 percent of world trade¹ Due to its loose structure, APEC's governance is managed by consensus through dialogue and discussion of the leaders,

¹ in APEC terminology, the word 'economy' is used instead of 'country'; the members are Australia; Brunei; Canada; Chile; China; Hong Kong, China; Indonesia; Japan; South Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; Russia; Singapore; Chinese Taipei; Thailand; the USA, and Vietnam Additional information can be obtained from: <http://www.apecsec.org.sg>

ministers, senior officers, the business advisory committee (ABAC), and the APEC for a comprising 3 committees, one sub committee, and 11 working groups. In order that development is sustainable both economically and environmentally, APEC encourages various cooperative activities and many of the activities are operated through the network of various APEC working groups.

Established on February 3, 1998, the APEC Center for Technology Foresight is supported by the government of Thailand and currently is hosted by the National Science Technology Development Agency (NSTDA). The Center works directly with the Industrial Science and Technology Working Group of APEC on various APEC-related activities, particularly, in terms of proposal submission for APEC central funding to cover partial expenses for its APEC-wide projects. During 1998-2002, the Center has completed 5 APEC-wide projects (or multi-economy projects under the Center's terminology) and is currently launching its 6th multi-economy project on "DNA Analysis for Human Health in the Post Genomic Era" through funding supports from APEC central fund with additional budget from the Thai government.

This paper as titled "Multi-Economy Foresight Activities of the APEC Center for Technology foresight" focuses specifically on discussing the five completed multi-economy projects covering pre-foresight stage, main foresight stage, post foresight stage, and conclusion.

Pre-foresight phase:

The pre-foresight phases of the APEC-wide projects are initiated not by the APEC Committee or Commission that has a mandate to implement the results but by the member economies themselves. Once a member economy has a concrete idea for project and has developed it in a proposal format according to the APEC guideline, it, then, requires consensus support firstly of the relevant Working Group or Task Force and then the APEC Senior Officials and Ministers, in order to become 'APEC' projects. To obtain financial support, there is an additional interim stage involving scrutiny of a Budget and Management Committee and if approved, this financial backing is only ever partial. The proposing economy must cover a substantial portion of the costs of the project, and other economies that participate will tend to cover most of their own costs too. The APEC CTF therefore has to work to mobilise the interest and commitment of other economies when it wishes to undertake a project. And thus the *pre-foresight* phase of these international projects, encompassing the tasks of choosing topics, engaging sponsors and resources, and framing the scope of the study, can be more complex and lengthy than the actual 'main' foresight stage.

Since the APEC CTF is a project of the Industrial Science and Technology Working Group, and is hosted by a National Science and Technology Development Agency, its projects naturally have an S&T focus. The first ideas for suitable topics were obtained during the feasibility study for the establishment of the Center, which included an APEC-wide survey of opinions for potential topics of study and an APEC Symposium with over 100 delegates from 16 member economies which prioritised those topics. The

international advisory board of the CTF then developed a set of criteria for choosing a topic, namely:

- (i) the issue concerns most member economies, with at least 4 agreeing to participate in the study and potential to share the results with all the rest;
- (ii) the issue transcends national boundaries, so that it can go beyond anything that might be achieved by a national or bi-lateral study;
- (iii) the issue is likely to be of general, public concern/ benefit and not one that is likely to be dealt with by the private sector; and
- (iv) the issue has important technological components but not necessarily 'high-tech' ones.

Once chosen, the CTF (with the aid of Consultants) develops a Concept Paper for presentation to ISTWG. This is then revised based on feedback from member economies and a full project proposal submitted to the following meeting. If approved and funding is sought, it then goes through further APEC committees, with funds becoming available the following year. While the formal steps are completed, the CTF works 'behind the scenes' to draw in experts and organisations from all over the region, to incorporate their opinions at every stage and secure their commitment to taking part once the study begins. Since some ISTWG representatives are far more active than others, the support of the international advisory board of the CTF is critical to this process. They and their institutions provide credibility to the study and through their networks, the CTF is able to reach topic experts in many different economies. ISTWG has a web site (ASTWeb) which enables electronic discussion of projects but it has to be admitted that most economies do not participate in these discussions. The CTF has also attempted to engage member economies / topic experts in electronic discussions both while scoping the studies and during them, but with very little success. While it might be assumed that electronic discussions would be an excellent way of involving the widely dispersed 21 member economies, the reality has fallen far short of the ideal.

The future is a moving target and once a study begins, perhaps some 2 years after it was first conceived, it is necessary to review again the scope and purpose. These must respond closely to the needs of those organisations and economies that have finally decided to opt in to the project, while at the same time, ensuring some value to *all* APEC members. The eventual focus of the study is therefore not strictly defined until an Issues Paper is prepared, as the first formal stage of the project. The Issues Paper is prepared by the core project team (which extends beyond the staff of the CTF), though in one study on megacities, the complexity and scale of work already going on the topic necessitated a meeting of the key participants in order to determine those issues. In all projects, there is a challenge to define the scope in terms of level and timeframe. The APEC CTF is keenly aware that there is no international-level implementing agency for its project outcomes². Therefore, the challenge is to make the most of the international scope in order to provide valuable recommendations and insights for national and organisational level planning. These studies thus emphasize making world-class S&T knowledge available during the study, learning from others experiences, and promoting international networking and collaborations. The APEC concern for equity is addressed by explicitly including issues for developing economies in discussions, as well as

² Recommendations to ISTWG for further projects are possible but action depends upon a member economy initiating a project as response and so are of limited value.

drawing out any gender implications. The time-frame is determined partly through discussions with participants but tends to be implied by the nature of the topic itself. For example, for an emerging field like ‘nanotechnology’ a fairly short frame of 14 years was adopted (to 2015) since the uncertainties were seen as too great beyond that time for explorations of the future to yield useful insights. Where the knowledge base of the topic is much stronger and more established, and the issues were less about setting up infrastructure and more about radically reforming it, a longer time frame seemed more valuable, such as during the ‘megacities’ project which developed scenarios for the year 2020.

Thus the pre-foresight phase of the APEC wide foresight projects is a lengthy and complex balancing act. Through formal and informal means involving APEC/ISTWG, topic experts and foresight experts, a topic is chosen and the frame and scope of the project gradually narrowed down. Support is sought at a political level to obtain approval from APEC and contributions from members economies, and at an ‘expertise’ level to engage the scientists and policy-makers who will provide the knowledge and judgments on which the project depends. Participation in the projects is entirely voluntary and while this makes setting them up a real challenge for the APEC CTF, it becomes a great strength during the projects when the participants’ commitment and interest become evident through their substantial efforts and their openness to engaging with new ideas and new ways of working.

Main Foresight Studies

Once the pre foresight stage is completed, the main foresight stage involves an intensive work on the part of the Center, the consultants, and the experts to undertake the activities as outlined in the proposal approved by the APEC. This stage heavily involves with choosing and inviting of the participants from other APEC economies, developing the role and mandate of key players, specifying the methodologies to deliver the results, and the final targets for outputs and outcomes. Since the establishment of the APEC Center for Technology foresight in 1998, 5 multi-economy projects have been undertaken with the varying degrees of outputs and outcomes. As the Center has already produced a number of the papers on different topics relating to multi-economy projects as well as the publicity of the activities as appeared through its web site, this section, in order to provide another perspective of the multi-economy projects, discusses specifically the outputs of the five projects in terms of scenarios and Delphi exercises. Sixteen scenarios and 2 Delphi projects, therefore, are described. The outcomes of the multi-economy projects as well as additional observational points are presented in the final conclusion and discussion section. The five multi-economy projects under this discussion are: Water Supply and Management (1998); Technology for Learning and Culture (1999); Sustainable transport for APEC Megacities (1999); Healthy Futures for APEC Megacities (1999-2000); and Nanotechnology--the Technology for the 21st Century (2001-2002).

The first project on **Water supply and Management** aimed to develop a strategic and integrated view of experts in the APEC economies in terms of the challenge, threats and

opportunities on water supply and management in addition to identifying issues of the concerns and importance to the APEC economies. After an issues paper, the scenario exercise, which included a group of 10 participating experts from 9 economies, was used to explore the alternative pictures on water supply and management. The exercise discovered three scenarios: *'Danger! Water Ahead'*--depicting a pessimistic future of water supply, a tough situation of disease and epidemic caused by water, unjust and unstable prices of water that would cause hardship on the people, competition and conflict arising from water issue between nation states, and consequently the loss of trust for the governments as well as international bodies. The situation led to a much higher recognition of the central role of water in economic and political, as well as human survival matters.; *'Water Rules'*-- the second scenario shows a consensus of agreement for an integrated water management system as well as a mutual binding for water quality and trade. Through this scenario, all APEC economies, by 2010, are able to reap the benefit of economic growth and high performance due to good water quality, water system and management. There existed also the emergence of new technologies such as electronic access to models and databases on total water cycle, satellite monitoring of water use including the improved transport and storage systems; and *'APEC Turns On The Tap'*-- portraying a difficult picture of the APEC community resulting from a prolonged natural disaster of 'El Nino.' APEC member economies had to readjust themselves through channeling a series of appropriate emergency short-term measures including highly controlled irrigation, domestic water saving through redesigning pumping, etc. to tackle the water problem. Such a timely measure was able to serve as a great catalyst for the APEC economies to increase their competitiveness, performance, and growth in R&D.

The three scenarios, demonstrating the forward looking and scale of images of the participants, became the background to the remaining steps of this multi-economy project.

In this first APEC-wide project, a Delphi technique was also implemented. The purpose was to survey the stakeholders' ideas on the series of topics related to water supply and management. The topics for survey were the three sets of scenarios which were completed previously. The Delphi questions were sent to a pool of 605 experts, of which 21% responded to the first round from 16 economies with an overall response rate of 12% after two rounds. The results, then, were analyzed with a focus on three categories: high importance, mean year of realization in the APEC region, and high need for APEC cooperation. The results of the three scenario exercises and Delphi questionnaires were analyzed and incorporated in a final report form for dissemination and distribution.

Technology for Learning and Culture (1999):

This second APEC-wide project reflected the APEC economies' realization for the need to timely readjust the course of their education, culture, and learning to the rapid change in information communication technology. With the National Research Council of Canada as a key study partner, the project employed both scenario exercise and Delphi survey as the main tools.

The scenario exercise, participated by 27 experts from 12 economies, yields four

alternative pictures: *Water, Water Everywhere; Learning through Adversity; Helpless and Hopeless; and The Folks Next Door*. The first scenario pictures the substantial rises of the sea-level due to the impacts of global warming. Under these circumstances, the skills of three professions: engineers, health workers, and teachers were most needed and essential as an important mean to help the society in easing the difficulties as resulted from the environmental disruption. Several emerging forms of schooling arose: home-based schooling and wireless internet emerged with the help of the APEC centralized education bank. The second scenario on Learning through Adversity pictured the changing lifestyle and learning process which had occurred as a result of the economic crises. Culture turned regressive and was much at a slower pace. Extended family system became a preferred pattern of family structure. In *Helpless and Hopeless*, the third scenario illustrated a much unhappy picture of the society. The world lost its technological capacity to the rivals from the outer space. The world economic structure, moreover, collapsed. What remained important and sustaining were education and culture. Teachers became indispensable as a mean to sustain the society. Curriculum for school was also readjusted to the change of world situation and was operated with limited available resource. The last scenario on the *Folks Next door*, on the contrary, gave a robust picture of a dramatic technological change and capacity which consequently had catalysed a significant growth around the world. Information and communication technology became an important tool for the design of curriculum, to satisfy the needs of the people, and to expand world's historical and cultural knowledge.

The Delphi survey was used to investigate the opinions of the experts and stakeholders across the APEC member economies. Two rounds of the questionnaire were conducted. The first round, participated by 520 experts in 14 member economies, surveyed the opinions on technologies, management, contents and learning resources, government policies, human resource development and training, and culture. The degree of importance, year of realization across the APEC region and within the economy of 51 topic statements were used as the criteria for the responding answers. The second round of survey, containing 60 responses from 11 APEC economies, indicated the role of national and international bodies in diffusing learning. Results of the scenario exercise and Delphi surveys were analyzed and incorporated in the Center's report for the public.

Sustainable Transport for APEC Megacities (1999):

Three scenarios were developed. The first scenario, *Green Light Ahead*, described an awareness and concern of political organizations over the serious effect of environmental deterioration on quality of life which had led to actions and breakthroughs in innovative creations of energy alternatives such as using hydrogen as a fuel for vehicles, establishing intelligent vehicles (no drivers) and movers using intelligent highway system and others. The second scenario, *Take The Train*, was about the uncertainty of world economic situation and markets which, consequently, caused the recession affecting the people's purchasing demand. This scenario involved the concern of the people over the greenhouse gas emission that prompted their actions to scale down the use of private motor vehicles. Mass transit system was, therefore, the main source of transportation that people want to promote. *Back To Basics*, the third scenario, showed the change in the people's life style and communication. The change occurred due to the world-wide problem in computer system, oil crisis, and the public

pressure to reduce such problem. An old mode of transportation and travel patterns had become the people's choices for living. This multi-economy project did not include Delphi study.

Healthy Futures for APEC Megacities (1999-2000):

A scenario exercise, participated by 46 experts from 10 economies, was used after a core group of experts meeting. Three alternative pictures were obtained: *Econologic City*, *Monopolis*, and *Fat City 2020*. The first one illustrated one of the top five most advanced cities in the world. The city showed a major design of the infrastructure that was environmentally focused, highly advanced, electronically connected, and designated to wealthy and healthy standard of living. Living in this community was selective and available to a score of people who could own a most-needed license of “EC-card.” The second scenario, however, gave another picture of living in a place where people were highly self-disciplined for their survival and sufficiency. The society was technology-based and highly efficient in resource allocation. The third scenario, *Fat City 2020*, was the dream city in 2020 where people were highly participatory, self-governed, and rich in local democracy. The life pattern reflects the type of social value which is different from the first two scenarios.

Nanotechnology—the Technology for the 21st Century (2001-2002):

The scenario exercise, participated by 26 experts from 9 APEC economies, offered three alternative pictures: *Nano-Paradox—Things are more the same today that they have ever been*; *Green Energy Triggers in Energy Markets*; and *Nanotech Wins the War!* The first scenario showed the use of nanotechnology in the productions of various technology-based merchandises, and the year 2000 covered the major expansion of the products through nanotechnology process resulting from the threats of world terrorism, energy saving, and other necessities. The growth of nanotechnology-related products was increasing as the number of years moved forwards. While nanotechnology enjoyed this growth expansion, the market for its products declined due to the uncertainty of nanotechnology inventions and change in the trust relationship among the consumers, thus, putting the market for a new readjustment. By 2015 it became necessary for the producers to integrate and rename nanotechnology products with other brand names to be accepted by the society. The second scenario gave the picture of a new creation of nanotechnology-based hydrogen storage systems and portable fuel cells for vehicles as a result from the demand for oil consumption which was on the rising trend; and it became necessary to find out more ways for energy saving mechanism to replace conventional energy producing methods from fossil fuels. The third scenario portrayed a strong push for R&D on nanodevices in early 2000s to tackle the world’s challenge in bioterrorism and energy shortage. In 2010, the world experienced critical energy crises that led to a major war entailing the use of both conventional and biological weapons for mass killing. The western powers were able to win the war due to their ability to make use of the nanodevices for virus detection and energy conservation. In 2015 new emerging industries on nanodevices with innovative commercialization led to global sustained economic growth.

Scenario and Delphi Exercises Used in the Five Multi-Economy Projects are summarized as the following:

Summary: Multi-Economy Projects of the APEC Center for Technology Foresight

Projects	Year	Methods	Participants	Partner
Water Supply and Management	1998	<ul style="list-style-type: none"> ♦Scenario workshop ♦Delph survey 	<ul style="list-style-type: none"> ♦10 experts from 8 economies : Australia; Canada;Chile;Hong Kong, China; Korea; Malaysia; Chinese Taipei, Thailand ♦605 experts contacted ♦21% participated from 16 economies in the first and second round 	1 RQH
Technology for Learning and Culture	1999	<ul style="list-style-type: none"> ♦Scenario workshop ♦Delphi survey 	<ul style="list-style-type: none"> ♦27 experts from 12 economies : Australia; Canada; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; the Philippines; Singapore; Chinese Taipei; Thailand; Vietnam ♦520 experts contacted ♦26% participated from 14 economies in first and second round 	National Research Council of Canada
Sustainable Transport for APEC Megacities	1999	<ul style="list-style-type: none"> ♦Scenario workshop 	<ul style="list-style-type: none"> ♦16 experts from 7 economies : Australia; Canada; China; Hong Kong, China; the Philippines; Singapore; Thailand; 	Centre for Strategic Economic Studies, Victoria University Of Technology, Australia
Healthy Futures for APEC Megacities	1999-2000	<ul style="list-style-type: none"> ♦Core Group meeting ♦Scenario workshop 	<ul style="list-style-type: none"> ♦6 experts from 3 economies plus WHO ♦46 experts from 10economies plus WHO (Healthy Cities Program) and U.N (Urban Management Program): Australia; Chinese Taipei; China; Indonesia; Japan; Malaysia; Peru; Thailand; USA; Vietnam. 	National Center for Environmental Health, Centers for Disease Control and Prevention (CDC), USA and Kenan Institute, University of North Carolina at Chapel Hill, USA
Nanotechnology: the Technology for the 21st Century	2001-2002	<ul style="list-style-type: none"> ♦Scenario workshop 	<ul style="list-style-type: none"> ♦26 experts from 9 economies: Australia; Canada; Japan; New Zealand; Philippines; Singapore; Chinese Taipei; Thailand; USA 	National Research Council of Canada

Post Foresight

It has been clear from the start that APEC CTF ought to put considerable efforts in post-foresight activities in order to disseminating outcomes of the multi-economy foresight studies and to maximize their impacts. The success of these activities will in turn bring

support from APEC Industrial Science and Technology Working Group, APEC member economies, and Thailand as the host economy. Various post-foresight activities have been carried out: some independently and some in conjunction with other activities. They may be broadly classified as publications, presentations, visits, seminars, and follow up studies. (Details are provided in Table 1, 2 and 3 in the Appendix section).

At the end of every foresight study, reports are produced in 2 volumes. Volume 1 is a booklet of not more than 20 pages aiming for policy makers who are more interested in the recommendations and outcomes than the methodologies while Volume 2 contains the full details of the study. They are printed in not less than 1,000 copies and distributed widely. The APEC CTF also operates a comprehensive web site <http://www.nstda.or.th/apectf> which has attracted more than 150,000 visitors up to now. All publications can be freely downloaded in full from the web. In addition, we also publish a few articles in journals.

APEC CTF has been invited to give presentations in several occasions. We also actively seek to be represented in appropriate international seminars. Some are on specific projects while some are on multi-economy foresight studies. They are summarized in Table 3.

Links in terms of conference discussions and paper presentations have also been developed with the Institute for Prospective Technological Studies in Seville, Spain because of their experience with regional foresight and through them to the European network of foresight experts who exercise considerable influence on policy in Europe.

Multi-economy foresight studies have inspired two sectoral studies in Thailand, namely, IT for Learning: New Paradigms and Strategies for Fundamental Changes and Training of Trainers for Strengthening Local Government's Foresight Capacity. The leaders of both projects were active participants of the multi-economy foresight projects of Technology for Learning and Culture and Healthy Futures for APEC Megacities respectively.

Concluding Discussion:

Both scenario and Delphi exercised were used in the first two multi-economy projects and later in the third, fourth, and fifth projects the Delphi survey was dropped. Through 5 scenario workshops that had yielded 16 possible pictures and two Delphi exercises mentioned in the foregoing, several observational points could be raised to reflect the Center's experiences in managing scenario and Delphi exercises: the logistic, expenses, and participation of the stakeholders in the projects.

Delphi Survey:

There can be no doubt that the Delphi technique is a good methodology for obtaining ideas from the experts on a larger scale. It works well in a single economy situation where the logistic aspect is easier to manage on a timely basis. In a regional setting, the

Delphi exercise causes some disadvantages: it requires greater effort for logistic, more difficulties in identifying and locating the experts needed for the study from a vast pool of the expertise areas, and even more difficulty in attracting the experts' attention to answer the survey at their first convenience. The reason for the Center to receive less feedback answers from the experts was due partly to its being a young organization which requires more time to establish itself in the APEC region. However, an effort was made in later studies to bridge this gap by enlisting the participation of key institutions in the economies involved in the later projects. Another challenge found in the regional Delphi process was in the responses by the experts themselves. Many experts were able to respond well to questions that were relevant to national interest, but did not feel they had sufficient knowledge to answer questions covering regional issues. Thus, they were able to respond well when they were asked to rank the level of "high importance" in the Delphi exercises in the Water Supply and Management in the APEC Region and Technology for Learning and Culture and could not be precise to answer "mean year of realization in APEC region" and "high need for APEC cooperation." . In addition, other barriers could also involve languages, cultures, and level of technological readiness of the economies involved in the process, since APEC comprises both developing and developed economies.

Scenario Exercise:

Scenario is an excellent tool for participatory discussion, brainstorming, and networking among stakeholders. Delphi exercises are suitable when the study aims to reach a larger pool of people in a manageable framework. Both tools could not be successful without the involvement of the stakeholders. In addition, the quality of the outputs and outcomes of the projects depend on the ability of the organizer to enlist the right and well-represented stakeholders who are decision-makers, administrators, practitioners, clients, and customers into the process.

All the sixteen scenarios were drawn up in a very short time of a few hours by a small group of experts, and some of them happened to know each other for the first time. We cannot fully expect these scenarios to have the coherence as the smooth, logical flow of scenarios is often developed by a group of foresight experts over a much longer period. Yet, several implications could be drawn from some of the 16 scenarios. Scenarios from the Water Supply and Management project highlighted the central role of water in human society and stressed the need for an integrated water management system. The Technology for Learning and Culture project had scenarios that emphasized the value of education and culture despite very adverse environmental conditions. The vulnerability of technology dependency was brought into the light. In Sustainable Transport, scenarios were not very favorable to private vehicles in cities for both economic and environmental concerns. Public transport seems to be the desired future. In Healthy Futures for APEC Megacities, the scenario participants eventually reached consensus that the goal of 'healthy megacities' was not only essential--fortunately it was possible. In the last project, a group of rather distinguished scientists gathered to brainstorm about the future of nanotechnology. Scenarios showed that nanotechnology products had clear technical success in many areas including solving the problem of dwindling supply of fossil fuels and wining a war against lethal germs. However, one has to be careful about safety and publicity. Otherwise, the public may have a negative reaction to it.

Despite the warning about over dependency on technology in Technology for Learning and Culture and the concern about ethics in the Nanotechnology, all other projects viewed science and technology rather favorably as problem solvers and as means to open up many new opportunities. The use of scenarios provides a good foundation for further deliberations on the part of the users and stakeholders. Insights gained through the scenarios are valuable for policy setting, strategic planning, and implementation.

Outcomes:

While people may differ in framing what actually is meant by the word "outcomes" and to what extent its expectation could be set, it is appropriate to state that the foresight method undertaken on a regional perspective is productive when the subject of the study rises above the national boundary to cover regional interest and, thus, contributes to a wider scope of outcomes, can provide the recommendation to a wider decision-makers, and address to the need of multinational challenges. This section provides some ideas of what the Center has done after the completion of the multi-economy projects. To illustrate the post foresight activities, however, the example of the Nanotechnology Project may be cited. Immediately after the study was completed, the web page of the project became most popular. We were contacted by the Asia Pacific Nanotechnology Forum to participate in an international conference in Japan in three months and a workshop on "Nanotechnology for the ASEAN Region" was jointly organized by APEC CTF, APNF, ASEAN, and the Thai Academy of Science and Technology on 19-20 September 2002 with 89 participants from 9 economies. Now the Thai government is aware of the importance of nanotechnology and NSTDA is proposing to establish a National Nanotechnology Center. The APEC CTF also cosponsors a training workshop on nanotechnology organized by the APNF and the Asian Institute of Technology, Thailand in July 2003. Our publication on nanotechnology is also very popular. Apart from individual requests for free copies, several hundred copies have been sold to USA and Chinese Taipei. We hope that certain issues like nanotechnology in education will have follow up activities. In terms of cooperation with individual APEC economies, the CTF has a continuing link of assisting Vietnam to establish a Technology Foresight Unit in the National Institute for Science and Technology Policy and Strategic Studies (NISTPASS) and has conducted a number of foresight workshops in Malaysia including assisting in the formulation of the Malaysian National Foresight Exercise. As far as scenario and Delphi exercises are concerned, the Center also used core experts group meeting, position papers, and issued papers to accompany the exercises. It might be a time that more methods by explored and experimented in the future projects.

To summarize, it is true that the five multi-economy projects were launched with the criteria of reaching the regional application and users. The real situation was that the Center could not determine whether the real implementation of the outcomes has successfully been made since it only can recommend the results and outcomes and has no specific authority to make those outcomes happen. APEC structure is only to serve as the forum for thinking and ideas recommendation. The implementing decision rests within the jurisdiction of each economy. Such the framework also provides certain limitation on the part of the ability for the Center to produce the clear outcomes of the Center's five multi-economy projects, even when the process is initiated through the

APEC process, it is time-consuming through the bureaucratic channel of national and multi-national meetings before it receives any immediate and timely decision.

Partnership of the APEC Member Economies:

Aside from the content of both scenario and Delphi exercises as foresight methods is the value of partnership and net working among the member economies. As years of experience grow, the Center is aiming to increase its partnership works with individual economies in addition to sectoral and organizational projects, specially in the area of best practices of any single economy or a joint project between more than one economies that could be brought to share at the regional level. The experience of sharing and cooperating through the five multi-economy projects, the lessons learned through the process of scenario and Delphi, and the new learning that is expected to generate in the sixth multi-economy project on 'DNA Analysis for Human Health in the Post Genomic Era' will be a proof that regional foresight is able to provide to complement the work of national foresight program and to cover an area of study that could yield the best result when it is done under regional foresight setting.

Possible Future Direction:

Describing only the five multi-economy projects may not justify the whole picture of the Center's activities. The following few sentences present some of the ideas and thinking of what might create a broad trend of the Center's activities, which are open for further deliberations.

A close look at the Center's main objective in diffusing foresight knowledge and developing capabilities in the region as well as its definition of "foresight" would give us some thinking parameter of what the Center is heading. "Foresight involves systematic attempts to look into the future of science, technology, society and the economy, and their interactions, in order to promote social, economic and environmental benefit." In July 2000 a team of experts were invited to review the Center's activities and has described the Center's foresight as having "...a range of different types of activities...at the technology-push end spectrum, the aim is to identify future technology opportunities...and at the social-pull end spectrum, the aim is to identify ways to meet social and economic needs " The five multi-economy projects have the blend of the two-end spectrum, from technological flavor to social dimension. The Center currently arrives at the third generation foresight stage where the trend of foresight would involve social and economic needs and the ways that technology could assist in fulfilling these needs to achieve the sustained development. According to the reviewers' comment: "...the Center has been able to use technology foresight in the APEC-wide application as well as the application of foresight to groupings of economies..." In the years ahead, while this focus on foresight at the regional will still be maintained, the Center aims to extend more foresight application at individual economy level, specifically in terms of the follow-up activities following the regional study. Our foresight combines the technological, social, and environmental aspects in the process. Through linking up with the APEC member economies and the international foresight bodies, the Center is developing itself to serve as a resource center for visiting and internship opportunities to build up an active foresight network

and capability to serve the region. These activities will be carried out in as much as the Center's resources could be made available to serve the objective.

Appendix:

Table 1: Published Articles

- Greg Tegart and Ainsley Jolley Sustainable Transport for Asia-Pacific Megacities
Foresight: the Journal of Futures Studies, Strategic Thinking and Policy Vol.03,
No.05, Oct.01
- Greg Tegart and Tamsin Jewell Healthy Futures for Asia-Pacific Megacities
Foresight: the Journal of Futures Studies, Strategic Thinking and Policy Vol.03,
No.06, Dec.01
- Greg Tegart and Chatri Sripaipan Nanotechnology: the technology of the 21st
Century Asia-Pacific Technology Monitor, September-October Issue, 2002.

Table 2: Presentations of Foresight Studies

Water Supply and Management	
September 1998	Institute for Prospective Technological Studies, Seville, Spain
5 March 1999	Hong Kong Water Supplies Department in Hong Kong, China
29 April 1999	Academy of Sciences Malaysia Forum "The Future of Water Supply and Management" in Kuala Lumpur, Malaysia
12-14 May 1999	Regional Scoping Meeting on the Water Sector, Global Water Partnership/South East Asia Task in Manila, the Philippines
8-9 July 1999	3 rd Annual Meeting of the ASEAN Academy of Science, Engineering and Technology and Similar Organizations in Manila, the Philippines
21-22 July 1999	Meeting on Water Sector Mapping and Visioning for Thailand, Office of the National Water Resource Committee, Bangkok, Thailand
Sustainable Transport	
1 December 1999	Ministry of Communications and Transport and the Bangkok Metropolitan Administration, Bangkok, Thailand
Healthy Futures in APEC Megacities	
20 March 2000	6 th International Conference on Pollution in Metropolitan Cities, Kuala Lumpur, Malaysia
11-13 October 2000	17 th Annual Congress of the Eastern Regional Organization for Planning and Housing, Korea
17-18 October 2000	PECC Conference on "Sustainable Cities" Pacific Economic Cooperation Council, Bangkok, Thailand
21 September 2000	A seminar on "Megacities" at Technomart IV in Suzhou, China. Also interviewed by local radio and television
October 2000	"Technology Foresight for Urban Sustainability", Institute for Prospective Technological Studies, Seville, Spain
19 November 2001	"Quality of Life in the Cities: Conversation Analysis on Water Resource in Bangkok's Problems and Policy Setting" Chart Thai Party Conference, Bangkok, Thailand.
Nanotechnology	
26-28 February 2001	Asia Pacific Nanotechnology Forum, Tsukuba, Japan
1 March 2002	US/Japan Workshop on Nanotechnology, Tokyo, Japan
14 March 2002	Institute for Prospective Technological Studies, Seville, Spain

26 August 2002	Symposium on Synergies of Engineering Branches, Czech Academy of Engineering, Prague
30 August 2002	Centro de Investigacion en Microsistemas, University of Navarra, San Sebastian, Spain
19-20 September 2002	Nanotechnology for the ASEAN Region Workshop, Bangkok, Thailand
26 September 2002	First National Conference on Nanotechnology, Institute of Materials Engineering, Sydney, Australia
International Foresight Conferences	
October 1998	The 3 rd International Conference of the International Association for Technology Assessment and Forecasting, New Delhi, India. One paper presented.
7-8 March 2000	The First International Conference on Technology Foresight, Tokyo, Japan. 5 papers presented.
12-15 August 2002	The 6 th International Conference on Technology Policy and Innovation, Kyoto, Japan. 1 paper presented.
27-28 February 2003	The Second International Conference on Technology Foresight, Tokyo, Japan. 3 papers presented.

References:

- APEC CTF (1997) Technology Foresight: Proceedings of APEC Symposium in Technology Foresight, Chiang Mai, Thailand 10-13 June 1997. Second Edition.
- APEC CTF (1999) Water Supply and Management in the APEC Region.
Ron Johnston.
- APEC CTF (2000) Review of the APEC Center for Technology Foresight.
Lan Xue and Paul Gander.
- APEC CTF (2000) Technology for Learning and Culture in the APEC Region to 2010.
Ron Johnston and Greg Tegart.
- APEC CTF (2000) Sustainable Transport for APEC Megacities: Issues and Solutions.
Ainsley Jolley and Greg Tegart
- APEC CTF (2000) Healthy Futures for APEC Megacities.
Greg Tegart and Tamsin Jewell.
- NISTEP (2001) Proceedings of International Conference on Technology foresight: The Approach to and Potential for New Technology Foresight.
- APEC CTF (2002) Nanotechnology- the Technology for the 21st Century.
Greg Tegart.
- Yuthavong Y and Sripaipan C (1998) Technology Foresight as a Tool for Strategic Science and Technology Planning and Policy Development. A Paper Presented to ASEAN 5th Science and Technology Week in Hanoi, Vietnam, Oct. 1998.
- Jeradechakul W (2002) Technology Foresight in the APEC Region. A Paper Presented to UNIDO International Foresight for Ukraine, Kieve, Ukraine, September 10, 2002.
- Jewell, Tamsin. International Foresight Contribution to Globalisation. (accepted for publishing in Foresight: The Journal of Futures Study, Strategic Thinking and Policy. 2003)