A Framework for Technology Foresight

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International Workshop on Sustainable Economic Development in ASEAN Countries
Jakarta, Indonesia
1 April 2013
Foresight, Not Forecasting

• Foresight identifies a range of plausible S&T developments within a timeframe
  – Technology applications leading to products or capabilities to meet goals
  – Based on assessment of available capacity, drivers, barriers to successful implementation
  – Implementation requires capacity and effort
    • To overcome barriers and meet goals

Goal of this foresight is sustainable, inclusive development
RAND 2020 Foresight Study Rated Countries Based on their Capacity to Acquire Representative Technology Applications

<table>
<thead>
<tr>
<th>Needed Capability</th>
<th>Technology Applications</th>
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<tr>
<td><strong>Low</strong></td>
<td>Cheap solar energy</td>
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<td></td>
<td>Rural wireless communications</td>
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<td></td>
<td>Genetically modified (GM) crops</td>
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<td>Filters and catalysts</td>
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<td></td>
<td>Cheap autonomous housing</td>
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<td><strong>Medium</strong></td>
<td>Rapid bioassays</td>
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<td>Green manufacturing</td>
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<td>Ubiquitous RFID tagging</td>
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<td>Hybrid vehicles</td>
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<td><strong>High</strong></td>
<td>Targeted drug delivery</td>
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<td>Improved diagnostic and surgical methods</td>
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<td></td>
<td>Quantum cryptography</td>
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<td><strong>Very High</strong></td>
<td>Ubiquitous information access</td>
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<td>Tissue engineering</td>
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<td>Pervasive sensors</td>
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<td>Wearable computers</td>
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General Capacity to Acquire Technology Applications and Drivers vs. Barriers for Selected Countries

Note direction of country movement:
- Up before right
Technology Applications for Some of These Policy Areas Are Easier to Implement than Others

- **Easier to implement:**
  - Rural economic development
  - Public health (*less capacity needed than for improving individual health*)
  - Resource use and environmental health
  - Individual health

- **Require same** as for overall S&T capacity to implement:
  - Military
  - Homeland security and public safety

- **Harder to implement:**
  - Economic growth and international commerce
  - Governance and social structure

This leads to slight positional shifts up or down in the quad charts.
The Interdependency Between Foresight and Capacity Development

Problems and Issues

Capacity Development

Foresight
- Technology Applications
- Drivers
- Barriers
- Capacity Needs
Foresight and the Local Context

• Who develops and implements technology applications, why, and when?
  – Determined by the “local context
  – “Local context” can be local, national, regional, or global

The local context is the social, economic, political, institutional, and cultural environment for implementation
Many Countries Pursue Foresight as a Continuing National Activity

- Japan—National Delphi Exercises
- Korea—Technology Roadmapping
- UK—Horizon Scanning and Scenarios
- Australia—Scenarios and Red Teaming
- APEC Center for Technology Foresight
  - Bibliometrics
  - Delphi
  - Expert Workshops
Recent Studies of the APEC Center for Technology Foresight

• Example 1: Technologies for Combating Emerging Infectious Diseases (EIDs)
  – Identifying, tracking, monitoring, and treating infected individuals and developing early detection and mitigation measures

• Example 2: Low Carbon Society (LCS) for Asia-Pacific
  – Policy, technical, institutional, and cooperative initiatives to undertake now to address challenges foreseen over the next 40 years due to climate change
Methodology for EID Study

• On-line survey of Asia Pacific experts
  – Key challenges from EIDs
  – Potential impacts of technology applications

• Workshops with APEC economy individuals
  – Scenarios looking out 10 years
  – Outcomes dependent on technologies
  – Identify domains for technology roadmaps
Framework for EID Study

Preventive Measures (PM)
- Filters/Membranes
- Computer-assisted Drug Development
- GM Insects / Animals
- Personal Medicine

Surveillance & Detection (S&D)
- Rapid Bioassays
- Bionano Diagnostic/Therapy
- RFID Tracking/Monitoring
- Networked Biosensors

Treatment (Tr)
- Bionano Diagnostic/Therapy
- Computer-assisted Drug Development
- Personal Medicine

Prevention of Spread (PoS)
- Filters/Membranes
- RFID Tracking/Monitoring
- Nanoscale Coatings
Methodology for LCS Study

- Experts from Africa, Americas, Asia, Europe, Oceania
- Local context characterized by important areas of consensus and non-consensus on
  - Climate change and its impacts, now to 2050
  - Developments in migration, resources, health, trade, housing, transportation
- Chronology of plausible societal, technical, policy developments by decade to 2050
  - Inputs for a scenario workshop that envisioned and examined alternative 2050 low-carbon futures
How APEC CTF Implemented the Low Carbon Study 2050

Foresight recommended policy actions to be taken in the near-term to achieve the future visions.
The Local Context for a Foresight for TBNA, A Development Region Near Tianjin, China

- TBNA’s mission as mandated by China’s State Council
- China’s pressing national needs
- Drivers and barriers to technological innovation
  - In China as a whole
  - In TBNA more specifically
- Relevant capacity currently available to TBNA, both locally and more broadly
  - Research and development (R&D)
  - Manufacturing
  - S&T commercialization
Seven Technology Applications Best Fit TBNA’s Needs, Drivers, Barriers, and Local Capacity

- Cheap solar energy
- Rural wireless communications
- Genetically modified crops
- Membranes, filters, and catalysts
- Cheap autonomous housing
- Rapid bioassays
- Green manufacturing
- Ubiquitous RFID tagging
- Hybrid vehicles
- Targeted drug delivery
- Improved diagnostic and surgical methods
- Quantum cryptography
- Ubiquitous information access
- Tissue engineering
- Pervasive sensors
- Wearable computers

Electric and hybrid vehicles
Molecular-scale drug design, development, and delivery
Advanced mobile communications and radio frequency identification
Backup Slides

Scenario Logic for Water, Energy, Food from 1st International Workshop for Integrated ASEAN Foresight
**Implementation**

- **Effective governance and strong capabilities**
  - Sustainable and acceptable to local community
  - BKK, THA
- **Unsustainable and/or unacceptable to local community**
  - Poor governance and weak capabilities
  - Rural, THA

**Technology**

- **Local aspiration**
- **Energy wasteland**
- **Fight for energy rights**
- **Energy for life**
  - SGP
  - INA
Government Involvement

Volatility of Production and Input

Sinking Slowly

- Pests and diseases outbreak
- Flood /drought / disasters
- Food safety and standard
- Shortage of food supply
- Fluctuation of investment
- High regulation demands
- Public Private Community Partnerships (PPCP) Growth

Big winner / Big Loser

Government Knows Best

Steady Sailing

- Adaptation / mitigation technology
- Easy international market (flow from outside)
- Good distribution system
- Subsidy / raw material price
- Slow adaptation to change
- Low productivity, low global reach
- Food for BoP regulated

- Predictable/regular/stagnant
- Innovation low/costly
- Cost per unit is increasing

- Regional commodities competition
- Competition/Demand : low
- Agriculture productivity low
- Low innovation
- Labor shortage due to low wages
- No youth opportunity

Thailand Situation 2013

ASEAN Situation 2013

Situation 2020

- Global economy rebound
- Price is rising, volatile
- Uncertainty of resources availability
- Climate Change impact

- Unpredictable productivity
- Advanced production technologies
- High input (unpredictable energy prices)
- Competition between ‘Foods and Fuels’
- Sudden rise in external demands
- Food innovation is high

Thailand Situation 2013

ASEAN Situation 2013

Situation 2020