Using Roadmapping to Drive Collaborative Innovation

Richard E. Albright
Albright Strategy Group, LLC
realbright@albrightstrategy.com
How can you measure innovation if you don’t know where you’re going?

- **Roadmaps and Roadmapping**
  - Roadmap objectives and purposes
  - A common planning framework

- **Roadmapping for Collaborative Innovation**
  - International Technology Roadmap for Semiconductors (ITRS)
  - METI’s Strategic Technology Roadmapping Initiative (Japan)
  - Malaria Vaccine Roadmap
Roadmaps and Roadmapping

A Roadmap
- is the view of a group of how to get where they want to go, or achieve their desired objective. (*Discipline*)
- helps the group make sure the capabilities to achieve their objective are in place at the time needed. (*Focus*)

Roadmapping
- is a *Learning* process for the group.
- is a *Communication* tool for the group.

The learning and communication benefits of the roadmapping process are as important as the roadmap document that results.
Many Roadmapping Objectives

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<th>Roadmap Types</th>
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<td>• Malaria Vaccine Roadmap</td>
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<td>• Identify or Set Research Agenda</td>
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<td>• Technology Assessment</td>
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<td><strong>Industry and Government</strong></td>
<td>• International Technology Roadmap for Semiconductors (ITRS)</td>
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<td>• Set Industry Direction</td>
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<td>• Coordinate Execution</td>
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<td>• Coordinate Execution</td>
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<td>• Manage Portfolios</td>
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Roadmap Planning in Four Steps

"Know-why" Definition and Scope
Understand applications and/or markets. Target key segments. Identify competitors, complementors, and partners. Set strategic direction

"Know-what" Direction
Define architecture. What characteristics/features are most important? Link application drivers to specific challenges and evolution. Set multi-year targets.

"Know-how" Technology Roadmap
What technologies are most important? Link drivers to technologies and evolution. Identify multi-generation technology investments to maintain competitiveness.

"To-Do" Action Plan and Investment Summary
What resources and investments are needed? Plan projects with the highest priorities. Are technology investments in the most important areas? Identify and track risk areas.

(Sources: Tom Kappel; Phaal, R., Farrukh, C., and Probert, D., Fast-start Technology Roadmapping; Richard Albright.)
Science and Technology Roadmap

**Science & Technology Elements**

1. Nanotechnology $10^{-9} - 10^{-7}$ m
   - Understand Physical, chemical, biological properties, behavior
   - Innovations in materials, electronics, medicine, environment, biotechnology, computing.

**Applications**

2. Nanostructured Materials "By Design".
3. Nanoelectronics, Nanoelectronics and Memories

**Definition and Scope (Know-why)**

- Nanostructures for chemical, biological, radiological, and science & technology
- Manufacturing at the nanoscale
- Microcraft and robotics
- Nanoscale instrumentation and metrology
- Efficient energy conversion and storage
- Advanced healthcare, therapeutics and diagnostics
- Nanoscale processes for environmental improvement

**Challenges**

3. Prioritize top to bottom
   1. Nanostructured Materials "By Design;"
   2. Nanoelectronics, Nanoelectronics and Memories
   3. Manufacturing at the nanoscale
   4. Microcraft and robotics
   5. Nanoscale instrumentation and metrology
   6. Efficient energy conversion and storage
   7. Advanced healthcare, therapeutics and diagnostics
   8. Nanoscale processes for environmental improvement

**Technology Roadmap**

- Prioritize top to bottom
  1. Nanostructures for chemical, biological, radiological, and science & technology
  2. Manufacturing at the nanoscale
  3. Microcraft and robotics
  4. Nanoscale instrumentation and metrology
  5. Efficient energy conversion and storage
  6. Advanced healthcare, therapeutics and diagnostics
  7. Nanoscale processes for environmental improvement

**Map to Investments**

- Prioritize top to bottom
  1. Nanostructures for chemical, biological, radiological, and science & technology
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**Research Direction (Know-what)**

- Prioritize top to bottom
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**Technology Push**

- Prioritize top to bottom
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  3. Microcraft and robotics
  4. Nanoscale instrumentation and metrology
  5. Efficient energy conversion and storage
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**Action Summary**

- Prioritize top to bottom
  1. Nanostructures for chemical, biological, radiological, and science & technology
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  5. Efficient energy conversion and storage
  6. Advanced healthcare, therapeutics and diagnostics
  7. Nanoscale processes for environmental improvement
Repeated, significant changes in product and technology
Semiconductor Roadmap coordinates many industry players, driving “Moore’s Law”

http://www.itrs.net/
Japan’s Strategic Technology Roadmaps

Collaboration for Economic Development

**Leadership**  METI (Ministry of Economy, Trade and Industry)

**Participation**  Government, Industry, Academia

**Challenges**
1. To maintain international competitiveness under growing economies in the world
2. To achieve sustained economy with sustainable environment
3. To supply sufficient human resources under the predicted decrease in population

**Purposes**
1. **Seeks public understanding** by providing an explanation of the perspective, details, and achievements of METI’s R&D investments
2. **Understands technological and market trends, prioritizes critical technologies**, and develops policy infrastructure for planning R&D projects
3. **Promotes cross-field and cross-industrial alliances, technology fusion**, and coordinated implementation of relevant policies
4. **Assembles the comprehensive strength** of industry, academia, and public institution

http://www.meti.go.jp/report/data/g50330bj.html
Japan’s Strategic Technology Roadmaps

Roadmapping Areas

Information and Communications
1. Semi-conductors,
2. Storage and non-volatile memory,
3. Computers,
4. Networks,
5. Usability (e.g. displays),
6. Software

Life Science
1. Drug discovery,
2. Diagnostic and Treatment equipment,
3. Regenerative medicine

Environment and Energy
1. Carbon dioxide capture and storage,
2. Reduction of CFC and development of CFC substitutes,
3. Comprehensive control of chemical substances,
4. 3Rs (Reduce, Reuse and Recycle),
5. Energy (under development)

Manufacturing
1. Robots,
2. Aircrafts,
3. Space,
4. Nanotechnology,
5. Materials and components,
6. MEMS (Micro-Electro Mechanical System),
7. Green Bio (Biotechnology for environmental improvement and fine materials production)
Coordinating Research Direction

**Leadership**  Malaria Vaccine Initiative (Gates Foundation) and other Funders.

**Global Ownership**  More than 230 people representing more than 100 organizations in 35 countries provided their input.

**Vision**  The malaria vaccine community will develop an effective vaccine that prevents severe disease and death caused by Plasmodium falciparum malaria in children under five in sub-Saharan Africa and other highly endemic regions. Efficient global coordination and collaboration will stimulate the malaria vaccine pipeline and accelerate progress towards this achievement.

**Landmark**  By 2015, develop and license a first generation malaria vaccine that has a protective efficacy of more than 50% against severe disease and death and lasts longer than one year.

**Strategic Goal**  By 2025, develop and license a malaria vaccine that has a protective efficacy of more than 80% against clinical disease and lasts longer than four years.

http://www.malariavaccineroadmap.net
Summary

Roadmapping:

Discipline & Focus

Learning & Communications
Roadmapping: To Learn More

- **Research and Technology Management** special sections on roadmapping:
- **Technological Forecasting and Social Change** special issue:
- **Mapping Tools**
- **Key Papers**
  - Philip J. Whalen, Strategic and Technology Planning on a Roadmapping Foundation, Research and Technology Management, Volume 50 Number 3, May 2007
  - Raymond R. Cosner; E. Jefferson Hynds; Alan R. Fusfeld; Carl V. Loweth; Charles Scouten; Richard Albright, Integrating Roadmapping Into Technical Planning, Research and Technology Management, Volume 50 Number 6, November, 2007.
  - Pieter Groenveld, Roadmapping Integrates Business and Technology, Research and Technology Management, Volume 50 Number 6, November, 2007 (reprint and update of an earlier paper).
  - Yuya Kajikawa, Osamu Usui, Kazuaki Hakata, Yuko Yasunaga and Katsumori Matsushima, Structure of knowledge in the science and technology roadmaps, Technological Forecasting and Social Change, Volume 75, Issue 1, (January 2008), Pages 1-11

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