Innovation in the Canadian Agri-Food Sector

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Overview

- Definitions, Dimensions and Process
- Innovation and Policy
- Case Study
- The Future
Innovation

“The introduction of something new”

“Something that deviates from established doctrine or practice… differs from existing forms”
Dimensions of Innovation

- Two main categories
  - Technological
    - Product/Service
    - Process
  - Organizational

- Dimensions not independent – varying combinations of all aspects

- Measured along a gradient
Dimensions – Technological Type & Degree of Change

Types of Innovation

Product
- Product line extension
- Branded organic products
- New Cancer Drugs
  Genetically Engineered Crops

Product/Process
- Enterprise Software Systems
- Genomic Research
- GM crops on farms
- E-commerce applications
  Reengineering

Process
- Process modification

Incremental  Radical
Dimensions - Organizational Degree of Internalization and Timing

Organizational Change and Innovation

Network

Supply Chain Management
Co-developed technology platform

E-commerce applications
Biotechnology commercialization

Internal

Total Quality Management
Web based
New process technology

Timing relative to Product Process Innovation:

Precedes
Simultaneous
Follows

Managerial Innovation
Managerial Adaptation
Innovation Process

- Innovation models - evolved from linear, technology push models to more fluid, evolutionary models
  - Networks of innovation
  - Feedback loops between different activities
  - Market pull as well as technology push
The Innovation Process
Linear Development Model

- Scanning
- R & D
- Assessment & Selection
- Development
- Outputs
- Diffusion
Innovation Sphere of Influence

Interested Partners

Customers, Supply Chain Partners, Network Partners

Scanning

Assessment & Selection

Development

Outputs

Diffusion / Outcomes

R &D

Environment

Government, Competition, Social and Educational Factors
National Systems of Innovation

- Lundvall, 1992
- Includes institutions, organizations and policies which impact a nation’s innovative activities and their ability to capture the benefits of those activities
- Evidence that even in a global environment, national policies matter
Innovation and Policy

- Objective - Improve well-being of citizens through economic and social policy
- Innovation is one contributor to economic performance
- Governments want to increase economic impact of innovation - not just innovation for innovation’s sake.
Progression of Policy Emphasis

**Fiscal & Monetary Policy – 70-80’s**
Create the national conditions that enable industry and organizational success

**Competitiveness Policy – 90’s**
Create the industry conditions that enable organizational success

**Innovation Policy – 00’s**
Support internal/network strategy processes to create foundations for success
## Canadian Incentives to Innovate

### OECD 1999 7 Innovation Indicators for G7

<table>
<thead>
<tr>
<th>Measure</th>
<th>1999 Standing</th>
<th>Growth</th>
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<tbody>
<tr>
<td>External patent applications</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Human Capital Devoted to R&amp;D</td>
<td>5</td>
<td>1</td>
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<tr>
<td>Business Funded Expenditure on R&amp;D</td>
<td>6</td>
<td>1</td>
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<tr>
<td>R&amp;D Intensity</td>
<td>6</td>
<td>1</td>
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<tr>
<td>Technology Balance of Payments</td>
<td>5</td>
<td>6</td>
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<tr>
<td>National Patent Applications</td>
<td>5</td>
<td>4</td>
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<tr>
<td>Government R&amp;D Expenditure</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>
Policies and Points of Impact

Interested Partners
Customers, Supply Chain Partners, Network Partners

Scanning

Technical/market Evaluation
Assessment & Selection

Cluster Formation, Funding
Development

Outputs

Technical Assistance, Taxation on Capital Spending
Diffusion/Outcomes

R & D
Funding, Taxation, Direct R&D

Education and Training Strategies
IP Strategies

Educational Assistance, Trade, competition policies

Environment
Government, Competition, Social and Educational Factors
Policy and Innovation Systems

- Policy decisions impact the general innovation system
  - IP, education, investment
- They can also target specific components or activities of the system
  - tend to be technology focused
Case Study – FONA DNA Identification
Technology and Policy Impact

Single-Stranded Sample DNA

Immobilized Target DNA

Optical Fibre

Fluorescent Probe into Double Stranded DNA

Hybridized Nucleic Acid Complex
Policy Impacts on New Technology

- **Idea Generation – R&D** *mid-1990’s*
  - Created at U. of Toronto
  - Funded by National Science Research Council

- **Transfer out of University**
  - Encouraged by University policy
  - Licensed to small diagnostic firm
  - R&D funding by firm – refundable tax credit

- **Patents initiated** *1998*

- **Search for partners through Agri-food Quality Cluster** *1999*
Industry R&D

- FONA - Hiring supported by Industrial Research Fellowship 2000
- FONA scientists located at U of T
- Development research supported by grants and R&D taxation support
- Funding secured from firm partners
- Application partners sought – partner in food and environment – both provided funding
- Canadian VC funding environment and technology crash eliminated access to venture capital
Sale to Technology Partner

- 2001 – FONA sold to instrumentation partner
  - Virtek Vision International Inc
  - Facilitated by taxation laws
- Virtek/FONA Development
  - Supported by R&D taxation laws
  - Continuing relationship with U. of T. research team
  - Reach forward to application partners – driven partially by funding opportunities
    - Applications in environmental testing and genomics
    - Separate funding initiatives, partners and applications - common core
<table>
<thead>
<tr>
<th>Technology component</th>
<th>Innovation</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibers and Chemistry</td>
<td>Radical, incremental dyes</td>
<td>FONA, U. of T.</td>
</tr>
<tr>
<td>Laser Reader</td>
<td>Incremental to ChipReader</td>
<td>Virtek, contract scientists</td>
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<tr>
<td>Sample preparation</td>
<td>Incremental to existing kits, Radical</td>
<td>FONA, Virtek, micro-fluidics partner &amp; testing lab partners</td>
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<tr>
<td>Application development</td>
<td>Incremental in target selection</td>
<td>FONA/Virtek and testing partners</td>
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<tr>
<td>Diffusion to testing labs</td>
<td>Radical, organizational</td>
<td>Distribution partner, customers</td>
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</table>
Dimensions – Product/Process and Incremental/Radical

Type of Innovation

Product/Process

Product

Process

ChipReader

DNA Fibres

Dye Chemistries

Sample Prep.

Application Development

Testing Process

Incremental

Radical
Innovation and Organizations
- Timing and Degree of Internalization

Organizational Change and Innovation

Timing Relative To Product Process Innovation:
- Precedes
- Simultaneous
- Follows

Managerial Innovation
Managerial Adaptation

Network
Internal

Application development partnerships
Biotech unit spin-out
Testing in water treatment plants
Conclusions

- **Innovation is complex activity requiring internal and external resources**
- **Issues around managing knowledge transfer between organizations**
- **Support policies differ for**
  - innovation leadership vs diffusion
  - organizational vs technological
  - different industry segments and levels of the supply chain
  - different competitive priorities
- **Innovation process can be learned – how do we transfer what we learn**
Future for Agri-Food Innovation Policy in Canada

- Canadian White Paper on Innovation
- National Forum on Innovation Management in Canada – Nov. 2002
- Agribusiness Input – Workshop in September
  - Identify priority areas
  - Identify special needs for agri-food
  - Set research agenda