Evaluating Research, Technology, Development and Innovation
Theories and Practice

Canadian Evaluation Society Conference
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Steve Montague, Partner
steve.montague@pmn.net
Performance Management Network Inc.
The Situation

• Research, Technology, Development (RTD) and Innovation evaluation has evolved over three to four decades
• Implications for approaches and methods
• Improved learning for policy, management and investment decisions
• Realistic accountability
Some Background:
A Short ‘History’ of RTD Evaluation and Indicators

• ‘Evaluation’ typically focused on science quality in the past and tended to focus on metrics and indicators at different segments and level of the results story
• Paper by Fred Gault, Statistics Canada (SPRU 2006) provides an excellent review of Canadian and international R&D and innovation statistics
  – Accepted input indicators include, GERD, R&D personnel, assumed to result in innovation (input / output model)
  – Output indicators link to IP (publications, patents) and new HQP also assumed to link directly to innovation, economic growth
  – Outcomes relate to increased innovation and need to consider a wide range of factors outside the direct influence of R&D
  – Recognition that the linear innovation model is simplistic and doesn’t reflect sectoral differences, influence of other policies and international economic situation
• More recently we have seen these formalized as scorecards and ‘payback’ categories
Evaluating the Valuation Approaches

<table>
<thead>
<tr>
<th>Examples:</th>
<th>Assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Economic Statistics</td>
<td>▪ Not ‘outcomes’</td>
</tr>
<tr>
<td>- Expenditures on R&amp;D</td>
<td>▪ Attribution problems</td>
</tr>
<tr>
<td>- GERD</td>
<td>▪ Understanding?</td>
</tr>
<tr>
<td>- Market share</td>
<td></td>
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<tr>
<td>- Trade deficit in innovative goods</td>
<td></td>
</tr>
<tr>
<td>Micro-economic Benefit-Cost</td>
<td>▪ Favours easily quantifiable ‘outcomes’</td>
</tr>
<tr>
<td>- Benefit-Cost Analysis</td>
<td>▪ Monetization problems</td>
</tr>
<tr>
<td>- Cost-Effectiveness Analysis</td>
<td>▪ High sensitivity to assumptions</td>
</tr>
<tr>
<td>Scientific Merit Valuation</td>
<td>▪ Partial ‘outcomes’</td>
</tr>
<tr>
<td>- Peer review</td>
<td>▪ Bias problems – science viewpoint</td>
</tr>
<tr>
<td>- Publications</td>
<td>▪ Misses the bigger system</td>
</tr>
<tr>
<td>- Citations</td>
<td></td>
</tr>
</tbody>
</table>
Recent Developments

• Results logic to ‘inform’ indicators
• Sort the levels
• Suggest the connections
• Focus on reach, engagement, and behaviour changes in system actors as part of the impact story
• Theories of innovation, knowledge translation and other ‘behavioral’ models
Moving Toward a Common Language and Practice in Evaluating Publicly Funded Research, Development and Innovation Programs

By the Research, Technology and Development Topical Interest Group of the American Evaluation Association (AEA)

Presented at
Canadian Evaluation Society Conference
June 17, 2014
Gretchen Jordan, AEA RTD Group Co-Chair
Outline

• Purpose, approach, scope
• Need
• General evaluation framework
• Common/comparable logic models, indicators
• Selected evaluation design and methods
Purpose, Approach

• The purpose of this paper is to engage R&D/Innovation evaluators and program managers in a dialogue about a common RD/I evaluation language and practice.

• The end goal is a consensus and broader implementation of RTD evaluation

• that is more useful for learning what works in what context both within and across publicly funded RTD programs.

• Approached through
  – Review of US government, national academy guidance and other literature, and
  – Our years of practical experience.
Scope is Broad But Not Comprehensive

• Publicly funded
• Program level
• All aspects: research, technology, development and deployment
• Including innovation, defined as a new product, process or organizational practice that is entering the “market”
• Outcomes before, during and after (life cycle)
• Program contribution to outcomes
• Learning, to improve
Need to Connect the Theories, Think “Contributing to a Causal Package”

Teams
Creativity
Knowledge Transfer
Discovery
Invention
Product, Practice
Delivery
Use
Effects of Use
Technology Transfer
Path Dependency
Modes of Coordination
R&D Policy
Norms, culture

DRAFT, AEA RTD group 17 June 2014
The Need For Common Frameworks and Practice and Comparable Studies

• Ideally there would be sufficient data and theory to enable policy makers to better target interventions, even to the point of comparing the cost, size and speed of pay off among alternatives.

• To build data and theory for the innovation process and system, there will need to be multiple studies and synthesis across those.

• Synthesis is easier if studies use similar terminology, good research design, and make clear the full context of an intervention.
An Evaluation Framework: Program Theory Is Key to Considering Designs for Impact Evaluation

Evaluation Purpose(s)

Evaluation questions

Selecting impact evaluation design

Program theory

Available evaluation designs (Ex ante, Progress, Ex post)

Program attributes

Source: Adapted from Impact evaluation of natural resource management research programs (Mayne and Stern, 2013)
A Proposed Generic Framework To Capture the Diversity in RTD Programs

• Separates science outcomes/questions from application and end outcomes/questions.
  – to distinguish what is under the direct influence of the program
  – To show importance of measuring and take up or potential take up of science
• Technology and development activities may or may not draw on science outcomes.
• For any new innovation there is an “application and progress” stage before end outcomes.
  – Many intermediate outcomes occur and can be anticipated
  – Often that detail is left out of planning and evaluation.

A Proposed Generic Logic Model and Context To Outline the Diversity in RTD Programs

Characterization of Context and External Influences

<table>
<thead>
<tr>
<th>Team, Organization</th>
<th>Research Problem</th>
<th>Interactions</th>
<th>Applications, Sector</th>
<th>Macro</th>
</tr>
</thead>
</table>

Activities & Outputs

Results Chain

R&D/Innovation Program

For/With

Resources

Interactions

Includes Transfer, Use

Science Outcomes

Application, Progress toward Outcomes

Sector, Social and Economic Outcomes

Diffusion Efforts

That Apply Research

For/With

Activities & Outputs

For/With

Resources

Activities & Outputs

Team, Organization

Research Problem

Interactions

Applications, Sector

Macro

DRAFT, AEA RTD group 17 June 2014
A Framework of Frameworks Is Needed To Describe Major Archetypes

• Outcomes and pathways to outcomes for various sectors (e.g., health, energy), various stakeholders (e.g., government, industry)

• Detail for pathways to outcomes for combinations of characteristics, e.g.,
  – Applied research in area where RTD networks already exist, technical, business and government infrastructure supports adoption of new product, which is an expressed need of consumers
  – The opposite of that

• Detail on commonly used mechanisms such as public-private collaborations, Research Centers.
A Menu of Indicators 
For the Generic Logic Model 

• Each element in the logic is described by the listing of indicators for types of outcomes for different RTD programs. 

• Results in a menu of many outcomes of RTD that can be measured, depending on 
  – the type of RTD and its desired objectives, 
  – target audiences for the application of the RTD, and 
  – timing of the evaluation relative to the time passed since the activities took place. 

• The list, while not comprehensive, reflects outcomes identified in numerous evaluation frameworks and literature reviews.
Logical Framework of Indicator Categories - 1

**Resources for Research**
- Funds for research, for research support
- Knowledge of researchers, technologists
- Team quality, organization
- Tools, techniques available
- Research environment

**Activities/Outputs**

**ACTIVITIES**
- Plan
- Investigate
- Build/Prototype
- Support

**OUTPUTS**
- Ideas/Knowledge advances (Excellence, Novelty, Publications, tech reports)
- New research tools, techniques
- People trained
- Preparation for transition to application

**Interactions**

**CONNECTEDNESS**
- With other scientists
- Across functions with developers, manufacturers, etc. marketing
- With intermediaries
- With potential application users

**LEVEL OF INTEGRATION**
(co-located, boundary spanners, etc.)

**MECHANISMS**

### Logical Framework of Indicator Categories - 2

<table>
<thead>
<tr>
<th>Near Term</th>
<th>Outcomes Mid Term</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCIENCE OUTCOMES</strong></td>
<td></td>
<td><strong>VALUE OF THOSE APPLICATIONS:</strong></td>
</tr>
<tr>
<td>• Addition to knowledge base</td>
<td></td>
<td>Economic</td>
</tr>
<tr>
<td>• Citations, awards, leadership</td>
<td></td>
<td>• general</td>
</tr>
<tr>
<td>• Affect organization, integration of knowledge</td>
<td></td>
<td>• business</td>
</tr>
<tr>
<td>• Addition to science infrastructure (tools, facilities, people)</td>
<td></td>
<td>• other sectors</td>
</tr>
<tr>
<td><strong>R&amp;D/Innovation/APPLICATION OUTCOMES</strong></td>
<td></td>
<td><strong>Social</strong></td>
</tr>
<tr>
<td>• Interactions with science, other R&amp;D, Innovation entities</td>
<td></td>
<td>• health</td>
</tr>
<tr>
<td>• Fund changes to technical Infrastructure</td>
<td></td>
<td>• environment</td>
</tr>
<tr>
<td>• New platforms for RTD, technical standards</td>
<td></td>
<td>• security</td>
</tr>
<tr>
<td>• Industry funds further research, development</td>
<td></td>
<td>• other</td>
</tr>
<tr>
<td>• New products, processes, organizational models</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Governments use in policy, programmatic decisions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Public groups use in decisions, advocacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• New skills, behaviors, attitudes, conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ADOPTION / INFRASTRUCTURE OUTCOMES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Business/Organizations/Government and Public groups support or develop production, delivery systems, adoption by end user</td>
<td></td>
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</tr>
</tbody>
</table>
Logical Framework of Indicator Categories - Context

Macro
- Availability of Capital
- Availability of Capabilities
- Ease of coordination

Meso/Sector
Characteristics of Interactions:
- diversity
- continuity
- mechanism used

Nature of the application of research:
- Breadth
- Timing
- Radicalness of change for application
- Sector speed for technical change
- Sector absorptive capacity, resources

Micro
Characteristics of the team (size, diversity, organizational/management, readiness, etc.)

Nature of the research problem:
- research type
- radicalness
- scope
Example: NSF Human and Social Dynamics Program

Resources
- HSD projects funded

Activities & Outputs
- Research published
  - Interdisciplinarity

Target Audience
- Non-HSD fields, collaborators

Science Outcomes
- Knowledge diffused
- Influences other fields

Near Term Results
- Research published
- Interdisciplinarity
- Knowledge diffused, Influences other fields

Indicators
- Expenditures
  - Topics funded
- Publications
  - number
  - co-authorship
- Integration scores
  - Network characteristics
- Publication maps
  - Citations - #, distance - velocity

Design, Methods
- Control group
  - Bibliometrics, Network analysis
  - Visualization of diffusion patterns
- Contextual Influences: Social/Cultural, Technical, Business/Economic, and Political/Legal

Innovation in Healthcare to Reduce Costs

Resources
- Activities & Outputs
  - Build Partnerships, Data systems

Interactions
- Practitioners, Information Providers
- Joint delivery, data utilized

Innovation Outcomes
- Healthcare Institutions
  - Public

Results
- Application reduces cost of accessible, quality care
- Improved health status

Expected, actual improved health status

Indicators
- Funds, Expertise, Existing relationships
  - Partnerships, Goal alignment, Multi-level leadership, Data bases on what works, costs
- Number involved, Dissemination mechanisms, Coordination in systems
  - Joint planning, delivery, Public accesses, believes data
- Institutions, practitioners, invest time, resources
  - Practitioners order fewer unneeded tests, Public asks for lower cost option
- Reduced risk to human health, Benefits from reduced morbidity & mortality

Context: Related programs, Interest groups, Financial incentives, Determinants of health, Social, Economic, Political/Legal factors

Notional, from portion of NAS study conclusions
For Example, Standardized Case Studies

• Standardized case studies share a common framework and characterize key aspects of a program and its context, so study data can be aggregated and hypotheses tested with data combined.

• Example that built on Research Value Mapping approach: French National for Institute for Agronomic Research (INRA)
  – Contextual and processual analysis to identify and analyze mechanisms that generate various dimensions of impact, in order to determine the specific contribution of INRA
  – Standardization overcomes some of the limitations of case studies while retaining the benefits of thick descriptions and stories.

Joly et. al. ASIRPA project, 2013
For Example, Standardized Case Studies – 2

INRA Study

• Tools standard across the studies
  – Chronology: time frame, main events, turning points
  – Impact Pathway: productive intermediaries/interactions, contextual factors
  – Impact Vector: Radar chart of impact dimensions
• 30 cases in five research divisions; meta cases for three (e.g., genomic breeding) identified
  – Production of actionable knowledge
  – Lag between research and impact (possible extrapolation of intermediary results)
  – Structuration role, e.g., upstream research consortium or downstream intermediaries or regulation
  – Anticipatory role, e.g. exploring new options or insuring existing
Summary

• The objective of the AEA RTD interest group is to engage RTD evaluators and program managers in a dialogue about a common RTD evaluation language and practice.

• The end goal is a consensus and broader implementation of RTD evaluation that is more useful for learning what works in what context both within and across publicly funded RTD programs.

• To that end we have proposed a high level generic logical framework (model, indicators, design).

• The paper is still DRAFT. Everything here is a candidate for further discussion.

• We also welcome ideas on how to engage the community.
Selected References


Acknowledgement

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Liza Chan  Alberta Innovates - Health Solutions, Canada
Cheryl Oros  Liaison, Evaluation Policy Task Force
Deanne Langlois-Klassen  Alberta Innovates - Health Solutions, Canada
For more discussion or questions, contact
Gretchen Jordan
360 Innovation LLC
gretchen.jordan@comcast.net

- Program outcomes/impacts differ by sectors because sectors differ in
  - Amount of investment for types of RTD
  - Rates of technical change
  - Ease of adoption
- Mission, policy and programmatic decisions are often sector specific
- Bottlenecks can be spotted more easily here.

Example: U.S. DOE Wind R&D Linkages with Commercial Wind Generation

Design, Methods

Historical Tracing study that included: Publication and patent analysis; interviews with researchers, program managers, firms, and technology and market experts; network analysis

Program-Level Research to Inform EPA National Ambient Air Quality Standards

<table>
<thead>
<tr>
<th>Research Program</th>
<th>For/With</th>
<th>Results</th>
<th>For/With</th>
<th>Results Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources</td>
<td>Interactions</td>
<td>Sci. Outcomes</td>
<td>Regulators are engaged, Use in Policy Making Activities</td>
<td>Application of Standards, Regulation, Expected, actual health and economic benefits of cleaner air</td>
</tr>
<tr>
<td>Activities &amp; Outputs</td>
<td>Research on effects; Identify effects, causes</td>
<td>Known weight of evidence on effects; can prioritize research</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Indicators**

<table>
<thead>
<tr>
<th>Funds</th>
<th>Laboratories</th>
<th>Scientists</th>
<th>Expert Advice</th>
<th>Partnerships</th>
<th>Projects funded PI workshops</th>
<th>Publications</th>
<th>New methods, tools, models</th>
<th>With Science community, Stakeholders, Public databases</th>
<th>New scientific knowledge Scientific progress Important science questions</th>
<th>Regulatory assessments Health-based standards Judicial decisions</th>
<th>Emissions reduced Air quality improved Human exposure reduced</th>
<th>Reduced risk to human health Benefits from reduced morbidity &amp; mortality</th>
</tr>
</thead>
</table>

**Design, Methods**

Health & Environmental Research On-line (HERO)  
Exposure, Risk assessment  
Independent expert review of science

A Framework for organizing the scientific questions and research topics needed to create the scientific foundation for environmental decisions - Particulate Matter Research

Change in emissions or discharge

Change in ambient environmental concentrations

Change in magnitude, duration, frequency of exposure

Change in uptake and/or assimilation

Early change in function, structure, or effect

Change in human or ecosystem health

Reduces uncertainty across the health-to-source paradigm and in critical links


DRAFT, AEA RTD group 17 June 2014
US DOE Framework Combines Interim Outcome Assessment with Formative Questions in Four Tiers

1. Describe Activities & Outputs
2. Assess Interim Outcomes
3. Assess Broader Outcomes
4. Analyze Strengths, Weaknesses, Opportunities

Evaluate Tier 1, then 2, then 3, then 4. Each tier builds on the tier(s) before it.

Evaluation Design and Methods Making Use of a Framework and Context

- Synthesis with standardized case studies
- Interim impact study with 4 tiers
## Categories of Information Needed for Additionality Assessment

<table>
<thead>
<tr>
<th>Categories of Information Needed for Additionality Assessment</th>
<th>Technology Timeline (Stage of Research, Development, and Commercialization)</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of the technology</td>
<td>Preliminary &amp; detailed investigation</td>
</tr>
<tr>
<td>What DOE Did</td>
<td>Develop components</td>
</tr>
<tr>
<td>What Others Did (Rival Explanations—Private Sector and Other Nations)</td>
<td>Develop system</td>
</tr>
<tr>
<td>What Others Did (Rival Explanations—US &amp; State Government)</td>
<td>Validate/demonstrate</td>
</tr>
<tr>
<td>The DOE Effect</td>
<td>Commercialize</td>
</tr>
<tr>
<td>Description of DOE Influence And its strength</td>
<td>Market Adoption</td>
</tr>
<tr>
<td>Basis of evidence of influence</td>
<td></td>
</tr>
</tbody>
</table>

Using Conceptual/Impact Frameworks to Evaluate Publicly Funded Research, Development and Innovation Programs - Canadian Examples -

Presented at:
Canadian Evaluation Society Conference
June 17, 2014

By:
Suzanne Lafortune, Partner
Performance Management Network Inc.
suzanne.lafortune@pmn.net
www.pmn.net
Performance Measurement Frameworks vs. Conceptual/Impact Frameworks

- Federal government guidelines for PM frameworks include:
  - Profile with brief context section
  - Logic model (activities, outputs, reach (sometimes), different levels of outcomes)
  - PM strategy with indicators, sources, etc.
  - Evaluation strategy

- Conceptual/Impact Frameworks may include:
  - In-depth contextual section
  - Conceptual/analytical framework with same elements as logic models but can also include:
    - Contextual issues informing activities and thus what outcomes and impacts are required to address these issues
    - Contribution of various stakeholders that facilitate achievement of impacts
    - Menu of indicators
Example of Context

- Innovation players for example:
  - Universities and colleges:
    - R&D performers
    - Train students and researchers
    - Create spin-off businesses
  - Research institutes
  - Commercialization players: organizations specializing in commercialization activities
  - Public sector organizations/programs
  - Private sector R&D performers
  - Business angels
  - Venture capitalists
Example of contextual issues

- The global economy and its impact on the need for the program
- Collaboration/partnerships: barriers and facilitators to effective collaborations/partnerships (including intellectual property barriers/facilitators)
- Mechanism required to mobilization of knowledge and technology
- Innovation clusters that may facilitate innovation activities
- Sector-specific issues
- Access to resources
  - Financial (e.g. other programs, financial institutions, angels, venture capital, etc.)
  - Human (e.g. management capacity, HQP, etc.)
Why it was important to emphasize the context

- Identify specific barriers to innovation and thus how the program needs to intervene, with what expected outcomes and impacts
- Identify specific aspects of need to help assess ongoing relevance in future evaluations
  - Federal evaluation issues include relevance
  - By clearly defining the context, evaluators can reassess this context and thus assess the relevance of the program, should the context have changed
- Also contribute to performance issues during evaluations, i.e.:
  - Should the context have changed, what was the program’s contribution to this change?
Impact Framework

- Example of direct outcomes for business innovation programming (and indicators)
  - Efficiency and economy outcomes (incrementality and leveraging)
  - Increased applied R&D activity (prototypes, beta testing, feasibility studies, technology demonstrations, new or significantly improved products/services/processes/techniques/technologies)
  - Increased capacity for applied R&D (lab development)
  - Increased acquisition and/or adaptation of technology (for internal productivity improvement or commercial purposes)
  - Establishment of networks and/or meaningful partnerships/alliances
  - Attraction, development and retention of R&D staff
  - Increased capacity for commercialization (certification, marketing, contacts, markets identifies, distribution channels identified, market assessments, spinoff companies created, angel investments, venture capital)
  - Commercialization
Impact Framework

- Example of impacts for business innovation programming (and indicators)
  - Innovation (ongoing R&D after projects, knowledge/tech transfer, partnerships/alliances/collaborations after projects, cluster development, new products/services/techniques/processes/technologies)
  - Commercialization
  - Enhanced productivity (access to skilled labour, increased market shares, increased sales volume, enhanced profitability, etc.)
  - Growth (increased sales, jobs, attraction of skilled labour, new markets, increased production capacity)
  - Competitiveness (sales, new customers, new markets, profits, jobs)
  - Benefits to the Canadian population (better/cheaper products/services, health care benefits, improved work environment, savings, safety, etc.)
Example: ACOA Innovation and Commercialization Draft Impact Framework

Activities
How?
- Financing of innovation and commercialization projects
- Networking expertise
- Coordination activities

Reach
Who?
- Firms
- Universities and colleges
- Research institutes

Outcomes
What?
- Increased applied R&D activity
- Increased capacity for applied R&D
- Increased acquisition and/or adaptation of technology
- Establishment of networks and of meaningful partnerships/alliances
- Attraction, development and retention of R&D staff
- Increased capacity for commercialization
- Commercialization

Impacts
Why?
- Enhanced Productivity
- Growth of Atlantic SMEs
- Competitive Atlantic SMEs

Context
- Economy
- Skilled labour
- Collaborations/partnerships
- Intellectual property
- Mobilization of knowledge and technology
- Cluster development
- Sector issues
- Access to resources
- Other

Enterprise Development
- Business Capacity/Assets
- Human Resources
- Financial Resources
- Physical/Technical Resources

Community Development
- Community Capacity/Assets
- Human Capital
- Economic Capital
- Social Capital
- Natural Capital
Conceptual/Analytical Framework

- Business capacity and assets
  - Human resource assets (education, job experience, acquired skills and experience, competencies of people directly and indirectly involved in I&C)
  - Financial resources (internal funds available and funding available to invest in I&C)
  - Physical and technical resources (machinery, equipment, facilities, etc. available for innovation activities)
- Community capacity and assets needed to help businesses build their own capacity and assets; business capacity and assets help strengthen community capacity and assets
From activities to impacts

- Pathway for innovation programming differs depending on the nature of the project and type of organization; found different pathways for:
  - Innovation projects in business organizations
  - Innovation projects in non-commercial organizations (need to be transferred to private sector or need to undertake commercial activities before impacts occur)
  - Innovation projects involving commercial/non-commercial partnership
  - Commercialization projects in commercial organizations
  - Commercialization projects in non-commercial organizations (spinoff companies)
Why Use Analytical Frameworks

- These are not necessarily new as they are based on practices such as systems-based theory analysis, contribution analysis, etc.
- What may be newer is their application in evaluation planning and analysis:
  - Helps frame the thinking of evaluators around how the program is supposed to work
  - Helps generate knowledge of a qualitative nature on how the program works (rather than #s)
  - Helps set policy direction for the program
Lessons Learned from the Development of Analytical Frameworks

- Innovation programming environment is complex (some within and others outside the sphere of influence of programs); frameworks show the program’s pathway to impacts but they are also important to understanding the multitude of factors that could help or hinder achievement of impacts
  - They therefore help evaluators better understand the program’s performance (including attribution)
- In non-commercial environment, the pathway to impacts may be longer; the timing of measurement must thus differ; this needs to be considered in the ongoing performance measurement strategy and evaluation strategy of programs
  - For evaluators, measurement methods and tools may be adjusted to reflect these different pathways
- This is an ongoing process; conceptual/analytical frameworks are evergreen and need to be adapted based on:
  - Findings from evaluations
  - Changes in the context for innovation programs (e.g. changes in federal government priorities for federal innovation programs)
Linkages between Frameworks and AEA RTD TIG work

- There are many similarities between the work we’ve done in the context of conceptual/analytical frameworks and the AEA RTD TIG work, for example:
  - Sector considerations (for example, in the ACOA case, we examined commercial and non-commercial but also re: context, differing needs of resource sector, manufacturing sector, etc.)
  - Interactions (collaborations, alliances, partnerships) important aspect to recognize in the model (for example, ACOA has an outcome on meaningful partnerships/alliances and has activities related to providing networking expertise)
  - Similar terminology in the models: how?, who?, what?, why?
  - Different pathways to outcomes identified
    - In the ACOA example, the pathways were based on commercial vs. non-commercial clients as well as innovation (R&D) vs. commercialization projects; our experience with other innovation programs have shown that these pathways apply to other innovation programs for example in a recent evaluation of a NRCan program that provided funding to government labs as well as private sector organizations, we found that the pathway to long-term outcomes was much longer for government lab research than for private sector research
    - Logic models on their own cannot always be used to clearly show these different pathways
  - Final outcomes are sector-related, social (health, environment, etc.) and economic (businesses, sectors, communities, individuals)
  - A menu of “generic” indicators is generally developed for conceptual/analytical frameworks, to be appropriately selected from for different types of projects
    - In the ACOA example, the indicators pertained less to science outcomes (as this is not the focus of ACOA funding)
Telling the CCSRI Research Performance Story

Canadian Evaluation Society Conference - June 17, 2014

Rudy Valentim, Senior Advisor, Research Monitoring and Evaluation, CCSRI
Presentation Overview

• Context / Background

• Describing our approach

• Effects on stakeholders
Canadian Cancer Society

• Officially formed in 1938 - a national, community-based organization of volunteers whose mission is to eradicate cancer and enhance the quality of life of people living with cancer.
CCSRI

- Formed in 2009 when the National Cancer Institute of Canada integrated operations with the Society

- Fund both open grant programs and strategic initiatives

- CCSRI research investments totalled $38.3 million in 2013
# Current Funding Programs

## Grants and awards

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prevention Research Grants</strong></td>
<td>to accelerate risk reduction research up to $600K over 4 years/7-8 new grants per year</td>
</tr>
<tr>
<td><strong>CCS-Partner Prevention Research Grants</strong></td>
<td>to reduce cancer incidence up to $800K over 4 years/3 new grants every 2 years</td>
</tr>
<tr>
<td><strong>Capacity Development Awards in Prevention</strong></td>
<td>to provide salary and research support up to $225K over 3 years/6-8 new awards per year</td>
</tr>
<tr>
<td><strong>Population Health Intervention Research Grants</strong></td>
<td>to support research on rapidly unfolding events up to $200K over 2 years/1-2 new grants per year</td>
</tr>
<tr>
<td><strong>Innovation Grants</strong></td>
<td>to support high-risk/high-reward creative solutions in cancer research, and feed the scientific idea pipeline up to $200K over 2-3 years/40-50 new grants per year</td>
</tr>
<tr>
<td><strong>Innovation to Impact (i2I) Grants</strong></td>
<td>to support development of successful findings from a funded Innovation Grant up to $450K over 3 years/10-12 new grants per year</td>
</tr>
<tr>
<td><strong>Impact Grants</strong></td>
<td>to support well-developed cancer research programs to significantly advance the scientific understanding of cancer up to $1.25M over 5 years/12-15 new grants per year</td>
</tr>
<tr>
<td><strong>Quality of Life Research Grants</strong></td>
<td>to support research aimed at reducing the burden of disease for patients, survivors, and their families up to $300K over 2-3 years/6-8 new grants per year</td>
</tr>
<tr>
<td><strong>Knowledge to Action Grants</strong></td>
<td>to close the gap between research evidence and practice, to improve outcomes across the cancer trajectory up to $100K over 2 years/4-6 new grants per year</td>
</tr>
<tr>
<td><strong>Travel Awards</strong></td>
<td>for trainees attending conferences up to $2K/45 new awards per year</td>
</tr>
</tbody>
</table>

* Canadian Cancer Society (Société canadienne du cancer)
Current Funding Programs

Research centres

**Canadian Centre for Applied Research in Cancer Control (ARCC)** is a pan-Canadian research centre whose mission is to improve cancer control and the delivery of care through interdisciplinary leadership in health economics, services, policy and ethics research, education and knowledge translation.

**NCIC Clinical Trials Group (NCIC CTG)** is a cooperative oncology group involving more than 90 member institutions across Canada that carries out national and international multicentre trials in cancer prevention, therapy, and supportive care.

**Propel Centre for Population Health Impact** is a pan-Canadian, collaborative enterprise that conducts research, evaluation and knowledge exchange to accelerate improvements in the health of populations, particularly in the area of tobacco control and youth health.
CCSRI Monitoring & Evaluation Framework
A Basic Results Chain

**Program Chain of Results**

1. Inputs
2. Activities and outputs
3. Engagement / involvement
4. Reactions
5. Knowledge, attitude, skill and / or aspirations changes
6. Practice and behavior change
7. End results

**Matching Levels of Evidence**

1. Resources expended; number and types of staff involved; time extended
2. Implementation data on what the program actually offers or does
3. The characteristics of program participants and clients; numbers, nature of involvement, background
4. What participants and clients say about the program; satisfaction; interest, strengths, weaknesses
5. Measures of individual and group changes in knowledge, attitudes, and skills
6. Measures of adoption of new practices and behavior over time
7. Measures of impact on overall problem, ultimate goals, side effects, social and economic consequences

**Indirect Influence**

**Direct Influence**

**Control**

Results Chains

• Tool for planning, monitoring, evaluating and reporting
• Shows logical relationships: inputs to activities and outputs, outcomes, and impact
• Focuses us on who we reach and what difference we make
• Provides a common language for performance measurement
• Fosters accountability and learning and helps tell the performance story
CAHS Impact Framework

• Roadmap to track health research impacts in 5 main categories:
  • Advancing Knowledge
  • Capacity Building
  • Informing Decision Making
  • Health Impacts
  • Broad Economic and Social Impacts

• 60 research performance indicators and metrics within categories of impact
<table>
<thead>
<tr>
<th></th>
<th>Inputs</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Project budgets, leveraged funds, fellows, students, and other personnel</td>
<td>Research and other related activities such as training and teaching</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collaborations and multidisciplinary research activities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Media coverage, media requests, honours or awards, leadership roles, and dissemination requests</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Knowledge, attitude, and skill changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Development of new knowledge or methods in cancer research, publications of research findings, presentations, consultations and briefings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Practice and behaviour change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Research used by other researchers, healthcare practitioners and program experts, policy makers and advocates, in training of new researchers, trainees launching careers in cancer research and commercialization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>End results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reduction of cancer incidence rates, cancer mortality rates, or enhancement in the quality of life of Canadians living with and beyond cancer</td>
</tr>
</tbody>
</table>

**WHY** do we fund research?

**WHAT** difference is our research making?

**WHO** is influenced by the knowledge generated and how?

**HOW** is research supported?

Tracking Research Performance

Planning

- Results chains with measurable research performance indicators are developed for each program

Monitoring & Evaluation

- Results chains act as frameworks for grant reports

Reporting

- Performance data is mapped along results chains and synthesized for reporting purposes
**WHO is influenced by the knowledge generated and how?**

Researchers, Healthcare Practitioners, Policy Makers, Public, and Other Stakeholders

<table>
<thead>
<tr>
<th>824 Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 713 peer reviewed publications</td>
</tr>
<tr>
<td>• 111 non peer reviewed publications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1269 Presentations</th>
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</table>

<table>
<thead>
<tr>
<th>250 Consultations/briefings</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>148 Honours and awards</th>
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</table>

<table>
<thead>
<tr>
<th>315 Media mentions</th>
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</table>

<table>
<thead>
<tr>
<th>86 Press releases</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>1296 Collaborations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 813 with researchers</td>
</tr>
<tr>
<td>• 148 with policy makers</td>
</tr>
<tr>
<td>• 190 with healthcare practitioners</td>
</tr>
<tr>
<td>• 145 with other stakeholders</td>
</tr>
</tbody>
</table>

**WHAT difference is our research making?**

<table>
<thead>
<tr>
<th>5 Impacts on healthcare and program delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research findings cited in health professional education material, cited in clinical and service guidelines, used in program development, etc.</td>
</tr>
<tr>
<td>Related research impact stories on pages: 33, 34, 50, 51, 52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6 Impacts on policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research findings cited in public policy documents, advocacy publications, etc.</td>
</tr>
<tr>
<td>Related research impact stories on pages: 32, 38, 46, 53</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>51 Impacts on work of other researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research cited in relevant scientific literature, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10 Impacts on training of new researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research findings cited in text books, reading lists, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6 Patents issued/licensed</th>
</tr>
</thead>
</table>

**HOW is research supported?**

<table>
<thead>
<tr>
<th>385 Investments</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 327 grants</td>
</tr>
<tr>
<td>• 58 career development awards</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1628 Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 294 principal investigators</td>
</tr>
<tr>
<td>• 504 co-applicants</td>
</tr>
<tr>
<td>• 191 PhD/MDs</td>
</tr>
<tr>
<td>• 376 students</td>
</tr>
<tr>
<td>• 260 highly qualified personnel</td>
</tr>
</tbody>
</table>
When your own blood cells turn against you
Dr Lorenzo Ferri, McGill University
White blood cells are normally a key part of the body’s defenses against cancer, but research has shown they may be responsible for helping cancer spread after surgery. Dr Ferri has studied...

Candy-flavoured tobacco study influences government policy
Propel, University of Waterloo
A recent survey led by Dr Steve Manske at the Propel Centre found that high school students who use tobacco choose flavoured products...

Hope for young people with a devastating cancer
Dr Torsten Nielsen, University of British Columbia
Synovial sarcomas are rare cancers usually diagnosed in young adults. They normally start near a joint...

Simple question helps restore patient dignity
Dr Harvey Max Chochinov, CancerCare Manitoba
Terminally ill cancer patients need caregivers to see beyond their illness and understand who they are as individuals...
CCSRI Performance Management Framework

End 1 Programs
- Prevention Research Grants
- Career Development Awards in Prevention
- Multisector Team Grants in Prevention Research

End 2 Programs
- Innovation Grants
- Impact Grants

End 3 Programs
- Quality of Life Research Grants
- Knowledge to Action Grants

Major Programs
- Propel
- ARCC
- CTG

Results Chains with Indicators
Outlines programs' theory of change.
Performance indicators identify areas to track and monitor for each program.
Framework for progress reports.
Developed in consultation with Program Reps., Development Committees, and ACOR.

Progress Reports
Administered to Major Programs and Grant/Award holders (annually and 2 years post grant/award) to track project and program outcomes and impacts.

Results Chains with Performance Data
Populate programs' results chains with performance data collected through progress reports.

Research Impact Report
Program and project level data consolidated to provide an in-depth overview of CCS funded research performance.
The report can provide an analysis by Ends.
The report includes internal and, where appropriate, external benchmarks to qualify performance data.

CCS Impact Report
Research performance data will continue feeding into CCS Impact Report.

Divisions
Overview of funded research performance by province for Divisions.

CCSRI Leadership, ACOR, Development Committees
Annual consolidated research performance report is presented to CCSRI leadership, ACOR, Development Committees to inform programmatic and strategic decision-making, which could feed back into research programs.

Periodic in-depth evaluations
Applicant and post panel surveys
NCIC CTG MA 17 Clinical Trial

• Case study methodology coupled with the results chain hierarchy was used to assess the long-term impacts of the NCIC CTG MA 17 clinical trial.

• The purpose of the case study was twofold:
  – To provide insight regarding the mission effectiveness of providing infrastructure funding for this type of large scale research initiative (accountability)
  – To assess trial impacts and document pathways from research to knowledge translation and impact (learning)
Effects on Stakeholders
Effects on Stakeholders

• Renewed enthusiasm for results chains methodology and evaluation in general

• Evaluative thinking is now better embedded into management processes

• Increased appetite for performance data & greater confidence in the evidence guiding decision-making
Questions?

• Rudy Valentim, Senior Advisor, Research Monitoring & Evaluation, CCSRI 
  rudy.valentim@cancer.ca

• For more information 
  www.cancer.ca/research